

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC
RESEARCH

HIGHER NATIONAL SCHOOL OF MANAGEMENT
ENSM. University Pole OF KOLEA



Masters in Management Specialty in Project Management and
Entrepreneurship

Risks related to supplying in an industrial
company
Case: Groupe Chennoufi Industrie

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Academic years 2018 / 2020

ABSTRACT

One of the most challenging things that an industrial company faces is risks that are related to supplying; in order to face these challenges a study must be put on action at the source of the problem.

The following work handles some risks that are related to supplying in an Algerian company that is active on mining, in order to do that the chapters include all the necessary data to identify potential risks and how to handle them properly from chapter one to chapter two and the results are shown in chapter three and the proposed recommendations for the risks that have been identified.

Key words:

SCM (Supply Chain Management) – PSD (Product and Service Delivery) – CBA (Cost Benefice Analysis) – Risk – Management – Risk Management – Production industry.

ملخص

من أصعب الأمور التي تواجهها أي شركة صناعية هي المخاطر المتعلقة بالتوريد؛ من أجل مواجهة هذه التحديات يجب إجراء دراسة عند مصدر المشكلة.

يعالج العمل التالي بعض المخاطر التي تتعلق بالتوريد في شركة جزائرية نشطة في مجال التعدين، من أجل القيام بذلك تشمل الفصول جميع البيانات اللازمة لتحديد المخاطر المحتملة و كيفية التعامل معها بشكل صحيح من الفصل الأول الى الفصل الثاني و النتائج مبينة في الفصل الثالث مع التوصيات المقترحة للمخاطر المكتشفة.

كلمات مفتاحية:

تسيير سلسلة التوريد – توصيل المنتج أو الخدمة – تحليل التكلفة و الفائدة – الخطر – التسيير – التحكم في المخاطر – الصناعة الإنتاجية.

RESUME

L'une des choses les plus difficiles auxquelles une entreprise industrielle est confrontée sont les risques liés à l'approvisionnement ; pour faire face à ces défis, une étude doit être menée sur l'action à la source du problème.

Le travail suivant traite certains risques liés à l'approvisionnement dans une entreprise algérienne active dans le secteur minier, afin de faire en sorte que les chapitres incluent toutes les données nécessaires pour identifier les risques potentiels et comment les gérer correctement du chapitre un au chapitre deux et les résultats sont présentés dans le chapitre trois et les recommandations proposées pour les risques que nous rencontrons.

Mots clé :

SCM (Supply Chain Management) – PSD (Product and Service Delivery) – CBA (Cost Benefice Analysis) – Risque – Management – Risque Management – Industrie de production.

Acknowledgment

By Gods will

Special thanks to my parents, my family.

Thanks for anyone who said the word Yes and No down the road.

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List of abbreviations

HSE: Health, Safety and Environment

SCM: Supply Chain Management

VaR: Value at Risk

SME: Small Medium Enterprises

3S: Synthesis Synergy Synchronization

HAZID: Hazard identification

HAZOP: Hazard Operability study

FMEA: Failure Mode and Effect Analysis

BPR: Business Process Reengineering

PSD: Product and Service Delivery

QFD: Quality Function Deployment

AHP: Analytical Hierarchy Process

PSM: Purchasing and Supply Management

EVT: Extreme Value Theory

General Introduction

This research handle one of the most disturbing challenges that every industry is facing at every moment, this challenge is represented in a word which is “supplying”, not just for wining a client, sell more or reduce costs and make billions out of it like Jeff Bezos did with Amazon, but some depends on the best practices of supplying to win wars or in even a worst-case scenario losing them if they mishandle their supplying like the case of Adolf Hitler and his war with the Russian federation.

The problematic lies within how to manage the risks that face the supplying, is it just by eliminating the risk? is it by reducing costs? find better ways? Or find a new strategy that replace the old ones; too many questions that represent a lot of challenges to supplying in our industry in our country.

The main question that this research will be answering in this work goes as follow; How to manage the risks of the supply chain in a company?

Risk management is an entire science full of a lot of perspectives and a lot of fields of studies, to mention risk management we need to define and precise the field of study before we start and that is because of the nature of the dimensions that we will be facing, and since it has such nature, using a systemic approach will be the best judgement, however using a mixture of methods would be necessary if needed, so the existence of qualitative methods is necessary to manage some risks properly.

As the risk management grows so fast many methods are discovered by the day to solve enormous problems, that concern the flow of our work every day, so being adaptable is something really necessary for the survival of the entire company.

The following work will be discussing the mining industry, since Algeria don't just mine for oil but also all sorts of minerals as well, the gypsum is one the main things that Algeria use in the construction industry, and every day use as well; and the targeted factory is a gypsum mining facility by the name “Chennofi Group” Located in Biskra region – Algeria, that depends on a series of treatment to deliver the product.

The aim of this research is to put a spotlight on the risks facing the suppling chain in the industry in Algeria and how to deal with these different challenges, also to leave a work that the upcoming researchers can depend on the mined data that we have gathered from the field to perform even a greater work based on what has been gathered, and to contribute in a managerial way for the progression of this industry.

This research will consist of three main chapters; first is to precise the working environment, this chapter will consist on the whole terminology on the supply chain management and the main key assets to perform a risk study.

After finish identifying the work environment, the work will go through the different aspects of risk identification, risk assessment and the best risk management methods, ways and practices to insure the best handling of the work challenges in supplying.

The final chapter will consist of the main field to study which is the factory, and how to assess the risks and find the best ways, practices and solutions for the problems that the industry in Algeria is facing.

Chapter One
SUPPLY MANAGEMENT

Introduction:

In order to start the work, a set of words is needed to conduct the necessary informations correctly and be able to deal with them properly, that will include all sorts of information on the supplying mechanisms and their definition by book.

As the Algerian companies faces many difficulties in the work and paper push there is a need to be able to understand the work area properly and efficiently in order to conduct the data well.

So as in this chapter there is all sorts of definitions that are necessary for the supplying to work properly with no disruption, and be able to document the results properly.

Section one: Primary Concepts:

1.1 Management:

The term management relates to all the procedures carried out to solve a problem or carry out a project. Management is also the direction or administration of a company or business. There are several types of management. Social management, for example, involves building various spaces for social interaction.

Project management, in turn, is the discipline that is responsible for organizing and administering resources in such a way that it may be possible to carry out all the work required within a project, depending on the deadline and a defined budget.

Another type of management is knowledge management. It is a concept applied in organizations, and concerns the transfer of knowledge and experience between its members. Thus, such a body of knowledge can be used as a resource made available to all members of the organization.

It should be noted that environmental management is the set of measures or procedures dedicated to the environmental system based on sustainable development. Environmental management is the strategy through which human activities harming the environment are organized, with the aim of achieving a suitable quality of life.

1.2 Procurement:

The purpose of procurement is to meet the needs of the business for the products or services necessary for its operation. It consists of buying, at the right time and at the best

price, the necessary quantities of quality products from suppliers who will meet deadlines. It therefore includes a purchasing element and an inventory management element.

This function is all the more important for the competitiveness of the company as the quality-cost ratio of supplies will affect the quality-cost ratio of production.

The value of purchases represents 30 to 85% of the turnover of companies depending on their sector of activity. A good purchasing policy can therefore allow a company to significantly reduce its production costs and consequently improve its commercial margin. Buying well allows the company to increase its profitability.

1.3 Inventory management:

The inventory consists of all the goods awaiting use and which can therefore:

- Be sold as it is (To a distributor).
- Either be sold after processing (Ex: wooden planks that will be used to make tables).
- Consumed at first use (coal, petroleum).

It makes it possible to adjust delivery flows to consumption flows.

Inventory management consists of determining both the quantities to order and when to place the order, with the aim of minimizing the costs attached to them.

Several inventory management systems exist, among which:

- The fixed quantity and variable frequency system: when the stock level reaches a low, called stock alert, an order is triggered. Inventory monitoring is carried out using an inventory card on which the inputs and outputs of a product are recorded, which makes it possible to know the quantities still available at any time.
- The fixed periodicity and variable quantity system: the order is placed on a fixed date in order to reconstitute the stock at a level considered optimal. To this is added a safety stock intended to guard against any stock shortages resulting from delivery delays or an increase in production.
- Just-in-time or tense-flow management: set up at Toyota then by the most successful Japanese and Western companies, this system aims to bring stocks of finished products and

intermediate products to zero. Raw materials and components (zero stock), to minimize the costs incurred by stocks.

The purpose of inventory management is precisely to determine the optimal times and quantities to order in order to meet customer demand while minimizing costs. The usual optimization criterion is that of the expected costs (per period, in the long term), possibly under service level constraint.

For our case we have the maintenance inventory and the product inventory.

1.4 Concept of supply management:

As a system, the company brings together several sub-systems including supplies that we propose to study in depth. The peculiarity of this last subsystem is that it is not limited only to the entry of the system which is the company. We are talking about the supply system at the input level as a producer and at the output level as a supplier. The company therefore has a dual function of managing the entry and exit of products. But for the purposes of this study, we will limit ourselves to the input level. In this case, the aim of supply management is to ensure that the various activities of the supply function are carried out properly. Forecasting, organization, command, control and coordination techniques make it possible to achieve this objective. The literature shows that it is especially within large companies and certain SMEs with a structured procurement service that these activities are most often carried out in a coherent manner. In SMEs, the management of operations and production is done unconsciously and informally by each stakeholder. In this way, the communication of everyone's knowledge is not always easy, both between the company and its environment and between internal stakeholders. In all cases, the final objective pursued remains the same, that of obtaining good results.

To achieve this objective, in terms of supplies, it is beneficial to classify the articles. According to Cabrera (1991), there are two types of articles:

- 1) Equipment and maintenance material to keep the facilities in operational condition.
- 2) Production equipment which includes raw materials, components and sub-assemblies being manufactured for internal demand, and finished products for external demand. As for the supply cycle, it has five main phases: the calculation of material needs, their acquisition, storage, distribution and final disposition.

For the calculation of material requirements, several authors, including Cabrera (1991), maintain that there are two methods: the economic lot method and the method of planning material requirements.

The economic lot method is carried out against the background of constant and independent demand. In this case, there is no relation between the most economical quantity to order and the production system. This quantity is rather related to the customer's requirements. In this case, we favour the marketing option to get the opinion of the consumer. And it is according to this demand that the company determines the quantity to order. This approach is mostly used in distribution companies.

The planning of material requirements is oriented towards organizational aspects. Planning consists of arranging the following various stages:

- 1) Information to employees at all levels.
- 2) Specifications of policies, procedures, quality standards, deadlines, etc. subsequently serving as a basis for performance evaluation.
- 3) Reading documents before purchasing materials.
- 4) The checks to be carried out during manufacture and on the finished product, in order to achieve the targeted objectives.

Thurston (1977) teaches us that when it comes to inventory management, sophisticated statistical methods are often unnecessary and can advantageously be replaced by a simpler method: "material requirements planning". According to this author, the planning of the requirements for materials used for the manufacture of finished products is "a process which, by systematic reasoning from the date foreseen for the end of the manufacture of finished products, consists in determining the quantities of materials. and components that must be ordered at a specific time, so we note that this is about stock management in the case of a dependent demand.

As for the acquisition operation, it is directly linked to that of planning because its purpose is to provide the company with the raw materials and components it needs for the product processing. Before the acquisition of these raw materials, the supply manager must determine certain specifications or conditions in relation to the controllable variables such

as quality, quantity, price (total cost), time and place of delivery of the materials. raw materials (Gobeil and Jobidon, 1987). Once acquired, these materials are transformed into a finished product. This can be measured by its useful form, the place of sale desired, the quantity desired, the satisfactory quality, the acceptable cost, the adequate service, the time and place of delivery (Mattio, Diorio, Deschamps and Landriault, 1988).

- The quality of raw materials: (the gypsum)

Several authors (Kelada, 1989; Mercier, 1990) agree that the quality of a product must be defined not only in terms of technical standards (characteristics), but also in terms of the needs to be satisfied, i.e. that is, its suitability for use.

Indeed, the quality of a product is recognized by establishing acceptable quality levels. If these levels are not reached, we speak of non-quality. Compliance is therefore the degree of agreement between, on the one hand, the design of the product and its operating characteristics, and, on the other hand, the established standards. Ducas (1981) mentions that quality is obtained by coordinating various actions of all functions of the company, including supply and production. The purchasing department is then responsible for finding raw materials that meet specifications and ensuring that suppliers' facilities and quality assurance rules comply with their quality policy. As for the production department, it will manufacture a product of the specified quality according to the process. Stressing that there are many quality criteria but all have the same raison to be: the more quality a product, the more we should increase our income.

Among these criteria is the notion of conformity which can take different forms, namely classification and regularity. Depending on its nature, a product may be rated higher or lower than another on the basis of various criteria such as colour, texture, taste, smell, reliability, durability and resistance. In terms of consistency, this refers to the ease with which a product manages to consistently meet specifications, that is, maintains its level of quality, appearance or consistency.

It is also possible to measure the quality of a product in his article entitled "How to measure quality" and published in 1981, Kelada provides information relating to the preventive or corrective way of measuring quality.

Basically, it is a question of studying the qualifications of the workforce, its equipment and its management apparatus. This assessment should be carried out jointly by the production and quality departments. The workforce assessment can be substituted by an analysis of past products, samples or an experimental partial order. In addition to supplier assessment, the buyer should be involved in quality control activities at the supplier's premises, which could be exercised when the supplier acquires its raw materials. This means that certain properties which are difficult to detect after processing the product should be checked before this operation. In this way, the buyer could ascertain the level of quality of the product which is subsequently used as a raw material in his company. This raw material would still be subject to another check upon receipt. In terms of corrective action, the company can measure the quality of the inputs by carrying out an objective check upon receipt. In this case, it is a question of comparing one or more characteristics of the materials to be checked with the pre-established specifications. Items that do not comply with this inspection will be returned to the supplier for replacement or scrapped if there is prior agreement to this effect with the supplier.

- The quantity of raw materials:

Gobeil and Jobidon (1987) define the notion of quantity on the basis of the elimination of two opposing situations: either having too many goods or lacking in goods. In fact, when you have too many goods, you see a decrease in liquid assets, a higher rate of obsolescence, and higher interest and storage costs. On the other hand, lack of goods leads to a decrease in sales, costs caused by production stoppages, additional transport of goods ordered urgently. In this case, it is in the company's interest to strike a balance.

- The price (total cost) of raw materials:

Larousse (1984, p.8481) defines the "administered price" as being a price fixed by the company according to the calculations of costs and profits that it desires and according to the quantities that can be sold at this price. In this sense, it is the price that results from a business decision and it is held at the chosen level for a certain period of time.

On the other hand, still according to Larousse (1984, p.8481), at the level of "price policy", State intervention obeys three kinds of motives:

1) Consumer protection against prices deemed too high.

2) Protection of producers against prices deemed too low.

3) The fight against an upward trend in the general level of prices due to an accidental restriction of supply, an excess aggregate demand or an autonomous rise in production costs.

In terms of supplies within the company, Clouët (1989) asserts that the fair purchase price is the result of a compromise between the quality and the service that the supplier will be able to provide and, can respect. To this end, the call for tenders and negotiation are the essential acts of the "purchasing" function so that it can fulfill its mission. They allow the two parties (buyer and supplier) to establish a compromise on the right price, that is to say the one that the company is ready to pay and that the supplier is ready to accept.

In view of the definitions of price and purchase cost that we have just given, several authors admit the existence of fundamental aspects to be taken into consideration when it comes to determining the price, in particular: supplier costs, production costs and the behaviour of the client company (the demanding company often obtaining the best quality and the best service at a low price).

- The delivery time of raw materials:

One of the goals of supply management is to provide the production department with the goods it needs to develop its most appropriate production schedule. When it comes to delivery times, the questions a purchasing manager should ask themselves are "do you have to order well in advance?" is the product constantly available? etc. ". The answer to these questions would allow him to contact the reliable suppliers are those who deliver the products at the appropriate time. In the same vein, Gobeil and Jobidon (1987) agree to ask: "What is the point of choosing a supplier who sells ice skates ten percent cheaper than his competitors if they are delivered after usage time?".

But besides the four variables of quality, quantity, price and delivery time, which we have just described, and which we can qualify as internal, there are environmental variables likely to disrupt the smooth running of operations. production activities, including sources of supply and government laws relating to imported raw materials, customs procedures, etc.

- Sources of supply:

Several questions also arise at this level before undertaking any transaction, such as:

- 1) Is it better to have a single large supplier or several small suppliers?
- 2) Is the supplier reliable in the quality of his product?
- 3) Is the supplier reliable in terms of delivery times?
- 4) Are the raw materials used difficult to transport because of their weight, volume, fragility, etc.?
- 5) Are the suppliers geographically dispersed?
- 6) Are the raw materials used diversified or are they limited to a few products?
- 7) What are the supplier policies regarding discount, payment methods?

In fact, once these questions have been asked, the answers will allow the procurement manager to choose, evaluate and diversify his suppliers as needed. Indeed, the choice of one or more or fewer permanent suppliers is made on the basis of several criteria. The supplier must, first of all, identify suppliers who are close in order to avoid very high transport costs. Secondly, he must consider the quality, quantity and price of the products requested and finally, the delivery time.

This last point, that is to say that which relates to the punctual delivery facilities of the goods ordered, may, with past experience, constitute in itself an important selection criterion. The objective is always to avoid stock shortages which can cause production stoppages. This approach makes it possible to find suppliers who are able to meet the needs of the company because "faced with two suppliers offering the same product at the same price, the buyer can choose the one who has a remarkable delivery capacity".

As for supplier diversification, it is crucial for the company in that it allows it to avoid dependence on a single supplier. In other words, not only can she get good quality products and services at reasonable prices (with suppliers competing), but also continue to do business with others in the event of bankruptcy or change of mind. from one or the other supplier.

Once the raw materials are acquired, they are stored before processing. Most observers agree that the existence of a permanent stock is necessary to some extent in order, among other things, to counteract delays in delivery times from suppliers, to deal with variations in demand, allow great flexibility in the planning of operations and benefit from economies of scale. But this stock should neither be too high to risk immobilizing capital nor too low to avoid stock-outs.

In addition, to manage stocks in the case of a demand dependent on the production system, it is not necessary to attach the same importance to all the stored products. According to several authors including Cabrera (1991), the financial costs of stocks vary between 10 and 45% of the total cost of production. Thus, inventory management not only reduces these costs but also increases productivity. For example, in a company, if 10% of the products purchased generate 65% of the total value of the inventory, they are classified as category A and subject to strict control, 25% of the products which generate 25% of the total monetary value stocks are classified in intermediate category B and should be subject to less tight control; finally, category C includes products considered by managers to be the least important, that is to say if 65% of products generate only 10% of the total value.

Distribution, on the other hand, includes the transport and delivery of items to the location required for production operations (Cabrera, 1991). It depends, among other things, on the availability of materials and the need for installations. On the other hand, final availability occurs when the company, after having used a material, decides to get rid of it for a financial consideration lower than the initial cost.

1.5 Definition of a supply chain:

A group of companies that are involved in the design, manufacture, delivery and distribution of a single product constitutes a subset of that product's supply chain. Globally, the supply chain is defined by the integration of transformation processes from raw material to consumer. Integration is defined as adaptation to merge or facilitate the introduction of processes into a whole, creating a fluid and efficient connection.

The supply chain consists of various entities such as suppliers, vendors, manufacturers, distributors and retailers interconnected by transportation, information and financial infrastructure (Funda and Robinson, 2002). This structure weaves a web in which are to be found actors, business processes and management dynamics whose setting in motion is the

responsibility of individuals. Indeed, all the information that circulates through the various companies is filtered at one time or another by the staff. Even though the exchange of information is sometimes automated, a supply chain cannot function without human intervention. In addition, these people form the driving force behind any action for change through their interventions in the activities of companies in the chain. These are the individuals who manage the supply chain by directing their business operations to enable the chain to deliver a product, or service, to the consumer.

1.6 Definition of supply chain management:

It is difficult to choose a single definition to describe supply chain management and therefore it can take many forms. For example, Vaaland and Heide 2007 noted three distinct orientations in the definitions made in by literature:

- Actors orientation: Organization and management of material flow from raw material to consumer.
- Relationship orientation: Relations between actors, cooperation and common interests for the improvement of performances.
- Process orientation: Activities and business processes, integration of key processes from the original supplier to the end user.

On the other hand, addressed the question "What do you understand by the term supply chain management (SCM)? " To 72 experts from academia. They reduce the responses obtained to three variables and propose their analysis model called 3S:

- Synthesis: Aspect of the physical structure.
- Synergy: Nature and influence of relationships, human aspect.
- Synchronization: Tools for operational control of processes.

By comparing the two previously mentioned studies, we notice that, despite the different classifications or models, supply chain management touches on aspects of production flow, relationships and information exchange.

Overall, it can be expected that any actions or decisions that affect supply chain management would have to take these three aspects into consideration to limit any risk of failure and deliver the products or services. consumer services.

The communicating information is an essential aspect of defining supply chain management. While these three aspects are all important, this dissertation focuses on the fundamental element of communication to harness its potential and determine its influence on supply chain performance.

Virtually all of the business processes of every company are involved with the exchange of information. When approaching the management of a supply chain, one should expect to generally deal with the functions of logistics, procurement, industrial and economic organization, marketing, and others (Arend and Wisner, 2005).

More and more, the Internet is becoming one of the major pillars of communication. It is ubiquitous through the various business processes embedded in the supply chain. A survey carried out by Rahman (2003) deals with the importance of the Internet as a management medium for the various processes of a supply chain. Its results rank different business processes according to the extent of their use of the Internet. Starting with the one who uses the Internet the most, these results give:

- 1- Transport,
- 2- Order process,
- 3- Relations with sellers,
- 4- Supply,
- 5- Customer service,
- 6- Inventory management and scheduling.

Of all these processes, inventory management is the most expensive. In this process, the Internet is critical in providing information on delivery times or priorities, in locating items, and in keeping inventory low. Transport is the second most expensive aspect of a supply chain (Lancioni, Smith & Oliva, 2000; Rahman, 2003). Based on these facts, these

two activities should be prioritized in order to obtain the most significant savings financially in any rationalization action.

In summary, companies are starting to break away from the vertically integrated model and are turning to the development of specialized skills to position themselves optimally within the supply chain. Gereffi et al. (2005) mentions the debate in favour of the development of the core competencies of companies in the supply chain. According to this debate, companies that focus on their core competencies, complementing the core competencies of other business partners, outperform vertically integrated companies. To position themselves effectively within the supply chain, these companies must acquire an attitude oriented towards collaborative commerce and requiring the dissemination of quality information with their partners (Bond, Genovese, Miklovic, Wood, Zrimek and Rayner, 2000). Moreover, companies such as Wal-Mart, HP, IBM, Intel and Proctor & Gamble have been able to increase their profitability by developing collaboration within their supply chains (Simatupang and Sridharan, 2005).

Section two: The role of procurement in industrial environments:

In general, the role of the supply function is to organize, plan and control all stocks belonging to the company. Indeed, it makes it possible to plan replenishment orders, to determine the quantities to be ordered and also to manage the handling and storage means. According to Bruel (2008: 17), the purchasing and supply function plays a central role for the following reasons:

- Purchases are the highest cost items in the income statement (from 80% to 30% of turnover depending on the sector, respectively from industrial assemblers to banking-type service companies).
- Often a large part of the products or services are under the control and responsibility of suppliers or service providers whose economic performance and quality play a determining role in the success of the company.
- This context of collaboration is necessarily expressed in the medium term but also on an operational level in relation to the "supply chain".

- According to Alazard and Separi (2005: 441), the role of the procurement function can be defined as the obligation to supply raw materials and components in sufficient quality and quantity, at the right time and at the lowest possible cost.

- This definition highlights the obligations of the supply function: obligation of better price, of good quality and of adequate quantity, of delivery time.

Section three: The challenges of the supply function:

We face many challenges when it comes to supplying, in order to go through them, we need to understand them first, and try to define them in a manner that serves our work.

3.1 The financial challenges:

The procurement function is most often the most important expense item in the company. In addition to its influence on purchase prices, it is directly responsible for several other charges such as:

- The financial terms of purchase (negotiation of supplier credit).

- Commercial purchasing conditions (minimum guaranteed quantities).

- The logistical conditions of purchase (transport, transit, handling).

- Inventory management costs (warehousing, financing)".

- According to Durand (1997: 9), "in industry it is considered that purchases represent on average 68% of the company's turnover and more broadly from 40 to 75% depending on the activity sector.

- The decrease in cost prices coupled with more and more frequent strategies of outsourcing and sub.

- Contract manufacturer have seen the weight of purchases constantly increase in the composition of turnover. In order to precisely identify the share of purchases in turnover, it suffices to take the income statement, add the amounts of the following three accounts and relate the sum to turnover: purchases, external services and other external services. The weight of purchases obviously depends on the activity of the company.

3.2 The commercial challenges:

The integration of the purchasing function very early on, from product design, will allow the company to make the most of the opportunities in the supplier market. Obviously, the quality of the products produced begins with the quality of the raw materials.

Customers and principals are increasingly called upon to ensure the performance of their suppliers, a guarantee of their own performance. Thus, as part of their quality approach, they develop audits of their suppliers. They watch over their purchasing performance. Indeed, large firms tend to choose subcontractors capable of understanding the strategic dimension of purchasing. When we talk about the image of the company, we usually think of the sales function. However, the purchasing function is also in permanent contact with the outside, it conveys the image of the company. This must therefore be considered when choosing the buyer, when fitting out the premises in which he receives and more generally in the day-to-day management of relations with suppliers.

The choice of suppliers will be based on the supplier's ability to meet quality, quantity, delivery, price, cost and service objectives.

Section four: Logistics in the supply chain:

As mentioned in the previous section, the supply chain is made up of three parts: procurement phase, production phase and distribution phase. The purpose of this section is to focus on the first phase such as the procurement phase, given the importance of this phase in the supply chain. Indeed, this phase's mission is to manage various levels such as the level of stock, the level of supplier selection, the allocation of orders to selected suppliers, receipt of orders, control of receipt of orders delivered by the supplier. ... In fact, in industrial manufacturers, the costs of purchasing raw materials and components can exceed 70% of the cost of production. Therefore, the purchasing department can play an important role in cost reduction. The selection of suppliers is one of the most important functions in purchasing management. In this part, we focus on some definitions of the buying process. Tang (2006) describes the supplier selection process in three stages. First, the decision maker must define a set of selection criteria and a set of supplier candidates. Then, these criteria should be used to select the right suppliers from among the applicants. Finally, the decision maker assigns the quantities requested to the chosen suppliers. Indeed, the decision-maker must assess all aspects when choosing suppliers and is not limited to a

few functional criteria such as price, quality, time, but also, he must integrate criteria relating to uncertainty, vulnerability, rupture, development, sustainability ...

The selection of suppliers has appeared in the literature since the sixties. The first works in this line of research are those of Dickson (1966), Weber et al. (1991). Dickson (1966) to conduct a survey of 274 companies in which he identified 23 criteria for evaluating suppliers. Quality, price, lead time are the most important criteria to identify and determine the optimal supplier. Weber et al. (1991) did a literature review of 74 works in which they found that quality is the most dominant criterion in the choice of supplier plus cost and time. However, this work failed to integrate the criteria of risk, disruption and vulnerability as a determining factor in the selection of suppliers.

Section five: Procurement strategy:

Organizations today operate in an environment characterized by multiple political and economic disruptions in their sources of supply. To survive in such a turbulent market, these organizations must continually monitor their competitive position by looking after their internal processes, especially their procurement process. This subsection therefore deals with procurement in two parts: the strategic part and the operational part. The first part focuses on the strategic role of procurement by describing the growing and strategic importance of procurement strategies within the company. The key characteristics for developing a procurement strategy are then discussed.

5.1 Procurement strategies: Definition and evolution:

The transformation of purchasing and the procurement function from a passive, administrative and reactive process to a strategic and proactive one, was predicted in the early 1960s, when the procurement function would gain increased importance in the business management (Renge 2005). Thus, in the late 1980s and early 1990s, the competitive success of Japanese automakers and their close partnerships with suppliers to support just-in-time manufacturing pushed the purchasing department to play a strategic role including development of procurement strategies (Baily et al. 2005). Purchasing has thus evolved from a cost centre function to a value creation function, from a procurement tradition that aims to work with multiple suppliers to a more strategic approach that aims to rationalize procurement.

Buying and sourcing are seen today as potential sources of strategic advantage for an organization. This new direction requires close collaboration with suppliers and involves a greater concern for total costs, including those incurred both before and after transactions, rather than just transaction prices (Baily et al. 2005). According to Fawcett (2000), the shift to a strategic sourcing strategy requires changes in four key elements: objectives, resources, environment, and feedback. Strategic purchasing practices also often require restructuring and training of staff to improve their skills.

Procurement strategy is a proactive way to acquire and manage a group of goods or services. It describes how the company proceeds to ensure cost effective and responsive as well as a reliable supply of high quality to meet current and future needs (Moore et al. 2007). The procurement strategy should not be designed to serve only the acquisition of a good, but to serve the acquisition and management of the whole business. The literature on procurement is very rich and diverse. However, no standard or process has emerged on exactly how to develop a sourcing strategy. Given the diversity of products and industries as well as the complexity of developing a competitive strategy, it is no surprise that a standard process is unlikely to adapt to all situations.

5.2 Why a procurement strategy:

According to Kraljic (1983), there are three key variables that justify the need for developing a procurement strategy. These same variables also affect the shape of such a strategy; are:

1. The strategic importance of a group of goods or services for the company and for its customers.
2. The complexity and uncertainty of supply markets.
3. The complexity and uncertainty of customer requirements.

When it comes to the strategic importance of goods and services, it is obvious that they vary in their effect on customers. For the complexity and uncertainty of supply markets, this includes the availability and performance of goods and services, the rate of technological change, barriers to entry to a market, logistics costs, the supplier market (monopoly, oligopoly, or competitive) and the conditions (profitability, competition, culture with the buyer, etc.). Finally, for the complexity and uncertainty of customer

requirements, this includes the variance and stability of customer demand over time, the breadth of expense categories, etc. A sourcing strategy for stable demands (such as food) is likely to be different from one for varying demands.

5.3 The growing and strategic importance of procurement strategies:

In recent years, the recognition that the supply chain is a source of competitive advantage has led many organizations to pursue the dual benefits of value and operational excellence. In many environments, it has been recognized that the competition in the future will not be between organizations, but rather between the supply chains of which they are a part. Best procurement practices recommend developing procurement strategies for all goods and services before they are acquired. Over the past century, sourcing practices have become increasingly important to overall business success. Many leading companies have adopted innovative practices in their Purchasing and Supply Management (PSM) to improve the quality, responsiveness, reliability and flexibility of their value chain while reducing costs (Moore et al. 2002).

These practices bring together important orientations such as:

- Analyse all the expenses of the company.
- Perform market analysis and sourcing strategies.
- Reduce or consolidate the number of contracts with each supplier.
- Establish long-term partnerships with the best suppliers.
- Work with the best suppliers to improve quality, cost and service.
- Integrate key suppliers into the system, plans, processes and organizations.

5.4 Procurement mechanisms:

Procurement mechanisms can be classified into six categories (Gaston 2005):

- Standard supply.
- The physical transfer.
- Consignment.

- Outsourcing.
- External services.
- Electronic procurement strategies, e-sourcing, e-procurement and e-tendering, which integrate the use of the Internet and combine auctions and bids electronic.

Gaston (2005) defines these approaches as follows:

Standard procurement: This is the classic strategy. All internal needs are expressed in purchase requisitions. The latter arrive at the purchasing department. The purchasing department contacts external suppliers, studies offer and selects suppliers. Purchase requests are then converted into purchase orders. We then wait for the delivery of the goods at the agreed date and place.

Physical transfer: Internal requirements are for example oriented towards a company store. The main store supplies secondary stores, workshops or offices. This internal flow of goods from one part of the business to another is called a "transfer flow". Indeed, the movement of stock does not cause any invoicing in return. Stocks are transferred with their value.

Consignment: The company's stock is kept on the supplier's site. This is called "consignment stocks". The company orders items, but keeps them in stock at the supplier's premises. The company is therefore the legal owner, but payment will only take place when a request for consignment items is made to the supplier. It is only after collection and removal of the goods that the supplier will claim payment for the quantities of goods consumed. Generally, for this type of contract, the supplier requires a minimum consumption guarantee.

Subcontracting: This involves entrusting a third party with the execution of a service, or the manufacture of materials or components. Outsourcing is a procurement strategy with particular characteristics that differentiates it from the procurement of external services. In an order, each subcontractor item is attached to one or more sub-items which contain the materials or components required by the subcontractor to perform his task. These materials or components generate consumption of the company's stocks. Once the purchase order has

been confirmed, a goods issue operation is carried out at the store level for the subcontractor.

External services: In an external service order, each item includes specifications that detail the supplier's services. The specifications can include items that represent services (service sheets), activities, but also articles. The service procurement strategy makes it possible to distinguish two categories of services: "Planned services" are services whose nature and extent are known at the time the order is placed. They are saved with a description, quantity and price. In the specifications, it is possible to authorize the overrun (in percentage) of the initial quantity, but also the modification of the contractual price. "Unscheduled Services" have no description. These are activities or works that cannot be specified in detail because their nature and precise extent are not yet known. In order to have control over the expenses incurred, limit values are indicated instead of the service lines. Services can then be executed up to a value not exceeding these limit values.

Electronic Procurement Strategies: There are many tools available today to facilitate the procurement activity of organizations. We find in particular e-sourcing which refers to the use of the Internet to identify and contact new suppliers for a given type of product, e-procurement which refers to the use of new technologies to automate and optimize the purchasing function of the company. business and e-tendering which refers to the use of the Internet to request quotes on the one hand and the receipt of offers on the other.

5.5 Process for developing a procurement strategy:

The processes and analytical frameworks for developing a procurement strategy are manifold, but also have some things in common. Moore and al. (2007) presented a process for developing a procurement strategy with two main phases. The first phase is to assess and strategically target opportunities in a company to improve processes and strategies by grouping and prioritizing different resources to be provided for the new targeted sourcing strategy. The second phase targets the choice of products according to particular needs, their effect on the business, their ability to free up staff (e.g. automation of purchasing), etc. and they go as follow:

Phase I: Evaluate, group, segment and prioritize business wide opportunities:

- Assign a team to determine company expenses by product and supplier

- Document and analyse purchases and expenses by group and sub-group
- Analyse and document the current basis of procurement and identify potential risks
- Segment and classify purchases as the strategic importance
- Identify and quantify potential opportunities
- Evaluate internal and external execution capabilities and reliability
- Prioritize expected profit possibilities.

Phase II: Develop a sourcing strategy for the initial group of merchandise with the greatest value and rapid recovery:

- Assign a functional team for each selected commodity (the project product)
- Develop a more detailed profit for the group of selected commodities
- Analyse the supply market for this commodity group
- Identify and prioritize potential risks
- Develop the strategy
- Execute the strategy

Large companies are making significant commitments to changing their purchasing and supply management practices. They analyse their spending, segment products into major groups based on their business value and vulnerability, and then prioritize them for initial purchase.

Conclusion:

As we have seen in this chapter the supply chain management has a diversified working filed, now we can distinguish between the used terms in our factory to make the work easier and minimise the confusion.

The seeing primary concepts are used in every industry not just the mining sector, but all sorts of industry as well, which make our work here transferable to all sorts of work, and it can be a basic model for building a new definition that can help in the future.

In our daily work, procurement forms the main job for any supply chain management, which means any disruptions will lead to a cascade failure to the entire production line; That being said, expecting financial and commercial challenges is part of our daily work at the factory.

As the production continues without any disruption, logistics must be taken care of at every single point to ensure our product delivery; In order to make that out establishing the best work strategies is a must.

So, as to conclude this chapter the next chapter will handle all sorts of risk that could be encountered.

Chapter Two

RISKS RELATED TO SUPPLYING

Introduction:

This chapter will go through another science field which is risk management, many companies have developed the best practices for handling risks, but depending on the needs there will be a selection the necessary ones that comply with the work.

This selection must take on consideration the amount of money charges that it will make place, and the regulations.

In order to enter the field of work we must go with initial information, then we walk through the data gathering, then we go to a set of data interpretation to determine what to do so we can avoid errors during execution and gain time and money and not waste them.

Section one: Supply chain risk:

The notion of risk occupies an important place in the logistics chain. Risk management is made up of a set of concepts, approaches and tools intended to identify, estimate, control and monitor risk throughout the supply chain.

1.1 Presentation and perspective of the concepts used:

1.1.1 Global view on risks:

A multitude of definitions have been proposed to define the notion of risk in general. Indeed, the term risk comes from the Latin “resecum” which meant “what cuts” and characterizes a warning. It appeared in the 14th century in the field of Italian maritime insurance. Today, this notion has been answered in several areas, particularly those affecting business activities: natural risks, technological, ecological, economic and health risks, etc.

Among the definitions of risk cited above, that of ISO / IEC Guide 73, which defined risk as "The combination of the probability of an event and its consequences." »ISO Guide 73 (2002). So, the risk is equal to the combinations of three factors such as the probability of the risk occurring (notion of chance), its event and their consequence. Risk is always treated in their negative sense whereas this notion has two facets: A pessimistic way, assuming the risk as the cause of loss and waste, and another rather optimistic, considering the risk as "an exposure to danger in the hope to gain an advantage and apply the principle of daring to win”.

1.1.2 Supply chain risk:

Various definitions have been proposed to define the notion of risk in the logistics chain. The aim of this part is to present the definitions of supply chain risk and the basic concepts of the risk management context in the supply chain. Among the definitions of risk that provided by Juttner et al. (2003) who defined the risk in relation to the integrity of the flow of the supply chain. “All risk of the flow of information, material and product from the initial supplier until the delivery of the finished product to the final consumer” while Goankar and Viswanadham (2007) have defined the risk of the logistics chain “it is the distribution of loss resulting from the variation of flows entering the chain, its probability and its subjective value”.

1.1.3 Procurement risk:

Gaonkar and Viswanadham (2007) supply risk is defined by the probability of an incident associated with the upstream phase of the supply chain. This risk can be carried out following a supplier or contract failure. This risk leads to the inability of the business to meet the needs of their customers and / or a threat to the life and safety of consumers.

Hou et al. (2010) defined risk as: it is the sudden unavailability of supply due to an unforeseen event that affects the source of supply. George and Zsidisin (2003), a rupture occurs when there is a radical transformation of the structure of the supply chain following the unavailability of certain production, warehousing, distribution, installation or transport activities, due to the events and human and / or natural disturbances.

There are several forms of rupture, we can cite for example:

- Break in production (the earthquake in Taiwan led to the disruption of production of integrated circuit chips (IC chip production), break in production of components following the fire at Toyota's suppliers in Mexico which resulted in the stopping of the downstream phase of the plant.
- Supply disruption (food supply such as meat supply following the spread of foot-and-mouth disease virus in England.
- Disruption of the supply chain: unexpected closure of US ports which blocked transactions between Asia and the United States.

a) Disaster:

Disaster is defined as the temporary irrecoverable shutdown of the supply chain network due to unforeseen catastrophic events. These events can be human or natural. Exemple of Disaster: The terrorist attack of September 11, 2001 which resulted in the deterioration of the economy of the United States due to low consumption (demand) expenditure, production.

b) Disturbance:

The risk can lead to disruptions in the supply chain. Literally, a disturbance can be defined as "the interruption and disruption of stillness, peace, rest, or a stable condition. Examples of disruption in the supply chain include: fluctuating demand, failure to deliver, or quality changes. According to Wehmeier et al. (2005), these disturbances can lead to negative impacts on the logistics chain for a limited period. Measures can be put in place like the buffer.

c) Resilience:

Christopher and Peck (2004) defined resilience as the ability of an organization to return to its initial state after a disruption in its system.

1.2 Types of supply chain risks:

A multitude of definitions have been dedicated to classifications of risk in the supply chain. Among these classifications, we can cite those of:

Juttner et al. (2003), who classified the risk into three categories: internal risk that comes from the organization, external risk of the organization but internal to the supply chain and external risk of the supply chain. This latter type of risk arises as a result of the interaction between the company and its environment.

Chopra and Sodhi (2004) who classified the risk into nine categories:

- a) Risk of disruption (natural disasters, terrorism, war)
- b) Delay (inflexibility of sources of supply)
- c) System (lack of information sharing, unavailability of infrastructure)
- d) Estimate (underestimation, Bullwhip effect phenomenon)
- e) Receivables (number of customers)
- f) Capacity (Capacity cost)

g) Intellectual property (vertical integration)

h) Market (exchange rate)

i) Inventory risk (uncertainty of supply, cost of storage).

Sinha et al. (2004) divided the risk into four groups: norms (standard), suppliers, technological and practice.

Finch (2004) categorized risk into: organization level, application level and inter-organization level.

Norrman and Lindroth (2004) classified the risk into: operational accidents, operational catastrophes and operational uncertainties.

Kleindorfer and Saad (2004) divided risk into two categories: risk resulting from the coordination between supply and demand and risk resulting from the disruption of ordinary activities.

Tang (2006) assumes that the risk can be of the following form: operational risk (example customer uncertainty, cost uncertainty and supply uncertainties) and cost risk (these are the risk generated either by natural disasters or by human being such as flood, earthquake, hurricane, terrorist attacks, economic crisis, currency fluctuations).

Waters (2007) considers that risk takes the form of controllable risks (internal risk) and uncontrollable risks (external risk).

Tang and Tomlin (2008), assume that risks are divided into two classes: strategic risk and tactical risk.

Kar (2010) classified the risk into two groups: systematic risk (such as uncertainty of demand, uncertainty of supply) and unsystematic risk (disruption in the installation of the production line).

Tummala and Schoenherr (2011) considered that supply chain risks can take the following form: demand risk, supply risk, risk of disruption, sovereign risk, risk of delay, system risk, transport risk, risk of process, physical level risk (capacity), failure risk and market risk.

Table 1. Different risk classifications

Authors	Types of risks
Juttner and al. (2003)	Internal risk of the organization, external risk of the organization but internal of the logistics chain, external risk of the organization and external risk of the logistics chain but with its environment.
Chopra and Sodhi (2004)	Risk of rupture, delay, system, estimate, receivables, intellectual property capacity, market, storage risk.
Sinha and al. (2004)	Categorized the risk into four groups: standards (standard), suppliers, technology and practice.
Norrman and Lindroth (2004)	Perhaps in the form: operational accidents, operational disasters, operational uncertainties.
Kleindorfer and Saad (2004)	Risk resulting from the coordination of supply and demand and the risk of disruption of ordinary activities.
Tang (2006)	Operational risk and cost risk.
Waters (2007)	Controllable risk and uncontrollable risk.
Kar (2010)	Systematic risk and unsystematic risk.
Tummala R. and Schoenherr T. (2011)	Categorized the risk into: demand risk, supply risk, disruption risk, sovereign risk, delay risk, system risk, transport risk, process risk, physical plane risk (capacity), risk of failure and market risk.

Source : Optimisation et planification de l'approvisionnement en présence du risque de rupture des fournisseurs FaizaHAMD I

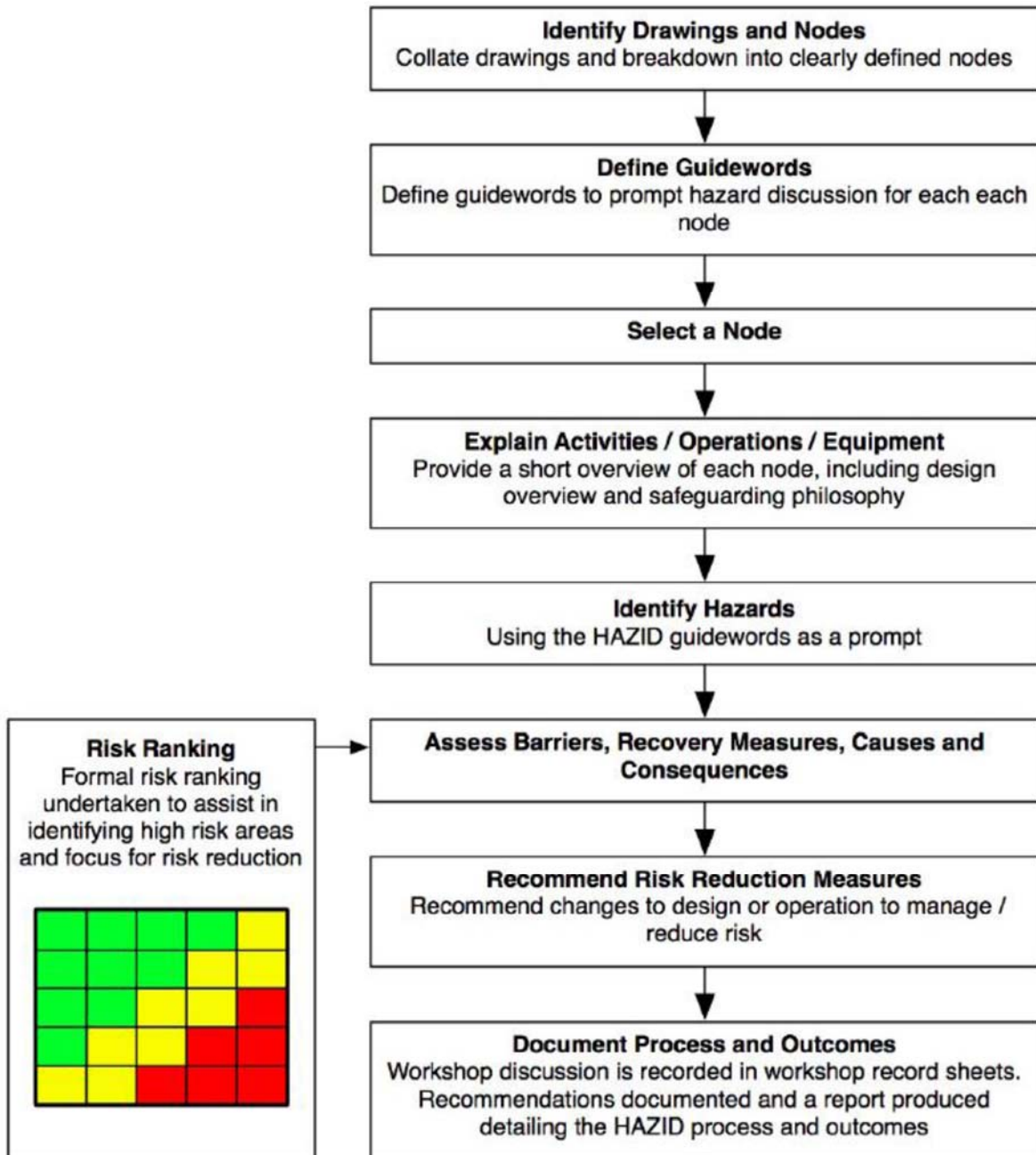
Section Two: Risk management process:

The following figure shows that the risk management process in the logistics chain which successively aims to identify, analyze, assess and control the risk. The goal is to master and consider the means necessary to properly manage risk, capitalize on know-how and experience in this area.

The first phase of this process involves identifying the risk from which to start first, choosing the place, link or node to follow in order to limit the scope of the study. After determining the location, a list of potential risks and its characteristics must be prepared to prioritize the possible risks that we are trying to control. There are several ways to develop a list of risks, let us quote as an example the method of quest, the experiment while indicating the most frequent risks, the method of Brainstorming can be used also to generate a list of risks.

The next step is to list the risk. It is about studying the correlation between the existing risks. This test may reveal a new risk. The identification of risks can make use of traditional methods such as historical data, expert opinion, etc.

Figure 1. Risk management process



Source: General HAZID process for risk assessment from the internet

The second phase of the risk management process is the risk analysis which consists of studying the frequency, criticality and severity of each risk separately to know how to prioritize them.

Various quantitative and qualitative methods are applied to analyze the risks, including: The AMDEC method (Analyse des Modes de Défaillance, de leurs Effets et de leur Criticité): This method consists of identifying the failure modes, evaluating their effects on the system and analyse their causes. The AHP method (Analytical Hierarchy Process) is a multi-criteria decision method.

The third phase of the risk management process concerns the risk assessment. The purpose of this step is to distinguish between the different risks and subsequently select the risks that have the priority to be addressed. We use a matrix of two dimensions a matrix that defines the frequency and severity of risks can also be used. This matrix makes it possible to differentiate between the risks to be eliminated, the risk to be transferred, the risk to be shared and the risk to be accepted, etc.

Several methods have been proposed in the literature to deal with this phase such as: Pareto diagram, QFD (quality function deployment), cause and effect diagram, HAZOP methods.

The last phase is that of control and monitoring in which. During which a real time monitoring of the risk which is done by several methods. When the risk is stable; we must maintain this stability and why not improve it by implementing improvement actions. If it is unstable, a step back to the risk assessment phase and taking corrective actions will be recommended.

Section three: Risk identification methods:

Companies are generally aware of the existence of risks associated with the supply chain, but they are unable to reduce or manage them because they have not been clearly identified. Indeed, an unidentified risk can never be managed or / and controlled. The purpose of this section is to list the different risk identification tools.

3.1 The Delphi Method:

Use of the knowledge of experts (managers, customers, suppliers with good knowledge of the supply chain) in order to obtain a vision of what could be the future and possibly to define a horizon or a probability of occurrence for future events.

3.2 Brainstorming:

Technique based on a group approach, using collective data and individual opinions.

3.3 FMEA (Failure Mode and Effect Analysis):

This method aims to prevent product and process problems from the development stage while determining the modes of failure of a system, and while establishing the effects of these failures on the performance of the whole system.

3.4 Flux mapping:

Standardized visualization of each link and each node of a process in order to better understand the interactions between risks.

3.5 Supply Chain mapping:

Representation of related processes and execution times; it is similar to flow mapping, but from a macro perspective.

3.6 Analysis of critical paths:

The term "critical path" refers to the sequences of activities of a project or process that generate the least amount of deviation or delay, in terms of time or resources, without the project or activity being penalized.

3.7 Identification of Constraints:

Management by constraints leads to determining the key processes which govern the rhythm of the supply chain.

3.8 The planning scenario:

It is a process of developing the plausible future context, against which the strategic decisions of the company can be evaluated.

3.9 The Cause and Effect Diagram (Ishikawa Diagram):

The Ishikawa diagram is a tool that allows you to detect the possible causes of an observed effect and therefore determine the means to remedy them. It comes in the form of fishbones classifying the causes by categories according to the law of 5 M (material, labor, material, method, environment).

3.10 Check List:

It consists of building a list, as close as possible to completeness, of undesirable events that may constitute threats.

3.11 Business Process Reengineering:

Business Process Reengineering (BPR) is a process of questioning and redefining in depth the processes of an organization in order to restructure it to make it more efficient while reducing costs Hammer and Champy, (1993).

3.12 Fault Tree:

Logic diagram using a tree structure to represent the causes of failures and their combinations leading to a feared event (tree root). The reduction of fault trees from the calculation of the minimum cuts makes it possible to identify the critical paths.

We deduce from this the hardware and software elements of the system whose failure contributes the most to the realization of the feared event. The fault trees can be quantified thus making it possible to calculate the unavailability or the reliability of the system modelled Mortureux (2002).

3.13 HAZOP:

Systematic review of the design and operating principles based on:

- 1) The search for all the causes of derivative of the various operating parameters.
- 2) Analysis of the consequences linked to these drifts.
- 3) The means of correction or protection to be provided, if necessary.

This review allows the systematic identification of operating and maintenance problems, and facilitates studies to make corrections or protections to the system studied. In industrial engineering, this study is used from the start of the realization studies on fluid circulation plans, utility diagrams and interconnection diagrams.

3.14 Stress testing:

Stress testing is a set of exercises allowing decision makers to understand and prioritize the risk of the supply chain. This technique is based on the principle "do if the scenario comes true".

3.15 QOOQCP technique (in English that would be: The What, the Who, the Where, the When, the How, the Why):

This technique makes it possible to deal with all the dimensions of the problem, the elementary information necessary to identify its essential aspects. This method is based on systematic questioning.

Section four: Risk measurement techniques:

The development of risk measurement techniques has continued to evolve for a long time. To better understand the field of risk management, it is interesting to know the development of risk measurement over time. In this part, we focus on citing the chronological evolution of risk measurement technique.

1545: Girolamo Cardano introduced the notion of the laws of probability in dice games. He considered that the measure of probability is obtained by the ratio between the number of times of positive results compared to the total number of results carried out.

1654: Mathematicians Blaise Pascal and Pierre de Fermat developed the mathematical bases of the theory of probability. From which, all the concepts and techniques that are developed subsequently are based on these bases such as standard deviation, sampling, applications of probabilities, normal distribution.

1662: English merchant John Graunt introduced birth and death tables based on the sampling method and the technique of statistical inference.

1696: English astronomer and mathematician Edmund Halley incorporated life tables to determine the price of life insurance, which depends on an individual's age.

1713: Swiss mathematician Jacob Bernoulli published "The Law of Large Numbers" from which one can determine the probability and significance of a variable in the presence of the limited amount of information.

1733: French mathematician Abraham de Moivre introduced the theory of normal distribution and the concept of standard deviation.

1738: Jacob Bernoulli, Daniel, introduces the concept of utility: decisions about risks including probability calculations and the value of consequences for the one who takes them.

1944: Researchers John Von Neumann and Oskar Morgenstern used the method of strategy game theory in opposition to gambling in making investment decisions.

1952: Harry Markowitz considered that there is a relationship between risk and return. And that risk can be mitigated through diversification.

1992: Introduction of the concept of Stress testing which is based on the notion of scenario

1994: Publication of the Risk Metrics methodology by JP Morgan which allowed the very wide dissemination of Value at Risk (VaR) methods

1997: development of the theory of extreme values (EVT) in risk management problems.

1999: Introduction of copula functions to model the dependence between risks and properties of a consistent measure of risk.

These techniques are used too much and are oriented towards the field of finance while in the supply chain are rarely used.

4.1 The Value at Risk:

VaR, an acronym indicating value at risk translates into French the value at risk or the value of risk. This is one of the techniques for quantifying risk in currency units that depends on a probability and a time horizon.

Value at risk currently plays a key role in the assessment, estimation, measurement and management of risk in several areas including insurance, financial institutions and more recently in the area of the supply chain. Its simplicity, flexibility and ease of being calculated have greatly contributed to its high popularity. The main objective of this technique is to calculate the possible loss that cannot be exceeded with a given probability over a given time horizon.

VaR is seen as a decision support tool from which the decision maker has an amount on the basis of which he can dare and make decisions. If the VaR is very high compared to the expectations of the decision-maker. The latter can choose between two solutions: either reduce its position (for example minimizing purchase orders) and consequently reduce the value of VaR or else take hedging actions that allow it to reduce the overall risk. So VaR is a risk management tool that allows you to estimate and quantify the value of risk. This tool is no longer limited to the financial field, but on the contrary it can be adapted in different fields such as: insurance, logistics.... (To estimate the risk associated with the breakdown of an actor in the logistics chain.

4.2 The fields of application of VaR:

Since its incorporation into risk measurement, the use of VaR has become increasingly broad and broader than when it first appeared. Indeed, it can be used as a tool to assess and improve business performance. This technique allows the decision maker to readjust performance against risk.

Capital adequacy: Integrating this technique gives the decision maker a rational basis for determining the capital value to keep as a reserve to better observe the unestimated loss.

Investment choice: VaR can be used to choose between two investment projects. The one that will offer the highest return value for a fixed level of risk. VaR also makes it possible to limit activities and subsequently it allows for a better allocation of resources.

4.3 The VaR parameters:

The calculation of VaR is based on three main elements which allow a correct interpretation of the value of VaR:

- The level of confidence.
- The distribution of portfolio profits and losses.
- The holding period the provision horizon (the time aspect).

a) The confidence level:

Confidence level is a basic parameter for measuring risk. It consists of setting a threshold or a critical value which makes it possible to distinguish between the acceptable level and the unacceptable level of risk (favourable situation compared to unfavourable situation). This is the probability of having a loss less than or equal to the value at risk. It is a parameter chosen between 0 and 1 and the most common confidence levels are between 90% and 99%.

b) Holding period:

The second element in calculating value at risk is the period during which the asset is held. This involves setting a period over which we seek to measure the change in portfolio value. There is no formula for choosing the holding period in the value-at-risk calculation. In this case, it all depends on the specificity of the company (the period can be a day, a month, a quarter, a year ...). In fact, to have a reliable measure, companies test with different levels of confidence and different holding period.

4.4 Methods of calculating VaR:

There are three methods for value at risk: the variance and covariance method, the historical simulation method and the Monte Carlo simulation method. Each method has advantages and disadvantages.

a) Historical simulation:

The historical simulation method also called the historical method. Without doubt, this is the simplest method in its design and implementation. It does not require assumptions about the shape of the distribution of returns. Its principle therefore consists in having the historical data of the gains and losses of a given variable for which we are trying to calculate the VaR. Based on these data, it is possible to reconstruct the empirical distribution of gains and losses of this variable and to deduce the value of VaR.

The main advantage of this method is that it does not use distribution assumptions on the random variable of the return. It also has other advantages in terms of simplicity and flexibility. However, this method is particularly weakened by its heavy reliance on historical data that it uses and considers the future and the reproduction of the past.

b) Monte Carlo simulation:

The principle of this method consists in simulating a set of random observations. The simulation parameters for this method can be set by the user (give a distribution law a priori preferably this law is compatible with the history) or estimated based on historical data. This method is characterized by its flexibility and it allows to process different scenarios and to test several tests at the same time. Of course, it requires a lot of iterations and therefore it is difficult to implement, more complex requires a lot of time to calculate it but it gives more reliable results when the number of simulations is large enough.

Indeed, this method differs from the historical VaR method since it is based on the generation of several scenarios while the historical method assumes that the fluctuations of the past will be reproduced in the future. In addition, the generation of several scenarios for the Monte Carlo simulation method allows it to go beyond the computation constraint of the quantile.

To calculate the VaR using the Monte Carlo simulation method: the following three steps can be followed:

- 1- Set the simulation parameters or the estimates (for example fix the average and the variance of the cost or profit, fix the interval ...
- 2- Generate n random variations with the fixed or estimated parameters.
- 3- Order the observations obtained.

c) Variance-covariance method (normal delta, parametric method):

The variance-covariance method also called the correlation method. It is a method which assumes that the profitability distribution of risk factors follows the multivariate normal distribution. The correlation measure or variance-covariance matrix between these factors is based on historical data obtained from a specific static model. Indeed, this method assumes that the correlation between these factors is stable over time.

This method has the advantage that it is easy to apply unlike the Monte Carlo simulation method, but it has the disadvantage that it is valid only with linear (portfolio) distributions.

4.5 Benefits of VaR:

VaR is relatively the simplest notion of risk management measure. VaR is easy to understand and interpret this using a given level of confidence: how much can we gain or lose with a given level of confidence?

- Based on the VaR figure, we can compare two distributions for the same level of confidence.
- For each confidence level, there is a specific value of VaR which allows to define the distribution. In this sense, VaR has superior characteristics than the standard deviation (the standard deviation).
- Unlike the latter, VaR focuses on a specific part of the distribution modelled by a level of confidence. This is what is often needed, which makes this technique very popular in the field of risk management including finance, nuclear power, airspace, materials science, various military applications....
- Among the most important properties of this tool, their estimation stability. It does not consider the tail of the distribution, that is to say, it does not detect the highest losses which are generally difficult to estimate.
- The simplicity of VaR makes it possible to quantify the potential loss involved in a single amount.
- VaR synthesizes the effects of exposure to various sources of fluctuations. It therefore makes it possible to quantify and compare the plausible losses linked to the different portfolios or positions regardless of their composition.
- It is proving to be a key tool for measuring a significant entity's overall exposure to risk.

4.6 Disadvantages of VaR:

VaR does not consider the properties of the distribution beyond the confidence level. This implies that the VaR increases slightly following a slight increase in alpha. To properly estimate the tail of the distribution, it is preferable to calculate several VaRs with different levels of confidence.

Failure to consider the tail of the distribution can lead to the adverse effects of high risk (not estimated).

Risk control using the VaR technique can lead to undesirable results for skewed distributions.

VaR is a non-convex and discontinuous function for discrete distributions.

Using it does not have the property of subadditivity. Hull (2006) a consistent risk measure must respect the following four properties:

- Invariance (or consistency) in the effect: any safe amount S (threshold) that modifies more or less a given position decreases or increases the amount at risk by the same amount, therefore by S .
- Homogeneity: multiplying a given position by m multiplies the risk by m .
- Monotonicity: if the position X yields less than Y in any state of the world, it is riskier since it is more susceptible to lower returns.
- Sub-additivity: the measure of the risk of grouped positions does not exceed the sum of the particular risks; in other words, bundling does not add to the risk.

Conclusion:

This chapter handled the related risks to supplying in an industrial company, which is why we need a lots of risk assessment and risk management methods to deal with each problem by its own way.

The proper way to deal with risks related to supplying is using a systemic approach because in any organism everything is connected to each other, and now by using proper methods it can prevent any failure in the supply chain.

As this chapter has explained there are many methods that risk management propose as a solution.

Chapter Three

FIELD STUDY OF THE FACTORY

Introduction:

This chapter will go through the detailed information's gathered from the field (The factory where the product is being made) to see the technical troubles that could cause some delays in supplying and the troubles that could disrupt the product delivery also known in the industry as PSD (Product/Service Delivery); and give the necessary recommendations that are fit. Note that in all what it comes the factory is an Algerian gypsum mining factory by the name Chennoufi Groupe.

In the gypsum mining industry, we rely on simple concepts combined together to perform the best practical idea to transfer our gypsum rocks into a commercialised product for urban use.

In this process we are relaying on a bunch of supplying processes to bring a raw material from the mining site to the factory where we will be working on creating the product.

The first aspect is cutting the rock using heavy weight equipment, then the workers will be loading it to the trucks to send it to factory pit where all the stones will be gathered.

In this particular factory to make the final product the work goes via loops to remove impurities from the raw material to make it commercially ready for use, and as the factory delivers three main types of product the principal factor that defines them is the cooking part in the oven.

In order to make our products ready for use the factory depends on cracking machines that breaks the rocks into smaller pieces, sieve machines depending on the needs of each one including the needed product characteristics and the phase we are in, and a heat source (The oven) to remove the main problem which is water within that is always present in these rocks.

After the product goes through these steps, the product get holds into another destination which is the packaging docks to be packed into gypsum bags depending on the clients' needs which is in this case the factory presents bags of 40 kilograms of three main products to be served.

Now and finally after the bags are being sealed two directions will be presented, the first option is the direct client delivery on his truck to provide best delivery, less trouble, less risky and easier with less time to waste, or the product goes to storage in combination of at least 30 bags in one shipment ready to be served via delivery tractors.

Section one: Walkthrough the production line in the factory:

The factory holds a single line that starts with a rock pit for the raw material, from it to the first crusher machine, that being said, it will be noticed that with every single crusher in the production line there will be a bypass for the unwanted pieces of rocks to pass through.

Usually after each phase of crushing or cocking our product, there will be a couple of silos for initial storage purposes, they will be preparing the product for the next step in the line, whether it's for sieving, crushing or cocking.

After the initial crushing from the first crusher, our product moves to the main silo via electric elevator and down of it another crushing machine.

After it, another two silos, those two silos will be filled by the crushed raw material via two electric elevators for each silo, and at the bottom of each one there will be a smaller crusher for the next crushing phase to deliver it to the oven where the product will be cooked to remove the impurities which is in our case the water within the rock.

The factory oven works approximately 24/7 and can process about 5400 Tonnes of raw material till the recock of another product. Mainly this oven can reach about 165 Celsius degree to make sure that the unwanted water gets clear out via a vapor discharge canal to the outside of the factory.

The oven processes the raw material by a horizontal spiral that keeps our material fluctuating inside the oven till it's completely cooked depending on our needs.

Besides of removing the impurities cooking the rock for a certain time will makes it reshape itself depending on the wanted product, so we are talking about three products that means three times are estimated (usually 1 hour, 40 and 30 minutes) by the engineer that takes on consideration the properties of the rock on each time.

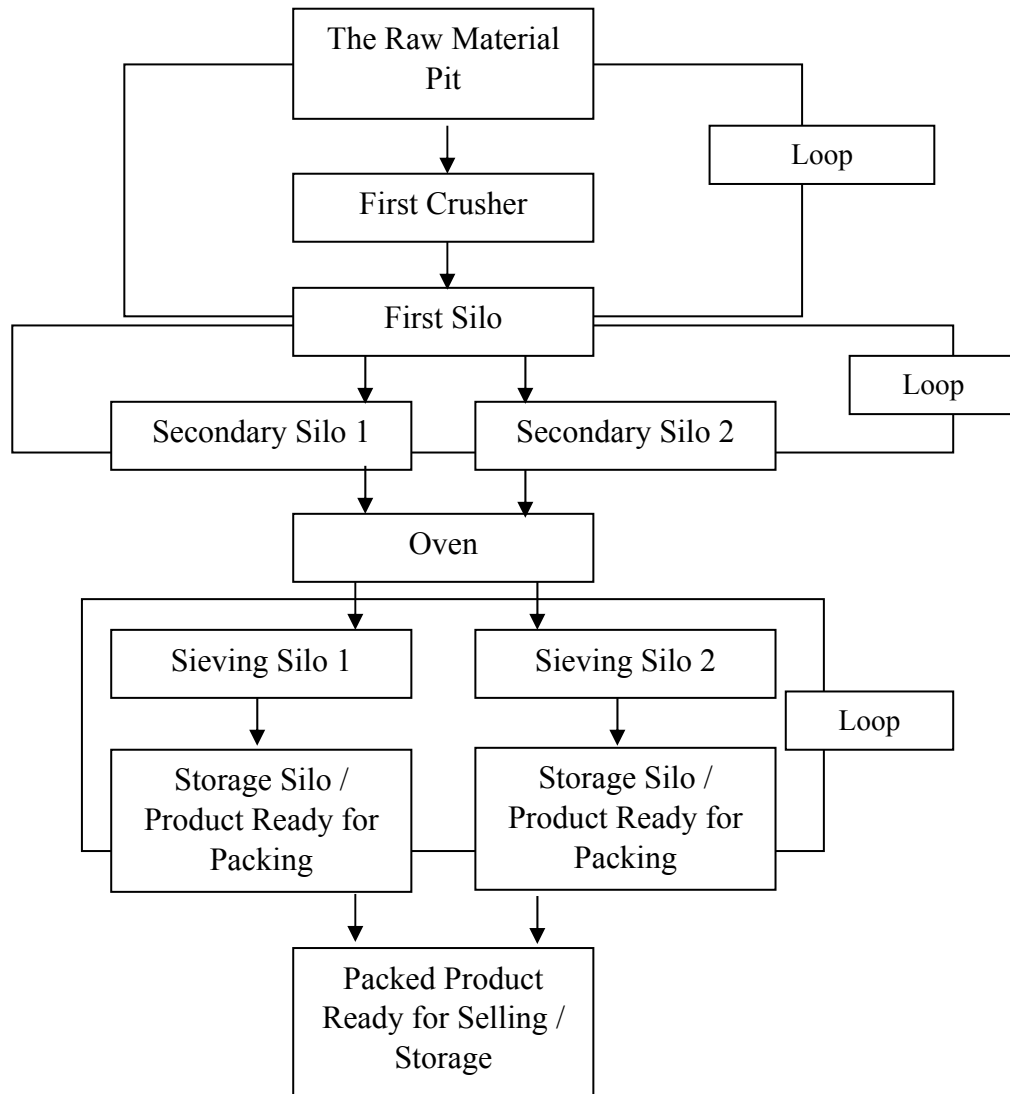
After the product has been cooked it will be moved to the next stage where it will be transferred to two separated silos via an electric elevator, the purpose of those two silos is sieving job.

Depending on the sieve installed we will get the wanted powder, the unwanted pieces will be sent back to another crusher under these silos to be crushed once more and back up once more for a second sieving job.

After the sieving the final silos will hold the final product as a ready to pack, in about 40 kilograms packs ready to be served to our clients or be send to storage.

In order to make things clearer the whole manufacturing process is in the following figure:

Figure 2. Diagram of the main production line



This organigram was elaborated by the researcher

Section two: Walkthrough the main risks that could disrupt our supply chain work:

Although it seems a simple process but things can go wrong if we miss seeing them, under any circumstances in any mining industry we must use the simplest methods to make things work, clean, efficient and cost less.

Complicating things will lead to unnecessary costs that the business doesn't need, which can lead to making sometimes huge cuts, that may occur in layoffs or even not buying necessary supplies that the factory needs all the time.

2.1 Human factor:

Sometimes the ones are responsible for any type of accidents are the working personnel them self, and there are several ways that could happened:

- Bad coordination or bad communication during work.
- Stress and tiredness.
- Non-qualified personnel.
- Wrong decision making.
- Bad working conditions.

2.2 Bad Weather:

One of the reasons that could disrupt or delivery process is bad working conditions, in this region we could expect, sand storms, dust storms, excessive heat temperature, and excessive low temperature for night shift works, also in some cases unexpected heavy rain, that could result in floods.

One of the main problems here that the factory does not have water discharge system that could help prevent a flood inside the factory because it contains low spaces underneath the production line.

2.3 Disruption in the main production line:

If we experience a zero error at the delivery from the mining site to the factory that's something great to begin the day with but problems could occur down the line.

The factory holds a production line with too much mechanical parts moving to serve us a fine product, these mechanical parts are being exposed to too much pressure and contact with the raw material this could lead to malfunction and breaks.

2.4 The main crusher:

By the main rock pit, one main crusher for initial crushing, it is responsible for the first crushing operation, its electric run and semi-automatic controlled.

The problem with this crushed that is its located under the ground level, which makes the access to it really troubling.

Although it was engineered right to match the right working level it is still placed in a level where operators and mechanics can't access to it easily.

One of the main troubles about it is changing parts in it requires the whole production line from it to the oven to stop for maintenance purposes or checks.

2.5 The first silo:

This silo is in the same line after the first crusher, it holds the first crushed material, when it's in his full capacity, the first crusher stops working and it is put to a rest, underneath it we will find another crusher to begin a secondary crushing.

Its capacity equals the deliver 7 times the normal silos that are coming up ahead, which makes it the biggest between the other ones in the production line.

The amount of load its experiencing is greater in all the upcoming silos, plus it must endure not only the weight but the vibration underneath it as well to deliver to the next two silos flawlessly.

This silo is being filled by an electric elevator, electrically powered via only the main power supply, which mean any power cuts could lead to its stop immediately.

One of our worst-case scenarios that this silo can come to face a collapse due to the enormous pressure that it faces, and this is a real issue because it will disrupt the entire production line

2.6 The secondary silos:

These two silos come after the main silo they are much smaller in capacity, distributed in two sides, if any of them stops working or puts in holds for any reason the other one keeps working perfectly and keeps the delivery to the oven.

In order for those to be filled the elevator must keep working all the time, in any case the elevator would fail and keeps the delivery with no stop; we could have a flood silo and this will cause the raw material to be wasted outside the silos.

Although that the elevators are semi-automatic there is always a chance of a failure, either it will just stop or just keeps delivering too much and that may cause a collapse of the body leading also the whole production line to stop.

2.7 The oven:

One of the main things to prepare the product is the cooking job, using a horizontal oven with a spiral will give us the ability to process our raw material to extract the impurities from it by dehydrating the product at the level we want it to be, plus giving it the physical shape that we want it to be.

The problem with the oven that it needs two main power supplies, they are gas and electricity, and the biggest problem that we will face is gas cuts for unknown reasons which mean the unscheduled ones, and electricity cuts.

If the case a gas cut, the whole production will stop except what's has been already cooked, and we wait till the gas is back, but we need to keep the spiral moving all of that is determined by the engineer and the line chief.

If the case was an electricity cut, the factory uses a secondary temporary power line that keeps only the spiral in the oven moving while the rest of the production is fully stopped, so the cooked product will not cause major problem to the oven.

2.8 The sieving silos:

After the cooking is done the sieving silos will process the cooked product depending on our needs the operators will make the special changes in those two silos to match our client's specifications.

The problem here that in each silo of those there is a door to change the size of the sieve in order to do that we must stop the elevator and empty the sieve before each change, this will kill time and this is also known as down time.

One of the main issues that this silos cause is too much powder loses in the air, any lose in the line of production will reflect in bad impact on the surrounding environment including the working personnel and the sensitive equipment and because of the nature of it that its

manually on and off it will oppose a threat to the entire production line if it was turned on or off by mistake.

2.9 The final silos:

The final silos hold the final product ready to be packed, those silos contain air compressors to release air inside of them to dispatch the powder to make it come down a singular tubing to the ground packing unit underneath it.

In any case those air compressors are to stop, the entire packing process will be disturbed till the restore of the functionality of the compressors on each silo.

However, under any case also that will include an electricity cut, this will stop the packing process even the powder is ready for packing, the problem is that this process here is not fully automatic but the silos has a sensor that indicates the level of the powder that it is inside the control room.

2.10 Disruption in the power supply:

Our entire production chain depends on both electricity and gas, any disruption in those two will lead to a downtime in the process and it is accountable with money in some cases, or can cause damage either to the existing equipment or the surrounding environment.

Gas cuts can provide huge problems but we can avoid them in some occasions avoided however the power must be restored immediately in case of urgent delivery the factory must always be ready work.

In case of electricity cuts, the entire production chain will be stopped however we use the secondary electricity supply power and keep the oven up to work; Temporary solution till the power is restored.

2.11 Human error:

Under any perfect engineering of equipment, process, management, the human error is always the probable one to occur, this could be due to a lot of reason:

- Communication problems
- Short in training
- Poor skills
- Minimum personnel number

It has been noticed that the working personnel tear up some bags while delivering the product, this will lead to a delay in the delivery process plus a lost in money, because the replacing will be by delivering a new bag, while the tear up bags will go through another processing.

2.12 Global pandemics:

As this research had been conducted during 2020, the Corona Virus has disrupted all sorts supply chains across the globe, even if our factory depends on mined rocks the factory still needs outside supplying such as:

- Change parts for maintenance purposes
- Protective clothing for the personnel
- The packing bag
- Available market
- Open roads

Not forgetting that the social distancing itself makes the work riskier and more stressful special when a factory like this works with the minimum personnel number.

2.13 Bad leadership:

Any organisation needs the right leadership to operate correctly, if there was any sign of bad leadership the whole supply chain will be disrupted no matter thy type of business, the type of the working personnel, or how new the technology is.

All of what we mention before rely on the leadership within to make things work correctly, without it everything collapses apart.

2.14 Accidents and incidents:

Talking about accidents as a main issue is something normal to see, because accidents are one of the main reasons for the work to stop, this occur due to human error and cause different troubles to the entire company not just the factory, including management end legal, but the working as well will suffer the consequences.

Not having a Health, Safety and Environment cell inside the company can cause it a severe trouble due to the amount of danger existing inside of the factory plus because of the amount of contact there to be with the production line or the mining site, therefor we can

witness a lot of accidents inside and outside the factory and that's the whole supply chain that we have.

Incidents are less to occur like accidents but if they did there is a great chance that they will be greater than the expected scenarios, as the 2020 has witnessed the explosion in Lebanon port, incidents could be severe due to their nature, however the factory may not have explosive materials but the used gas could be sufficient to break everything down.

Even if all the security measures have been placed well by the manufactured company of the factory, risks could break through any barrier in unexpected manners, which will lead to catastrophic problems to the working personnel the environment and the factory, and even a client at the site could be in danger.

Section three: Recommendations:

As a nation that depends on the mining industry in all of its forms, we need to keep moving through all the challenges that we face in this industry and under any circumstances we need to keep moving forward to preserve our riches.

Some of the risks that faces the production line, they are not considered as problems but always considered as challenges, and some of them don't need the intervention of any technology at all, just need to be handled and controlled in a proper manner.

3.1 Establishing a Health, Safety and Environment policy:

Although the production line is semi-automatic, the human error is one of the things to occur during working to insure full product delivery, a policy must be made, this policy must include the work ethics and the proper instructions for the best job practises.

The workplace must include all sorts of tags, restriction pictures, security observation to remind the working personnel with the proper safety execution during work, this is not limited just to production line area but also during all sorts of movements, weather serving a client, side works, or paper work.

This policy as well will reflect the company's dedication to the safety of its operations and the safety of its working personnel, and its best to take in consideration to use British petroleum risk assessment matrix as a reference as shown in Appendix A.

Establish a work permits that allows the work to flow in order and minimise the risk exposure to the operator and the production line, as shown in the example in Appendix B.

3.2 Externalization:

One of the best ways to hold the full safety of the production line, is to externalise all unnecessary work such as inspections, maintenance and the turn around of the regularly factory inspections, this will minimise the risk to occur.

This will minimise the risk of being short of the necessary changing parts for the factory and it will insure for us the best quality services when needed

3.3 Leadership and empowerment:

It has been clearly noticed that the human error has a lot of factors to occur from and the basic one is the carelessness, it clearly be notice in the field when there is an absence of leadership in the field.

Empowering people to do what's right will rise the amount of awareness among theme, this will lead to the creation of bonds between the working personnel so that they could excel in work.

Empowerment has been the most effective ways in leadership management in any organization, and it has been noticed that it rises their trouble-shooting in the fields of work, this will make us be less concern about the work and make us move toward optimization of performance.

3.4 Inventory development:

Using a developed system such digitalization can help reduce the down time in the factory while we are short in part, because any time loss or product lose due to production losses is a major thing to be handled by the fast intervention of the maintenance team, which mean our inventory must have a digitalize system to notify us in any short of pieces necessary.

3.5 Team track:

Establishing a team track system will allow the supervising personnel to keep in touch with the working personnel progress, this will include all sorts of personnel development such as:

- Safety meeting
- Weekly meeting
- Training

To insure the best investment in the people them self.

Conclusion:

As we have seen in this chapter risks management related to suppling in the factory involves more precision to the executed job, risks to the suppling chain can occur in many forms and have many shapes to be handled.

Using a systemic approach is always the best way to handle such situations, that will include teams monitoring, from training to empowerment, and follow always a best model to handle risks, either to remove them, isolate them, or externalize them so the factory may not be affected.

General Conclusion

From all the chapters, to understand now the nature of the supplying work flow in an industrial company, and how it would generate the value in the company structure are now clear.

Identify each necessary component in procurement, supplying, inventory is necessary because they are working on as a set of gearboxes that turns on one another in the most productive way that gives us maximum of value in the mining industry.

As it has been shown in chapter two, before we do any risk assessment we need to go through a set of commands to identify our potential risk, identifying the risk will not only help solving the problem but it will show the best method to use, the best practices that we should use, and profit in money, and time.

Risks related to supplying move horizontally in any organization, so in order to encounter any risk, we need to use a systematic approach and extend it horizontally and vertically if needed, this will allow the whole organism to function properly as it works and prevent the company from facing a cascade failure in all the way.

From the field, it is not always the intervention of new technologies that prevents the storms, it's the clever thinking of ways and methods, in order to prevent something bad from happening we need to simplify our ways and methods in order to surpass the complexities.

In Algerian companies the need to work more on communication between people, that includes different departments, and different ranks inside of the company, this will insure the best practices of risk prevention, and one of the best ways to establish that, is as mentioned in the chapter three, we need a HSE Policy inside the company that gather the whole workloads in one multi discussion to insure the safety of execution.

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APPENDIX A
RISK ASSESSMENT PAPER by Bp

APPENDIX B
RISK ASSESSMENT MATRIX

Rating for Likelihood for each risk		Rating for Consequence for each risk				
A	Frequent – Expected to occur	1	Serious – Death or permanent disability			
B	Likely – Will probably Occur	2	Major – Long term illness or serious injury			
C	Possible – Might occur sometime	3	Moderate – Medical attention and off work			
D	Unlikely – Not likely to occur	4	Minor – First aid treatment			
E	Rare – Exceptional circumstances	5	Insignificant – No injuries			
Grade: Combined effect of Likelihood/Consequence Likelihood						
		Likelihood				
		Frequent	Likely	Possible	Unlikely	Rare
Consequence	Serious	1	1	1	1	2
	Major	1	1	1	2	2
	Moderate	1	2	2	3	3
	Minor	2	2	3	4	4
	Minimum	2	3	4	4	4

Recommended actions for grades of risk	
Grade	Risk mitigation actions
1	Extreme Risk – immediate action required. Mitigation actions to reduce the likelihood and consequence to be identified and implemented as a matter of urgency.
2	High Risk – Notify Senior Management. Mitigation actions to reduce the likelihood and consequence to be identified and appropriate actions implemented within 24 hours.
3	Medium Risk –Mitigation actions to reduce the likelihood and consequence to be identified and implemented within 7 calendar days and monitored for duration of risk.
4	Low Risk - Risk to be monitored and action to be taken within 30 calendar days. Ongoing monitoring required to ensure grading doesn't increase over time.