

Higher School of Management and Digital Economy



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**ERP System and its impact on business
performance**

Case study: SONATRACH

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Dedication

To my mother

*Words are unable to express all my gratitude and love.
To the woman who sacrificed her whole life for us.
May you accept this modest work as a testimony to my deep gratitude
and affection.
May god keep you healthy
And give you long life.*

To my father

*To whom I owe everything
In testimony of the effort he made for my training and my studies
For his unwavering faith in my success.
May God keep you healthy and give you long life.*

*To my brothers
To my dear sister
To my nephews and niece
To my uncles and my dear aunt*

To all my friends for their encouragement and support

To everyone I love and who loves me

I dedicate this work

Yahia

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Abbreviations list

AI	Artificial Intelligence
BDM	Business Development and Marketing Department
CEO	Chief Executive Officer
CIM	Computer-Integrated Manufacturing
CIO	Chief Information Officer
CMN	Communication Department
CRM	Customer Relationship Management
DSI	Department Système d'Information
DSS	Decision Support System
EIS	Executive Information System
EPM	Engineering & Project Management
ERP	Enterprise Resource Planning
EVA	Economic Value Added
FI CO	Financial accounting and controlling
FIN	Finance Department
HR	Human Resources
HSE	Health, Safety and Environment Department
ICT	Information and Communication Technologies
IT	Information Technologies
JUR	Direction Centrale juridique
KM	Knowledge management software
MIS	Management Information System
MM	Material Management
MRP	Materials Requirements Planning
PP	Production Planning
QFD	Quality Function Deployment
RHD	Human Resources Department
ROE	Return On Equity
ROI	Return On Investment
SCM	Supply Chain Management
SCP	SAP Cloud Platform
SD	Sales and Distribution
IS	Information Systems
SONATRACH	Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures
SPE	Direction Corporate Stratégie, Planification et Economie
TPS	Transaction Processing System
TRF	Transformation Department
WM	Warehouse Management
XRP	Extended Resource Planning

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GENERAL INTRODUCTION

General Introduction

Companies are functioning in an increasingly complex and changing environment. They are faced with various problems: saturated markets, rising competitiveness, more demanding and less loyal customers, etc. In such an environment, the competitiveness of businesses depends more and more on their flexibility and their capacity to innovate, both in the way they are organized, their mode of production and in their mode of exchange with consumers and suppliers.

However, in their quest for competitiveness, the biggest challenge businesses encounter is the difficulty of acquiring correct data and information, and adequate interfaces between the numerous operations of the company. The difficulty originates from the fact that the company is generally organized according to a functional model characterized by the multiplication of information sub-systems. In order to deal with this challenge of dispersed knowledge and the requirement to be competitive, the company is striving to convert its vertical organization by function to a horizontal organization by process, directed towards the customer. This new model presupposes the integration of the company's core operations and the creation of a coherent information system assuring the uniqueness of the information and access to it from all the company's activities. ERP (Enterprise Resource Planning) software enable such organizational and strategic orientations.

ERP is without a doubt the most advanced sort of integrated software package on the market today in the search for a fully and optimally computerized firm. ERP is one of the most dependable options, and its goal is to connect all data relevant to the company's functions through a single database. Adoption is justified as an organizational technology whose transformation has a significant impact on the company's structure and management procedures.

In fact, if many firms are attracted to ERP, it's because it is intended to provide advantages in productivity and efficiency, notably through its potential to make the firm more integrated. This integration involves both the company's automatable procedures and the information processed by the software. Indeed, integration is one of the key reasons why businesses seek to equip themselves with an ERP.

In this context, our work aims to seek a link between Enterprise resource planning and the enhancement of the company's performance. We illustrated the subject with a practical case in the well know Algerian gas and oil company, SONATRACH.

The objective of our work is to demonstrate the impact of ERP system on the performance of an enterprise by answering the following question:

“How can ERP contribute to the improvement of a company's performance?”

This problem raises the following sub-questions:

- Does the ERP offer fewer disadvantages and better advantages than the old management software?
- What Key Performance Indicators are critical in measurement of performance?
- Does ERP with all its dimensions have an impact on firm performance?

To answer these questions, it seems important to us to examine the following hypotheses:

- **Hypothesis 01:** ERP is an integrated management software that gives fewer disadvantages and better advantages compared to the old management software.
- **Hypothesis 02:** Economic indicators (ROI, ROE...) are the most critical KPIs in measurement of firm's performance.
- **Hypothesis 03:** ERP with its dimensions have an impact on all the aspects of company's performance (economic, organizational, and human performance).

In order to confirm or disprove these hypotheses, we will conduct a bibliographical search such as books, academic works and a rich webography. For the practical part, we will proceed with the descriptive method with a qualitative study that will allow us to know the impact of ERP system on the performance of the enterprise.

The organization of this research is articulated as follows:

- **The first chapter** aims to introduce the concept of information system and to present ERP as an integration technology and then, the process of implementing an ERP system.

- **The second chapter** presents the concept of firm performance, then shows the link between ERP and company performance, and finally how the performance of a firm is measured.
- **The third chapter** is devoted to the presentation of the hosting company SONATRACH, then description of the data collection methodology necessary for the empirical verification of the pre-established model, and lastly analyzing the results of the research data.

CHAPTER I: INFORMATION SYSTEMS AND ERP

Chapter I: Information Systems and ERP

Separate applications comprised the information systems (IS) (accounting, production management, commercial management, etc.). Only interfaces allowed these various applications to communicate with one another. It was critical to implement integrated systems, such as Enterprise Resource Planning (ERP) software packages, to improve information exchange between the company's various functions.

This chapter is composed of three different sections. In the first section we'll know the definition of Information systems and how they evolved over the years. Then, we will see the components, types, and the role of Information systems in a firm. After that, we'll focus on Enterprise Resource Planning system in section two. We are going to define ERP systems, talk about it's evolution, it's specificities, and what are the motivations for a business to get an enterprise resource planning system. Finally, in section three we'll know the different characteristics of an ERP system, the difficulties that a business could face while implementing an ERP system, and how the process of implementation works.

Section 01: Information systems

To better understand what the I.S function represents today, it is necessary to be aware of the changes it has undergone. This is precisely the aim of this first section which is devoted to talk about the emergence and development of the I.S function. We will focus on the major paradigm shifts experienced by the world of information systems by distinguishing three main periods, ranging from fifteen to twenty years old. This breakdown, however arbitrary it may be, aims to highlight the durations of adoption of the ruptures experienced by the I.S as well as the direct implications on their functions in the company.

1.1 History of Information Systems

1.1.1 A first centralized period (1950s-1960s)¹:

There is, strictly speaking, in the 1950s and 1960s no real notion of “Information System” but rather a computer system seen like a results machine. In this context, computing management is not addressed to the lifeblood of the organization but only to its administrative system. Indeed, this period is that of the large systems centralized, called "mainframes". Centralization implies that these programs are not portable, so they cannot be used on any platform.

The logic at that time is to produce independent applications. The problem arising from all this is the redundancy of the data collected, making their analysis very complicated. It is important to specify that in this context, the use of these systems is entirely the most exclusive and limited to very large companies, as well as to major research programs. which are programmed very specifically for company-specific management.

In this context, the role of I.S is limited to the processing of transactions, record keeping, accounting and other electronic data processing applications. This role, however, saw its importance grew in the late 1960s when the concept of management information system (MIS) was developed under the incentive of Robert N. Anthony who, as early as 1965, introduced the notion of “Management Information System”. This innovative concept involved a new function aimed at

¹ Pascal Vidal, Vincent Petit, Systèmes d'information organisationnels, Paris, 2nd edition Pearson Education, 2009, p6-7

providing user managers with the information they want in the form of management reports. But in these years of a continuous race for performance, information systems evolves very quickly.

1.1.2 Early 1970s: the beginning of research on information systems¹

At the end of the 1960s and the beginning of the 1970s, the field of information systems was still embryonic and certain concepts were not yet well defined. Very often, the information system is likened to an automatic data processing system, an essential tool for "automated management" with the idea that these I.S must be able to provide the right information, to the right person, at the right time (R3 rule: the Right information at the Right time to the Right person).

A few years later, the main paradigms of the Organizational Information Systems (OIS) were present in major American universities.

We also found the central idea of decision support which played a major role in the emergence of Management Information System (MIS). The latter must meet the needs of the different strategic, tactical, and operational levels.

1.1.3 The 1980s: research in information systems²

In the 1980s, the field reached maturity with the creation of the first research centers on IS, universities continued to create independent research departments on Management Information System and set up places specific teaching programs on information systems. In addition, the work of WISEMAN³ has observed the association, in the field, between IT and strategy. He suggests abandoning the classic approach to information systems and adopting a strategic perspective. In this work, he tries to understand to what extent a company can use information technology as a "strategic weapon" capable of bringing out new strategic options or supporting their implementation. It uses the recent works in strategy of A. CHANDLER⁴, and PORTER⁵, the latter show that IT can be, more than a tool for controlling the performance of organizations, it is a source of competitive advantage, "a strategic weapon" which is already being used in the field.

¹ M.Bigand, J.P.Bourey et al, *Conception des systèmes d'information*, édition technip, Paris, 2008, p.93

² <https://altametrics.com/en/information-systems/what-is-information-system.html> accessed (04/07/2022)

³ Eric Wiseman, Chairman, President, *CEO, VF*.

⁴ Alfred Chandler, an American economic historian. Having focused on *the study of the management of large American companies*, he is often referred to as a "business historian".

⁵ Michael Porter, a professor of *business strategy* at Harvard University and a *business consultant*.

1.1.4 Information systems today

In less than half a century, driven by the phenomenal progress of information technologies and by an ever-increasing demand from managers, information systems have profoundly modified the functioning and management of our organizations, especially in the face of increasing complexity or diversity situations encountered, the organization must be able to provide its decision-makers quickly and efficiently with valid and efficient information, and for this it seems to be accepted that decision-makers rely on advanced Information and Communication Technologies (ICT).

1.2 Definition of information system

Information system (I.S) is a set of company resources that allow the management of information. The I.S is generally associated with technologies (hardware, software and communication), the processes that accompany them, and the people who support them. First called IT, then it took the name of I.S with the arrival of new technologies that have expanded its field.

Various authors have attempted to define Information system in different ways:

“An information system (IS) can be defined technically as a set of interrelated components that collect, process, store, and distribute information to support decision making and control in an organization.”¹

“Information systems are combinations of hardware, software, and telecommunications networks that people build and use to collect, create, and distribute useful data, typically in organizational settings.”²

¹ Laudon, K.C. and Laudon, J. P. (2014) *Management Information Systems*, thirteenth edition. Upper Saddle River, New Jersey: Pearson.

² Valacich, J. and Schneider, C. (2010). *Information Systems Today– Managing in the Digital World*, fourth edition. Upper Saddle River, New Jersey: Prentice-Hall.

“Information systems are interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and visualization in an organization.”¹

These three definitions focus on two different ways of describing information systems: the components that make up an information system and the role those components play in an organization. Each one of these needs to be examined.

1.3 The Components of Information Systems

Information systems can be seen as having five major components: hardware, software, data, people, and processes. The first three are technology. These are what can probably be viewed as what defines information systems. The last two components, which are people and processes, separate the idea of information systems from more technical fields such as computer science. To fully understand information systems, we must understand how all these components work together to bring value to an enterprise.

1.3.1 Technology²

Technology can be defined as the application of scientific knowledge for practical purposes. The application of scientific knowledge for practical purposes especially in industry, from the invention of the wheel to the harnessing of electricity for artificial lighting, technology has become ubiquitous in daily life, to the degree that it is assumed to always be available for use regardless of location. As discussed before, the first three components of information systems – hardware, software, and data – all fall under the category of technology. Each of these will be addressed individually.

¹ Laudon, K.C. and Laudon, J. P. (2012). *Management Information Systems*, twelfth edition. Upper Saddle River, New Jersey: Prentice-Hall.

² <https://www.britannica.com/technology/technology> accessed (04/07/2022)

- Hardware

“Hardware is the tangible, physical portion of an information system – the part you can touch. Computers, keyboards, disk drives, and flash drives are all examples of information systems hardware.”¹

- Software

“Software, instructions that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system. The term was coined to differentiate these instructions from hardware—i.e., the physical components of a computer system”².

A set of instructions that directs a computer’s hardware to perform a task is called a program, or software program.

- Data

The third technology component is data, we can think of data as *“individual facts, statistics, or items of information, often numeric. In a more technical sense, data are a set of values of qualitative or quantitative variables about one or more persons or objects, while a datum (singular of data) is a single value of a single variable”³.*

Pieces of unrelated data are not very useful. But aggregated and organized together into a database, data can become a powerful tool for businesses. Organizations collect all types of data and use it to make decisions which can then be analyzed as to their effectiveness. The analysis of data is then used to improve the organization’s performance.

¹David T. Bourgeois and James L. Smith. *Information Systems for Business and Beyond* Updated edition: August 1, 2019: page 13

²Britannica, The Editors of Encyclopedia. "software". Encyclopedia Britannica, 14 Jan. 2021, <https://www.britannica.com/technology/software> Accessed 15 May 2022.

³ OECD *Glossary of Statistical Terms*. OECD. 2008. p. 119. ISBN 978-92-64-025561.

1.3.2 Networking Communication¹

Aside from the technical components (hardware, software, and data) that have long been regarded the fundamental technology of information systems, one new component has been suggested which is communication. The early personal computers were stand-alone devices that didn't connect to the Internet. In today's hyper-connected world, however, a computer that is not linked to another device or an electronic network is exceedingly unusual. Although the networking communication component is technically made up of both hardware and software, it is such an important part of today's information systems that it has been given its own category.

- People

When considering information systems, it is tempting to focus on the technological components and overlook the need to look beyond these tools to properly comprehend their integration into an organization. The next phase is to concentrate on the people who work in information systems. People working with information systems are critical, from front-line user support personnel to systems analysts and developers, all the way up to the chief information officer (CIO).

- Process

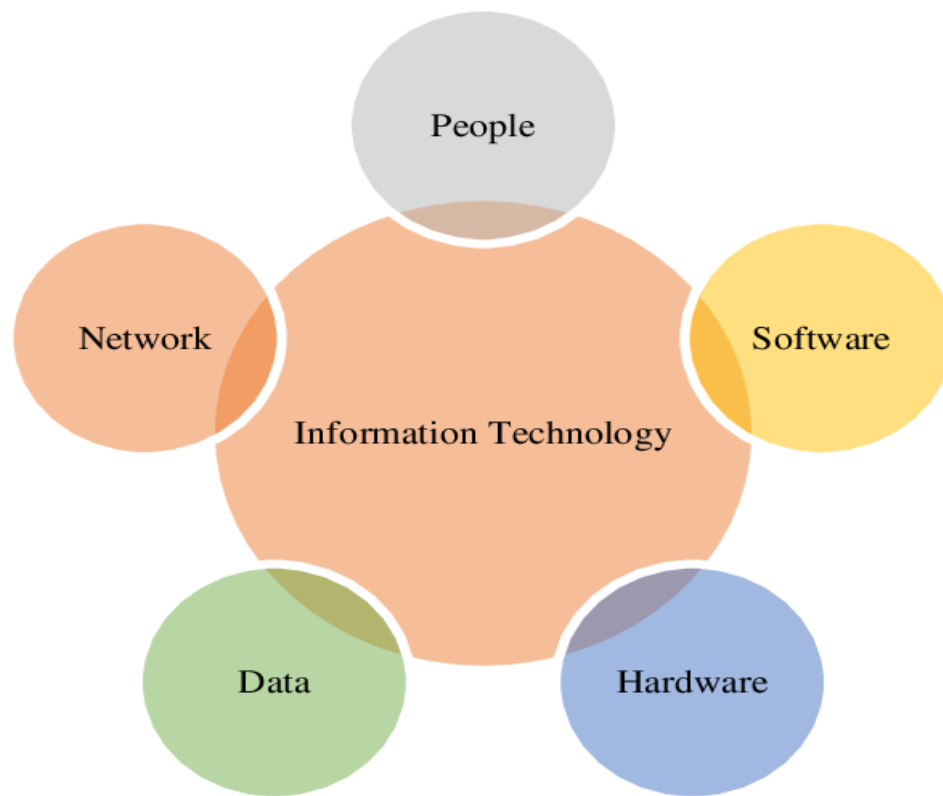
Process is the last element of an information system. A process is a set of stages that are followed to attain a certain result or purpose. Organizational activities are becoming increasingly integrated with information technology, resulting in increased productivity and control. However, employing technology to automate processes isn't enough; companies that want to use information systems must go farther. The ultimate objective is to optimize internal and external processes, including supplier and customer interactions.

"Business process re-engineering," "business process management," and "enterprise resource planning" are all technological buzzwords that refer to the continuous improvement of these business operations and the integration of technology. Businesses who want to acquire a competitive advantage over their competitors pay close attention to this aspect of information

¹ David T. Bourgeois and James L. Smith. *Information Systems for Business and Beyond* op..cit., p14

systems.¹

Figure 1: Components of information systems



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¹David T. Bourgeois and James L. Smith. *Information Systems for Business and Beyond* Updated edition: August 1, 2019: page 15

1.4 The Role of Information Systems

Information systems clearly contain a variety of critical components, some material, some ethereal, and still others of a people character. Data is collected, stored, organized, and distributed within the company using these components.

One of the functions of information systems is to convert data into information, which is subsequently transformed into organizational knowledge. As technology has advanced, this job has expanded into the organization's backbone, making information systems essential to almost every corporation. Over the years, the integration of information technologies within companies has developed.

- **Business Communication Systems**

Gathering and sharing information is part of management, and information systems may make this process more efficient by enabling managers to interact quickly. Email is fast and efficient, but managers may make better use of information systems by keeping files in folders that they share with workers who require the information. Employees may cooperate in a systematic manner using this sort of communication.

By making adjustments that the system monitors, each employee may transmit extra information. The manager compiles the feedback and distributes the freshly amended document to his intended audience.

- **Business Operations Management¹**

Information system supports the business process and operations by:

- Recording customer purchase
- Keeping track of inventories
- Keeping track of employee payment
- Evaluating the sales trend.

¹<https://qsstudy.com/vital-roles-of-information-system-in-business/> Accessed 10/05/2022 at 2.45PM

- **Company Decision-Making**

Management information systems assist decision-makers in understanding the consequences of their actions. The systems compile raw data into reports in a manner that allows decision-makers to immediately spot patterns and trends that would not have been apparent in raw data.

Management information systems may also help decision-makers comprehend the possible impact of change. A sales manager, for example, may forecast the impact of a price adjustment on sales by running simulations inside the system and asking a series of "what if the price was?" questions.

- **Support Competitive Advantage¹**

Innovative application of information to technology helps a business to gain strategic advantage over the competitor.

- Implementing ERP software in the organization
- Introducing e-commerce to attain new customers.
- Creating loyal costumers
- Capturing the lifetime value of customers.

1.5 Types of Information Systems²

Information needs can vary by different departments of an organization, several information systems are used for business units.

Mid-management, for example, needs secret and precise information to follow every employee's activity, but regular employees demand tools that assist them in completing their goals.

Therefore, most businesses have many information systems running at the same time. These are some examples:

¹<https://qsstudy.com/vital-roles-of-information-system-in-business/> accessed 15/05/2022

²<https://altametrics.com> : All the Info on Information Systems. By Lauren Christiansen, January 28, 2022.

- **Executive IS**

Senior management leaders generally use this IS to enhance operational decision-making. Executive information systems contain inventory data, expected financial figures generated by new service/product expectations, economic and market data, and other information.

“An Executive Support System (ESS) is software that allows users to transform enterprise data into quickly accessible and executive-level reports, such as those used by billing, accounting and staffing departments. An ESS enhances decision making for executives. ESS is also known as Executive Information System (EIS)”¹.

It is used to gather, evaluate, and provide the most useful internal and external data needed to run the business and gain a competitive advantage.

- **Management IS**

Internal operational data sources are handled by management information systems (MIS). They often collect and summarize transaction data for use in management reports. These systems produce descriptive data in real time, allowing concerned stakeholders to monitor KPIs, take actions, and overcome obstacles.

“Management Information Systems (MIS) is the study of people, technology, organizations and the relationships among them. MIS professionals help firms realize maximum benefit from investment in personnel, equipment, and business processes. MIS is a people-oriented field with an emphasis on service through technology”².

¹<<https://www.techopedia.com/definition/543/executive-support-system-ess>>accessed 17/05/2022

²“What is Management Information Systems?”. Mays Business School. on May 9, 2015.accessed 17/05/2022

- **Decision Support System**

“A decision support system (DSS) is an information system that supports business or organizational decision-making activities. DSSs serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e. unstructured and semi-structured decision problems. Decision support systems can be either fully computerized or human-powered, or a combination of both”¹.

When a certain circumstance happens, this information system supports workers in making a decision. It includes strategies and tools for gathering relevant data and evaluating different options so that the user may make the optimal decision.

A decision support system often use spreadsheets as well as other tools to develop models that aid staff when confronted with a complicated problem.

- **Knowledge Management System**

Companies utilize a knowledge management system to assist organize documentation, frequently asked questions, and other material into conveniently accessible forms for both internal and external clients.

Knowledge management software may aid in keeping documentation up to date, assisting customers in discovering their own answers, and managing knowledge access and permissions among user groups. It's a useful tool for both local businesses just getting started and large corporations that need to disseminate information to a wide range of audiences.

¹ Keen, Peter (1980). *“Decision support systems: a research perspective”*. Cambridge, Massachusetts: Center for Information Systems Research, Alfred P. Sloan School of Management.

“Knowledge management software (KM software) is a subset of enterprise content management software, which contains a range of software that specializes in the way information is collected, stored and/or accessed. The concept of knowledge management is based on a range of practices used by an individual, a business, or a large corporation to identify, create, represent and redistribute information for a range of purposes”¹.

- **Transaction Processing System**

A transaction processing system is used to create and perform time-consuming procedures rapidly and consistently. Companies, for example, often have billing information systems that create bills for clients or accounting systems that process payroll and pay taxes using pre-programmed formulas.

Organizations may improve efficiency and accuracy by replacing manual operations with a transaction processing system.

“Transaction processing is a way of computing that divides work into individual, indivisible operations, called transactions. A transaction processing system (TPS) is a software system, or software/hardware combination, that supports transaction processing”².

- **Office Automation System**

An office automation system is used to improve the productivity of employees who must handle transactions or data. Many of these automation solutions enable remote employees to access corporate data from their laptops, eliminating the need for them to visit the office.

¹ de Carvalho, and others. *“Knowledge Management Software.”* Encyclopedia of Knowledge Management, edited by David G. Schwartz, Idea Group Reference, 2006, pp. 410-418.

² IBM Corporation. *“CICS Transaction Server for z/OS, Version 3.2 Transaction processing*

“Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system”¹.

This enables enterprises to increase their operational capabilities so that they are not limited to working from a single place.

Section 02: ERP systems, a general presentation

The environment in which companies operate has changed a lot in recent years due to the ever-increasing competitiveness they face. As a result, organizers are always called upon to innovate in the organization of their businesses and must make decisions at several levels within increasingly limited timeframes.

In this section we will introduce the basic concepts essential to understanding the concept of ERPs, and we’ll talk about how ERP evolved over the years.

2.1 ERP definition

An integrated management software package called ERP (Enterprise Resource Planning) is defined as: *“An ERP is a set of application molds generally signed by the same publisher and working in native mode on a single database, in the sense of the term ”*

“An ERP is software that aims to provide an informational backbone to a process. A process is a sequence of ordered tasks with well-defined inputs/outputs. This notion of process is fundamental to understanding the impacts of such a system on a company.”²

According to these definitions, ERP is a flexible software built around a single database and fulfilling most of the needs of the company's many functions through a series of modules.

¹http://www.melbtest.com.au/woa/what_is_oa.htm June 2006, Accessed 17/05/2022

² Jean Louis Tomas et Yossi Gal. *ERP et conduite des changements*. Dunod, 2011.

Davenport (1998) defines ERP as a software package that allows the integration of all the information circulating in the company: information concerning finances, human resources, the supply chain, and customers¹.

For Giard (2003), ERPs are: “integrated management software packages which aim to efficiently manage all of the company's resources. They offer a modular architecture that makes it possible to compose a tailor-made system, based on a relational database and a process base that can be adapted to the specificities of the country (language, regulations) and the company (business lines, procedures, etc.)²”.

As for Reix (2004), he defines ERP as "a configurable, modular and integrated computer application, which aims to federate and optimize the company's management processes by offering a single repository and 'based on standard management rules'. This definition underlines the standard character of this software package³.

Furthermore, according to Jones (2006), the term ERP refers to the software infrastructure that not only provides internal cohesion throughout the company but also supports the external business processes in which the company participates⁴.

ERP applications are therefore characterized by being modular and integrated applications. In fact, a comprehensive ERP package can address all (or most) aspects of a company's management functions. It can even go beyond these internal aspects to manage the company's relationships with its suppliers, customers, and partners.

¹DAVENPORT, T.H., (1998), «*Putting the enterprise into the enterprise system*», Harvard Business Review.

²GIARD, V. (2003), *Gestion de production et des flux*, Economica, Paris. translated to English.

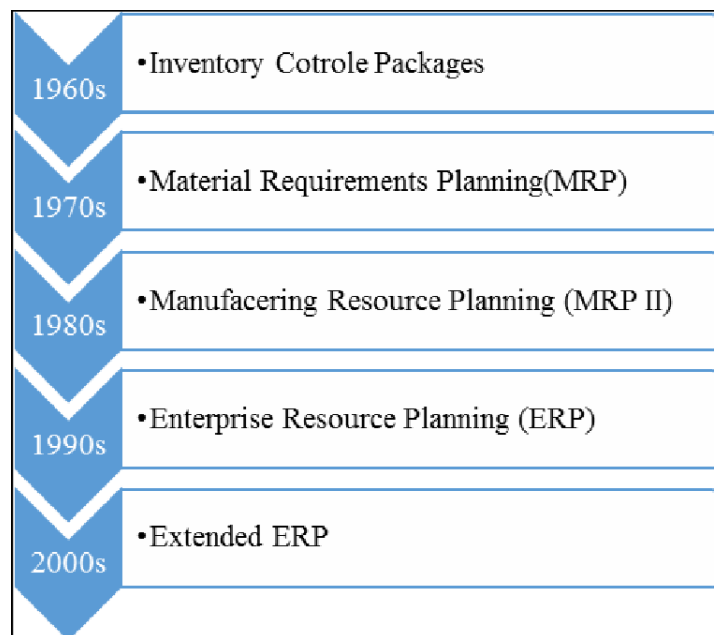
³REIX, R. (2002), «*Système d'information et performance de l'entreprise de l'entreprise étendue*», dans *Faire de la recherche en système d'information*, VIBERT et FNEGE, Paris. translated to English.

⁴JONES, K., (2006), *L'ABC de la gestion intégrée : Guide d'introduction pour les dirigeants*. translated to English.

2.2 Evolution of ERP

According to Wallace and Kremzar¹ (2001), ERP is an enterprise-wide set of management tools that balances demand and supply, has the ability to link customers and suppliers into a complete supply chain, employs proven business processes for decision making, and provides high degrees of cross functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development, and human resources, allowing people to work more efficiently.

Figure 2: ERP systems Evolution



Source: https://www.researchgate.net/figure/Evolution-of-ERP-Systems-1_fig2_315680017 [19/05/2022]

Although management systems have been a key tool for business transformation since the early 1990s, this generation of systems continues to evolve from the early 1950s (Deloitte², 1998; Watson and Schneider³, 1999):

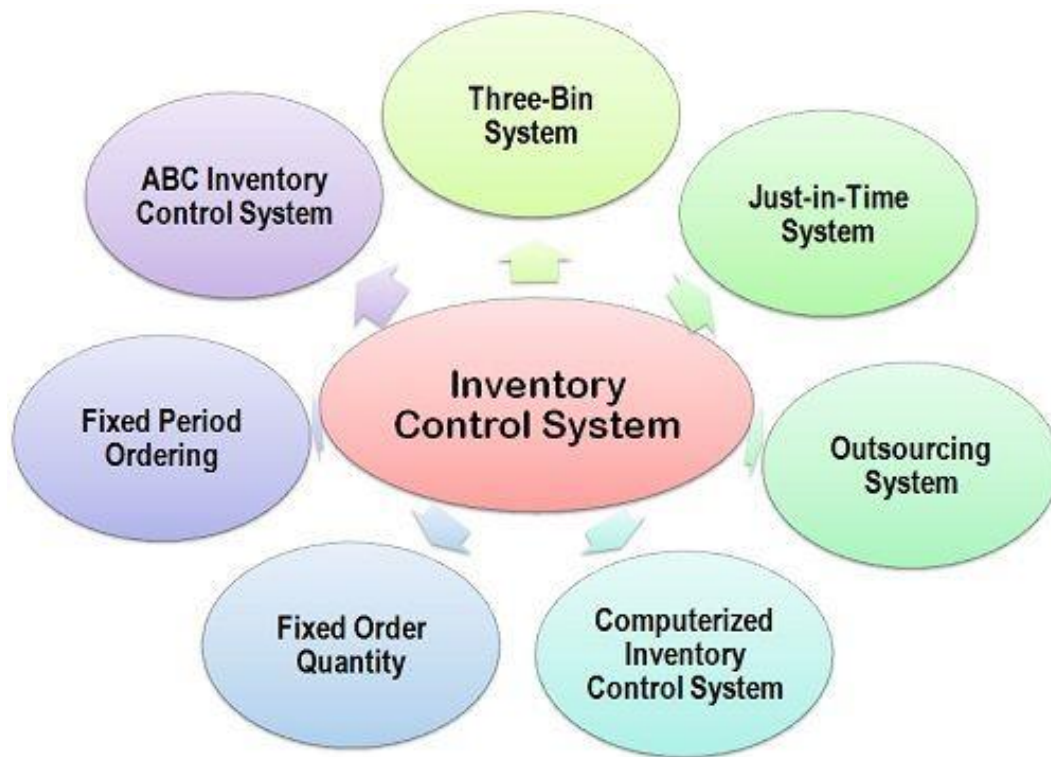
¹ Wallace, T.F., Kremzar M. H. (2001), *Making it happen* (John Wiley & Sons, Inc.).

² Deloitte Consulting (1998). *ERP's second wave: Maximising the value of ERP-enabled processes*, [online].

³ Watson, E.E., Schneider, H.(1999). «Using ERP systems in education », *Communications of the Association for Information Systems*, 1 (9) [online].
<http://www.cab.latech.edu/homes/ztang/reading/usingerpsystemsineducation.htm>

The 1950s: Inventory management system - provides for multi-level inventory tracking and tracing - very popular. It was the first technological application for business activities outside the accounting and finance sectors.

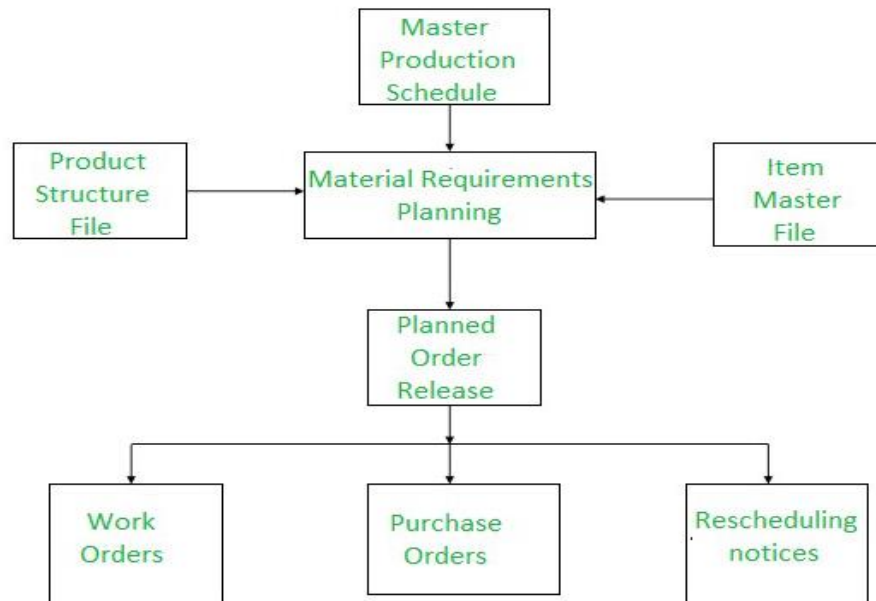
Figure 3: Inventory control system



Source : <https://businessjargons.com/inventory-control-system.html>

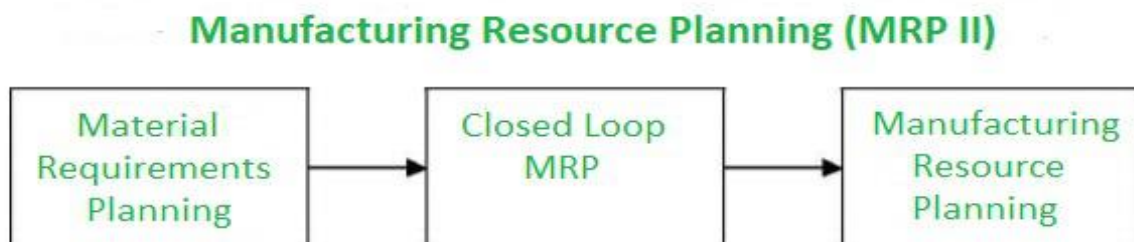
1950-1960: The first model for manufacturing - Materials Requirements Planning (MRP) -was developed. It supports the planning of purchasing and the production process. It has enormous potential for SMEs to compete in international markets (Petroni and Rizzi¹, 2001). However, MRP is difficult to manage and expensive to maintain.

¹ Petroni, A., Rizzi, A. (2001). « Antecedents of MRP adoption in small and medium-sized firms» *Benchmarking: An International Journal*, 8 (2) 144-152.

Figure 4: MRP system

Source : <https://www.geeksforgeeks.org/evolution-of-erp-system/>

1970-1980: MRP is improved, but still at the level of manufacturing industries, which becomes MRP II, or manufacturing resources planning. The integration of the financial functions available in MRP II allows the tool to be used for purposes other than successive production resource planning.

Figure 5: MRP II system

Source : <https://www.geeksforgeeks.org/evolution-of-erp-system/>

Mid-1980s: Breakthroughs in manufacturing companies - just-in-time delivery, combined with falling prices for computer equipment, plus the creation of "automated islands". Thus, by means of CIM (Computer-Integrated Manufacturing), production lines were able to automate their operational processes. The market for automated systems has experienced strong growth.

Figure 6: CIM System



Source: <https://www.ques10.com/p/48460/nature-and-role-of-the-elements-of-cim-system-1/>

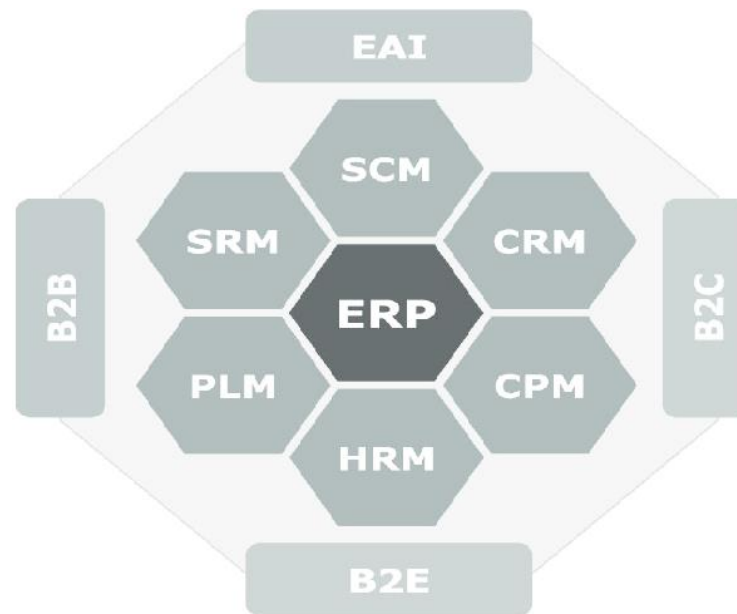
Between 1980 and 1990: With the development of client-server technology, MRP II evolves into ERP systems. ERP systems cross the boundaries of MRP II as they include critical resources, especially human resources.

1990-2000: Companies are converging on the use of ERP systems - these systems have become a strategic technology choice because they provide a competitive advantage for companies. Towards the end of this period, additional technologies such as value chain optimization and customer service management system are added. ERP is extended to all business functions.

Figure 7: ERP System

Source: <https://insightsolutionsglobal.com/what-is-erp-enterprise-resource-planning/>

in the future: Companies are now ready to extend their business systems, beyond their organizational boundaries, through different forms of electronic business. Extended ERP (XRP) makes it possible for the organization to be in direct contact with its customers and suppliers. In the coming years, business systems will become the infrastructure for the growth of a company, more than a resource and a cost management tool.

Figure 8: Extended ERP system (ERP II)

Source: https://www.researchgate.net/figure/Fundamental-framework-of-the-ERP-II-system-Source-Moller-2005_fig2_303843627 [accessed 19 May, 2022]

2.3 The specificities of ERP

ERP is in fact a set of functional modules integrated around a single database. Moreover, what distinguishes an ERP from sectorized software packages is the presence of different modules covering all the needs of a company "from sales, production, logistics, finance, human resources, after-sales service, all the fields are present and with an equivalent level of completeness" (Deixonne, 2001)¹.

Another difference with specialized software packages is that the dependencies that exist between processing in these different domains are automatically taken into account. This characteristic is often the result of the use of a single database (Deixonne, 2001). Indeed, before ERP, a lot of time was spent repeating the same tasks and entering the same information into different programs. This caused some problems such as:

¹ DEIXONNE, J.L. (2001), *Piloter un projet ERP*, Dunod, Paris. translated to English.

- Repeatedly entering the same information is a waste of time.
- Input errors are likely and therefore information may look different from one program to another.
- Information from very different and unrelated applications may be inconsistent. Therefore, any attempt to analyze this information is doomed to failure.

However, with an integrated ERP package, a single version of the information only needs to be entered once, and then distributed to all areas of the business where it is required. This means that all employees using the application and all managers making decisions for the business see the same version of reality, in real time, all the time.

Furthermore, Jones (2006)¹ believes that the modularity feature of ERP comes into play mainly when purchasing and implementing the ERP system: one may not need all applications at the same time or may prefer to deploy one application at a time. This is what distinguishes modular applications from other stand-alone applications. When more than one module is implemented, all installed modules interlock and automatically work together. In addition, ERP solutions grow with the needs of the business. Unlike stand-alone applications, these solutions do not leave managers without a transition path when they reach their limits and therefore do not force them to start from scratch with a new application.

Another feature of ERP that Jones (2006) mentioned is the possibility of obtaining services and support at an affordable cost. Moreover, it is easier to maintain an integrated ERP environment than several separate applications.

Therefore, what distinguishes ERP from other specific applications is the fact that it is a set of modules that share a single database and cover all business functions. Each module works while automatically considering the dependencies that exist between the processes in the other modules. This reduces data entry time, improves the quality of information, and optimizes the cost of application maintenance.

¹ JONES, K., (2006), *L'ABC de la gestion intégrée : Guide d'introduction pour les dirigeants*.

2.4 Motivations for ERP

There are various reasons why companies implement ERP. In his research, Ross (1999) reports six main reasons that motivate managers' decisions to implement an ERP: the need for a common technology platform, the desire for process improvement, data accessibility, the reduction of operating costs, increased ability to respond to the customer and improved strategic decision making (see Figure n°09).

According to this study, the most important reason is the need for a common technological platform for the whole organization, especially observed around the year 2000. This infrastructure allows, among other things, to support and improve the company's business processes. Most organizations have identified processes where they were significantly underperforming and needed to review their ways of doing things, such as logistics, customer service, etc. By standardizing processes, they hope, for example, to reduce the time required between order entry and delivery to the customer (business cycle).

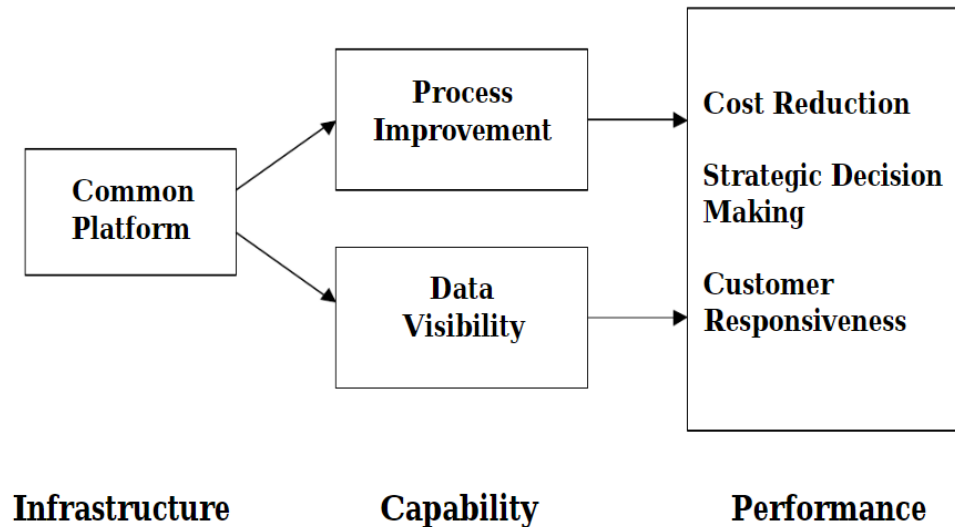
Also, many firms deploy ERP to replace long-standing and obsolete legacy systems that are often very expensive to maintain, or following mergers or acquisitions, companies are left with diverse systems that are not compatible with each other. So, by implementing ERP technology, they integrate their operations and become more efficient and effective.

Data accessibility is an increasingly important motivation. Since ERP systems are integrated, they offer better availability of information. This accessibility makes it possible to obtain information quickly from one end of the company's value chain to the other, which improves operational decision-making. The same is true for strategic decision-making, as it is possible to obtain "online", real-time data on the performance of the organization, thus increasing its responsiveness to market conditions.

Few companies have yet determined how to measure the achievement of their ERP implementation goals. However, most focus on cost reduction as an objective. Other objectives include customer responsiveness in terms of satisfaction or process improvement in terms of stock

rotation, etc. According to Ross¹ (1999), it is very difficult to give a satisfaction rate for the achievement of objectives; nevertheless, companies seem to follow a path that goes from technical motivations to more strategic motivations (see Figure n°09).

Figure 9: Motivations for ERP



Source : Ross, Jeanne & Vitale, Michael. (2000). *The ERP Revolution: Surviving vs. Thriving*. Information Systems Frontiers. 2. 233-241. 10.1023/A:1026500224101.

For their part, Parr and Shanks² (2000) include other reasons for implementing an ERP system, such as: reducing operating costs, standardization of various business units, the need for greater efficiency and integration, and the restructuring of a company's business processes. The replacement of existing systems with a common technology platform is imperative for two reasons: a set of outdated systems with high operating costs, and the anticipation of significant benefits such as improved business processes and accessibility of corporate data. Another study by Deloitte Consulting (1998) of 68 companies, reports that the reasons for adopting a MIS fall into two broad

¹Ross, J.W. (1999). «*The ERP Revolution: Surviving Versus Thriving*», Center for Information Systems Research,

² Parr, A., Shanks, F. (2000). «*A Taxonomy of ERP Implementation Approaches* », 33rd Hawaii International Conference on Science Systems HICSS, Maui, Hawaii

categories: solving technological problems and solving operational problems such as lack of competitiveness or efficiency. Chen (2001) identifies other reasons why organizations adopt a MIS, namely duplication of effort and duplication of data inputs, inability of the existing system to support organizational needs and business growth. However, these motivations result in projects that vary widely in terms of the number of sites, the distribution of sites, the number of users, the complexity of the system and the scope of the project (Parr and Shanks, 2000; Markus and Tanis, 2000).

Section 03: Implementation of ERP system

In this section we'll talk about the different characteristics of an ERP System, then the difficulties and process of ERP implementation.

3.1 Characteristics of ERP

Business systems have many characteristics, each with important implications for the company that adopts it (Markus and Tanis, 2000).

- **Integration**

Enterprise systems promise the integration of information as it flows throughout the enterprise (Davenport, 1998). However, it is extremely important to realize that the nature and degree of integration depends on the configuration of the system.

In this context, the term configuration means the choice of software parameters as well as the modules that will be installed and the possibilities of adjusting its characteristics to adapt it to the company. The configuration task is important as it involves decision-making and the reasons that lead to the choice (Markus and Tanis, 2000)¹.

Integration is the simultaneous linking of an entire organization's information and processes. Moreover, this integration can occur between different units as well as between different functions

¹ Markus, L., Tanis, C. (2000). *Framing the Domains of IT management, projecting the future . . . through the past*, Chap 10, The Enterprise System Experience from Adoption to Success, Editor Robert W Zmud, Michael F. Price Hair of MIS, Unis Oklahoma, 173-207

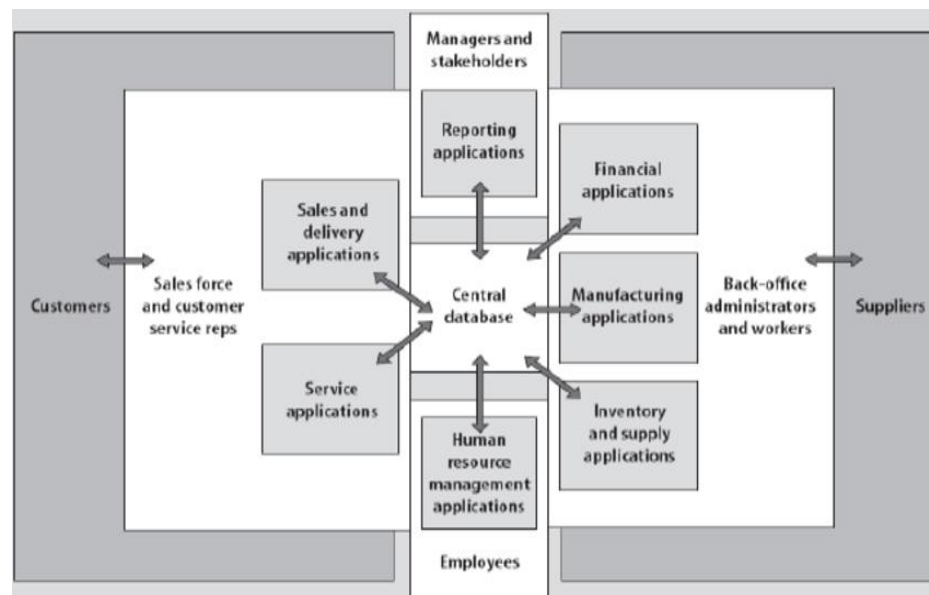
(see figure n°10).

ERPs link all (or several) business functions and operational units together. Thus, they all have access to relevant and up-to-date information (Davenport, 1998). However, integration requires standardized data as well as standardized processes (Gattiker and Goodhue, 2000)¹.

- **Software packages**

ERPs are generally commercial software packages produced by enterprise system publishers such as SAP, People soft, Oracle, Baan's, and others. Moreover, when an organization acquires an ERP, it enters a long-term relationship with its supplier. Most of the time, organizations do not have the resources to support, maintain or modify their software package. Consequently, they depend on their supplier to continue improving their ERP (Markus and Tanis, 2000).

Figure 10: DAVENPORT ERP Anatomy



Source: Methodological proposal to implement enterprise resource planning systems - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/ERP-Anatomy-Davenport-1998_fig1_215641265 [accessed 21 May, 2022]

¹ Gattiker, T. F., Goodhue, D. L. (2000). « *Understanding the plant level costs and benefits of ERP: will the ugly duckling always turn into a swan?* », Proceedings of the 33rd Hawaii International Conference on System Sciences.

- **Best practices**

Being software packages, ERPs are designed based on the common needs of several companies. These software packages are built to support generic business processes, but they are developed using exemplary business process models “best practices”, which may differ significantly from current practices in an organization.

Consequently, best practices represent a major reason to justify the adoption of an ERP by the leaders. Nevertheless, most organizations that have successfully adopted an integrated software package claim that they did not have to review all their business processes to obtain the increases in effectiveness and efficiency promised by these software packages (Markus and Tanis, 2000)

- **Requires some adjustments during installation**

At the installation level, the notion of "integration" of an enterprise system is exaggerated. Integration does not mean simply integrating the IT infrastructure. In fact, the adoption of an enterprise system is most of the time difficult to integrate with the already installed hardware (software, hardware, databases, etc.) which is adapted to the size of the company, its structure, and its geographical distribution. In addition, as several elements are involved in the installation, it is often very difficult to make them compatible with each other. This is a huge headache for suppliers, because when an organization acquires such a system it wants, among other things, to recover its old data.

Moreover, an ERP system often does not meet all the needs of a company; it only meets them in part. So, to meet its specific needs, the company opts for various solutions, known as a "best-of-breed" approach (Payne, 2002)¹. The best-of-breed approach consists of the firm selecting the modules that suit it and/or that most closely resemble the practices it wishes to implement, which may involve different suppliers. In general, in this type of approach, a firm specializing in integration takes charge of the installation of the various modules selected and takes care of integrating the modules to make an integrated and customized enterprise system.

¹ Payne, W. (2002). « *The time for ERP?* » Work study, 51(2), p 91-93.

- **Evolving**

Finally, as in all information technologies, ERPs are changing rapidly. In 1980, they were designed on centralized system architecture. Today, they are client/server architecture. Functionalities have also evolved to meet the new needs of organizations such as: e-commerce, CRM, SCO (supply chain optimization), extended ERP, etc. (Markus and Tanis, 2000; Chen, 2001)¹.

3.2 Difficulties of ERP implementation

The attractiveness of ERP comes mainly from the potential of this software package that allows informational integration. However, the vulnerability of ERP implementation is important since the project of implementing an ERP presents several difficulties. Indeed, Davenport (1998) has mentioned several cases of companies that have failed to implement an ERP. These include Dell Computer and Dow Chemical.

Among the problems that can be encountered during the implementation of ERP are:

- **Integration problems**

In trying to adapt ERP to the existing platform, companies find it difficult to integrate the package with existing systems, existing databases, and company-specific communication systems (Markus and Tanis, 2000). In addition, many companies decide to keep some legacy applications that meet needs that the ERP could not satisfy. These applications must therefore be interfaced with those of the ERP, which is not easy and can be costly.

- **Modification of the software package**

According to Markus and Tanis (2000), modification of the software package is not recommended. Moreover, publishers very often refuse to make changes because of the high costs involved in specific developments and their maintenance.

¹Chen, I.J. (2001). « *Planning for ERP systems: analysis and future trend* », Business Process Management Journal, 7 (5) p374-386.

- **Resistance to change expressed by the staff**

As the implementation of an ERP generates organizational changes, this resistance represents a kind of manifestation of a refusal of the organizational model conveyed by the ERP. Moreover, this resistance to change may be the key element in the failure of ERP implementation and is essentially due to the fact that users are often ill-prepared for the task (Gowigati, 2001)¹. In fact, if their ERP training is inadequate, their lack of operational knowledge of the project causes them to become frustrated, which may result in general laziness or even sabotage.

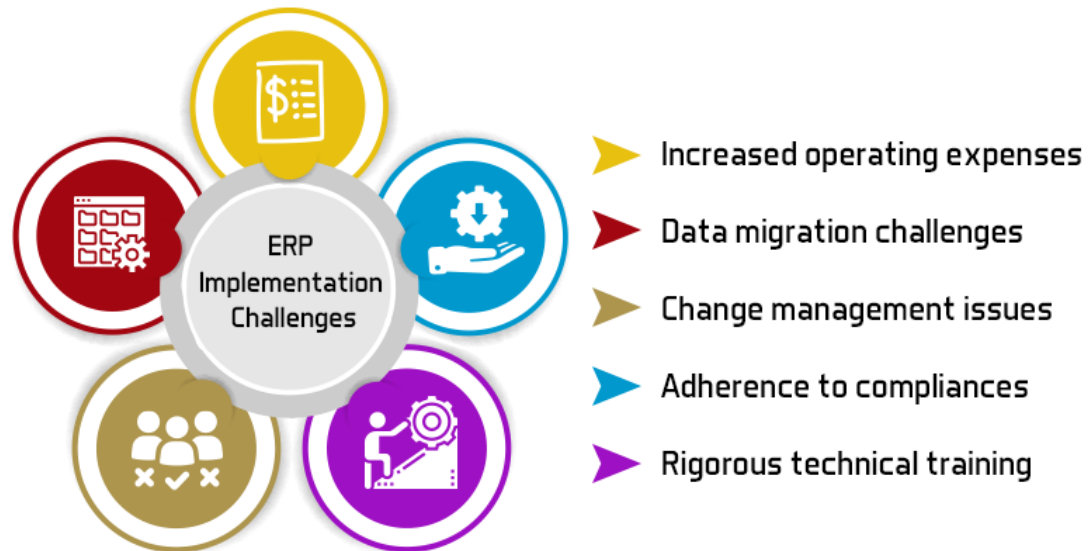
- **Lack of skills**

Given their complexity, ERP projects require significant expertise, often from outside the company (MARKUS, L.M. et TANIS, C. 2000)². Moreover, ERP specialists are essential to overcome problems related to the design and implementation of ERP. However, the project team should include both internal and external expertise. The frequent use of external consultants due to the unavailability of in-house staff results in significant costs.

¹ GOWIGATI, B., GRENIER, B.(2001), « *Un vent de changement* », CMA MANAGEMENT, Novembre 2001.
Translated to English

²MARKUS, L.M. et TANIS, C. (2000), « *The Enterprise System Experience_from adoption to succes* », in Framing the domains of IT management, R.W.Zmud Editor, Pinnaflex, Cincinnati.

Figure 11: ERP implementation challenges

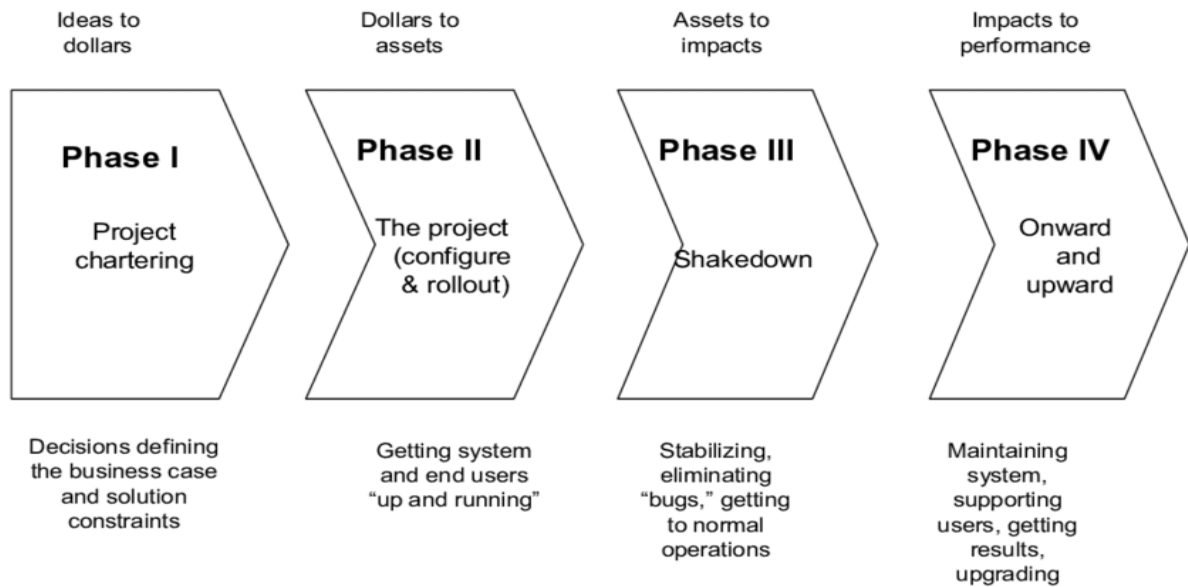


Source: <https://www.sagesoftware.co.in/blogs/top-challenges-in-erp-implementation/> accessed [21May, 2022]

3.3 Process of ERP implementation

The development of an ERP project is a long and complex phenomenon. Indeed, it follows a precise process in which the progress of each stage determines the progress of the next stage. However, the phases of the ERP project implementation process differ from one author to another.

According to **Markus and Tanis (2000)**, **the process of implementing an ERP system should follow four phases:** the project foundation, the project phase, the testing phase and finally the "Onward and Upward" phase. Figure n°12 represents the different stages of the process as established by Markus and Tanis.

Figure 12: Markus and Tanis (2000) Enterprise System Experience Cycle

Source: A multi-level approach to individual readiness to adopt enterprise resource planning software - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Markus-and-Tanis-2000-Enterprise-System-Experience-Cycle_fig5_36416432 [accessed 21 May, 2022]

The first phase of this process, named "Project chartering" by Markus and Tanis, corresponds to the definition of the ERP project by the company. This involves defining the company's various needs, choosing an ERP supplier, identifying the project manager in charge of the implementation, and finally establishing the budget and schedule, essential elements of any ERP project. The authors highlight key points that can negatively impact an ERP project during this phase, such as poor identification of needs, poorly defined objectives or necessary organizational changes that are not considered. All of these can jeopardize the ERP project and, if not identified in time, can continue until the final implementation phase, becoming extremely costly for the company to remedy and sometimes even irreversible.

The second phase "Project phase", corresponds to the implementation of the ERP project and the use of the tool by one or more company functions. This involves configuring and integrating

the information system, testing the correct functioning of the tool, putting it into service and training users. This phase can be disrupted if the data extracted from the old system is not properly "cleaned up", since anomalies can then appear in the ERP, rendering the new system inoperative.

The third phase, called the "Shakedown phase", corresponds to the handover of the tool by the company and the various users. All the problems are solved, the system is fine-tuned to best meet the company's expectations and certain key users are trained to deal with problems that may be encountered when using the ERP. This phase ends when the ERP is operating "normally". It is during this phase that the errors or problems described above may become critical to the business.

Finally, **the last phase** of the ERP project implementation process is the "Onward and Upward" phase, i.e., a phase of continuity and, in some cases, improvement of the ERP project. The main elements of this phase are the improvement of the tool, further training of users and, for some projects, the upgrade to a higher version of the ERP or a new ERP. This phase is also where the benefits and results of the ERP implementation are measured by the company.

For his part, **De Rongé (2000)¹ defines five phases in the implementation of ERP:**

The choice of an ERP solution: the company defines the information needs and the elements that triggered this need for ERP. It is also a question of analyzing the information system offers available on the market and defining which of these offers could best meet the company's needs. According to the author, this phase is essential, since at this stage various problems can arise, such as a poor evaluation of the cost of the system, a poor definition of the company's needs, or a poor understanding of the link between the implementation of an ERP system and the reengineering of the organization's processes. Such situations can jeopardize the entire ERP project and even bankrupt the company in the most extreme cases.

Business process analysis: this phase takes place immediately after the choice of an ERP solution. It involves defining the organizational processes that structure the company's activity and the problems that may arise from them, hence the need to implement a new ERP system.

¹ De Rongé, Y. (2000). *L'impact des ERP sur le contrôle de gestion : une première évaluation*. Finéco, vol.10. translated to English.

The company also needs to understand the current state of its information system and the elements that prevent it from functioning properly.

Process reengineering: according to De Rongé (2000), this phase is the most essential and risky phase of ERP implementation. Indeed, during this phase, the company must reconfigure its organizational processes - analyzed during the previous phase. This phase determines the results and benefits that the company will receive from the implementation of the ERP system.

"Module customization": although each ERP system offers standard solutions with best practices to ensure that the system is operational within a limited time and cost, it seems important for companies to be able to select and customize the modules they implement. However, "customized" solutions are extremely costly since they require the reprogramming of certain modules - or even of all the modules since they are all linked - and recourse to consultants in order to optimize this customization. In this context, De Rongé (2000) proposes three solutions: either the choice of a pre-existing solution for each management process; or the selection of certain modules to be customized and others allowing for a standard solution; or a distinction between processes allowing for the choice of a standard solution, those requiring customization of the ERP modules, and finally those which are maintained outside the ERP system because they represent a major strategic issue.

"Implementation": this is a very risky stage and is often poorly managed by companies. They tend to underestimate the budget required to implement an ERP project; they are rarely aware of the extent of the need for user training as a condition for the success of the project, and therefore underestimate the cost of this training. Moreover, this stage also generates transition difficulties, either at the production level (paralyzed factories, malfunctioning of production processes, etc.), or at the level of customers or suppliers (undelivered or late orders, confusion over orders, problems with raw material supply, etc.). In their work, Markus and Tanis (2000) cite Fox-Meyer Drug¹ as a glaring example of failure during the implementation of the ERP project: all the elements of the system were not tested, the gains were not as great as those expected; these elements combined with changes in the company's competitive environment led Fox-Meyer Drug to bankruptcy.

¹ The Meyer Brothers Drug Company was a major wholesale drug house founded by Christian F. G. Meyer at Fort Wayne, Indiana in 1852

Although the different authors have identified somewhat different phases of ERP implementation, each highlights elements that are essential to such a project:

- The precise identification of the company's needs and expectations in order to make an informed and coherent ERP choice.
- Analysis of the organizational processes that give rhythm to the company's activity and the possible need for process reengineering.
- Training of employees in the use of the system is essential for the proper functioning and acceptance of the ERP.

In this chapter, we have introduced the concept of information systems. Several definitions focused on the main components: technology, people, and process. We saw how the businesses use of information systems has evolved over the years, with all the different types of information systems that exist. During each of these phases, new innovations in software and technology allowed businesses to integrate technology more deeply into their organizations. And we have also introduced ERP systems, their development, their different characteristics and their implementing process in a firm.

CHAPTER II: PERFORMANCE OF THE ENTERPRISE

Chapter II : Performance of the enterprise

Performance measurement has been an important subject of study in recent years, due to the essential aspect of performance measurement in the management of the company, and is now at the center of the expectations of the stakeholders of the organization. It has evolved strongly with management theories. Moreover, recent events have highlighted the importance given by companies to the measurement of performance and its management.

Therefore, this chapter is composed of the sections. Firstly, we'll start by defining the "firm performance" and know its development over the years. Secondly, we are going to see the impact of ERP systems on the performance of the firm. Lastly, we will know the key performance indicators and how can the performance of an enterprise be measured.

Section 01: Enterprise performance

1.1 History of performance:

Firm Performance: From the 50s to the End of the Last Decade of the Twentieth Century

Firm performance was thought to be the equal of organizational efficiency in the 1950s, which symbolizes the degree to which an organization, as a social structure with restricted resources and means, achieves its goals without requiring undue effort from its members. Productivity, flexibility, and interorganizational tensions are the performance criteria employed (Georgopoulos & Tannenbaum, 1957)¹. Later in the 1960s and 1970s, organizations began to experiment with new methods of evaluating their performance.

Performance was characterized at the time as an organization's capacity to exploit its environment in order to access and use the restricted resources (Yuchtman & Seashore, 1967)². According to Harrison (1974)³, performance is the result of appraising effort.

¹Georgopoulos, B.S. & Tannenbaum, A.S. (1957). *A study of organizational effectiveness*. American Sociological Review (pp. 534- 540)

²Yuchtman, E. & Seashore, S. (1967). *Factorial Analysis of Organizational Performance*. Administrative Science Quarterly (pp. 377-395)

³Harrison, J.S. & Freeman, R.E. (1999). *Stakeholders, social responsibility, and performance: Empirical evidence and theoretical perspectives*. The Academy of Management Journal (pp. 479-485).

In comparison to other scholars during the same period of time, Lupton (1977)¹ studied the concept of organizational performance with the most care and clarity. According to Lupton, an effective organization has a high productivity rate and high levels of motivation and satisfaction among its members, while turnover, costs, and labor unrest are minimal or absent. However, according to Katz and Kahn (1978)², an organization's effectiveness and efficiency were identical, and both were critical components of global organizational performance, which may be measured by maximizing total returns of all kinds.

In the 1980s, the firm's performance was determined by its capacity to add value to its clients (Porter, 1986).

According to Robbins (1987)³, performance is the extent to which an organization, as a social system, can examine both its methods and its aims. Cherrington (1989)⁴ defined performance as a concept of an organization's success or effectiveness, as well as an indication of the organizational style in which it is functioning effectively to fulfill its goals successfully.

Adam (1994)⁵ believed organizational performance to be highly dependent on the quality of employees' performance throughout the next decade. He believed that in order to ensure high-quality organizational performance, it was critical to expose company employees on a regular basis to new and up-to-date knowledge and skills, which would help them, keep up with market changes and, ultimately, increase the quality of organizational performance.

Cohen (1994)⁶ distinguishes between performance and efficiency by observing the results obtained by the entity in relation to the resources consumed.

¹Lupton, T. (1977). *Organizational Behavior and Performance*. London: The Macmillan Press

²Katz, D. & Kahn, R.L. (1978). *The social psychology of organizations*;

³Robbins, S.P. (1987). *Organizational Theory: Structure, Design, and Application*. San Diego: Prentice-Hall.

⁴Cherrington, D.J. (1989). *Organizational behavior: The management of individual and organizational performance*. Allyn & Bacon.

⁵Adam, E.E. (1994). *Alternative quality improvement practices and organization performance*. *Journal of Operations Management* (pp. 27- 44).

⁶Cohen, E. (1994). *Analyse financière*. Economica, Paris.

Bourguignon (1997)¹ assimilates performance with an “action”, with a certain “behaviour” (in terms of a dynamic view, meaning, “to perform”) and not just as a “result” (in terms of a static view).

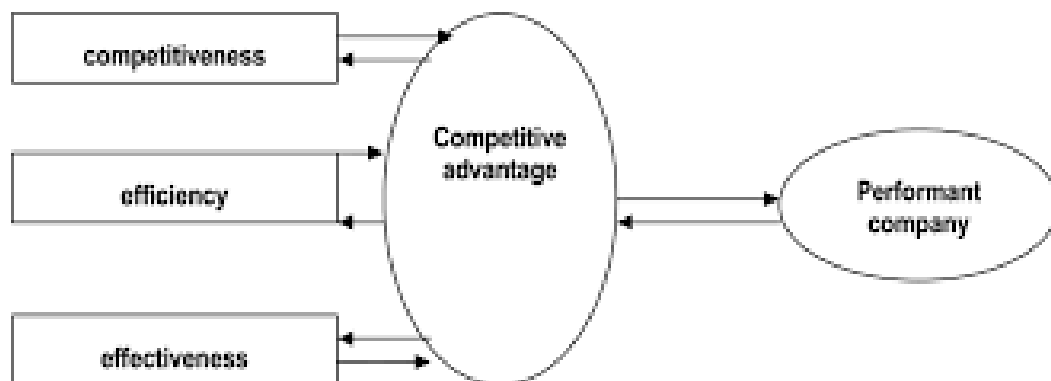
Harrison and Freeman (1999) confirmed that an effective organization with high performance standards is one that meets the needs of its stakeholders.

Firm Performance: From the First Decade of the Twenty-First Century

In the first decade of the twenty-first century, the definition of organizational performance was primarily focused on an organization's capability and ability to efficiently exploit available resources to achieve accomplishments consistent with the company's set objectives, while also considering their relevance to its users (Peterson, Gijsbers, & Wilks, 2003)².

According to Verboncu and Zalman (2005)³, performance is a specific result gained in management, economics, and marketing that confers competitiveness, efficiency, and effectiveness to the organization and its structural and procedural components.

Figure 13: Factors that drive performance (Verboncu&Zalman, 2005)



Source: PERFORMANCE - AN EVOLVING CONCEPT - Scientific Figure on ResearchGate. [accessed 23 May, 2022]

¹Bourguignon, A. (1997). *Sous les pavés la plage...ou les multiples fonctions du vocabulaire comptable: l'exemple de la performance*. Comptabilité, Contrôle, Audit. Tome 3 -Volume I (pp.89 à 101)

²W. Peterson, G. Gijsbers, and M. Wilks. 2003. *An Organizational Performance Assessment System for Agricultural Research Organizations: Concepts, Methods, and Procedures*. ISNAR Research Management Guidelines No. 7. The Hague: International Service for National Agricultural Research.

³Verboncu, I. &Zalman, M. (2005). *Management și performanțe*, Editura Universitară. Translated to english

To exemplify the concept of organizational performance, Lebas and Euske (2006)¹ developed a set of definitions:

- Performance is a set of financial and nonfinancial indicators that provide information on the level of achievement of goals and outcomes.
- Performance is a dynamic process that necessitates judgment and interpretation.
- Performance can be represented using a causal model that illustrates how current activities effect future outcomes.
- Performance can be interpreted differently depending on who is assessing the firm's performance.
- To define the concept of performance, it is vital to understand its fundamental qualities in relation to each area of responsibility.
- In order to report a firm's performance level, the outcomes must be quantifiable.

Siminica (2008)² recognizes that a corporation is performant when it is both efficient and effective. As a result, performance is determined by two variables: efficiency and efficacy.

The term performance is a bag-word because it encompasses a wide range of concepts such as growth, profitability, return, productivity, efficiency, and competitiveness.

According to Bartoli and Blatrix (2015)³, the notion of performance should include aspects such as piloting, assessment, efficiency, effectiveness, and quality.

1.2 The different conceptions of company performance

Three main concepts of performance group together the different concepts of performance: financial performance, operational performance and competitive performance.

¹Lebas, M. &Euske, K. (2006). *A conceptual and operational delineation of performance. Business Performance Measurement*. Cambridge University Press.

²Marian Siminica& Dorel Berceanu& Daniel Circumaru, 2008. "The Performances Of Industrial Firms From Romania. CorrelationDimension"Romania - AGER, vol. 12(12(517)(s), pages 71-78.

³Bartoli, A. &Blatrix, C. (2015). *Management dans les organizations publiques* - 4ème édition. Dunod, Paris.

- **financial performance:**

Its theory often defines the performance of a company by its financial value, for example the market price of the company. There are three fundamental factors that determine financial value: cash flow, long-term cash flow forecasts, and the cost of capital. In this framework, the evaluation of the financial performance of the company is done from a going concern perspective, in other words, by growth opportunities offered, possible synergies, positioning in a sector, etc. positioning in a sector, etc.

- **operational performance:**

The current economic context and the pressure of competition lead to the implementation of policies and projects aimed at increasing efficiency and operational performance (cost control, process efficiency, organizational flexibility, etc.)¹.

The value or operational performance can also be translated by productivity, which covers two different concepts: the partial productivity of the factors of production (labor and capital) which is measured by making the ratio between the quantity produced and the quantity of factor used to obtain it, on the one hand, and the overall productivity of the factors of production, i.e. the volume of production, it has been defined by the INSEE² as the ratio between the production achieved by an economic unit and all the factors of production (capital and labour) used in the production process, on the other hand.

- **competitive performance**

A company's competitive performance is measured by competitive advantage. The development of a company's strategy begins with an assessment of its industry's attractiveness and competitive position within that industry. A company is regarded successful if it masters the competitive games of a certain industry. In his model, PORTER has highlighted three levels of strategic action to compete³: reinforcing core competencies and protecting one's assets, a defensive attitude; playing with the rules of the game, which can modify the balance of forces for a given sector; and building

¹ Cross Knowledge, *optimiser la performance opérationnelle*. Accessed: 25/05/2022.

² Institut National de la Statistique et des Etudes Economiques. France

³ Porter, M.E. (1985) *Competitive Advantage. Creating and Sustaining Superior Performance*. Free Press, New York, 557 p.

new rules of the game by anticipating changes in the sector, in order to create a future competitive advantage faster than the competition you have today.

1.3 Components of performance

In a general sense, performance is the combination of effectiveness and efficiency; relevance and economy; in other words, a company is performing if only these concepts are applied.

- **Effectiveness**

Effectiveness is simply defined as “*the relationship between the outcome of a system and the objectives sought As a result, the closer the results are to the goals, the more effective the system. As a result, the degree of efficiency is used to characterize a system's performance¹*”.

- **Efficiency**

Efficiency refers to the relationship between the goods or services produced and the resources used to produce them.

In an efficiency-based operation, for a given set of resources used, the product obtained is maximum, or the means used are minimum for any given quality and quantity of products or services.

" Efficiency is the consumption of resources used (input, material or energy) in the production of an output. It is an important component of performance measurement.²"

This means that efficiency corresponds to the best possible management of means and capacities in relation to results.

- **Relevance**

The concept of relevance remains highly subjective and difficult to quantify.

However, it can be agreed that relevance is the conformity of the means and actions used to achieve a specific goal, to put it another way, to be effective and efficient in achieving the goal set.

¹ BOISLANDELLE, (H.M) : « *gestion des ressources humaine dans la PME* », Edition ECONOMICA, Paris, 1998, P139.

² Benoît Pigé et al., *Management et contrôle de gestion*, Nathan, 2008, p. 9.

- **Economy**

Economy refers to the conditions under which human and material resources are acquired. For an operation to be economical, resources must be acquired with acceptable quality and at the lowest possible cost.

It can be added that performance requires a global interdependent vision of all the internal and external, quantitative and qualitative, technical and human, physical and financial parameters of management. The manager must therefore seek to achieve performance, which integrates several levels of evaluation:

- For production, it is the permanent improvement of productivity, i.e. physical output, combined with a high level of quality.
- For sales, it is competitiveness in the market.
- For finance, it is profitability.

1.4 Objectives of Performance

Measuring business performance is not an end in itself; it has a plethora of objectives and goals that can be classified as follows:

- Creating new products.
- Rewarding individual performance
- Improving manufacturing processes and working conditions.
- Reducing manufacturing costs.
- Introducing new products and meeting deadlines.
- Increase employee creativity.
- Improve complaint handling.
- Boost market share and customer loyalty.
- Strengthen and improve workplace safety
- Identify and evaluate key competencies.
- Anticipate customer needs and increase profitability.

1.5 Types of performance

1.5.1 Organizational effectiveness

Organizational performance concerns the way in which the company is organized to achieve its objectives and the way in which it succeeds in achieving them, there are four factors of organizational effectiveness:

- Adherence to the formal structure,
- The relationships between the components of the organization (organizational integration logic),
- The quality of the flow of information,
- The flexibility of the structure.

In this conception, the performance of the company results from the value of its organization. The latter is decisive and imposes its requirements on the social system. It structures the job and the set of positions, which in turn determine the professional requirements.

1.5.2 Strategic performance and competitive performance

Contrary to short-term visions of performance guided by stock market appreciation of the company's value, some companies have focused on long-term performance as a guarantee of their survival. The companies that have achieved global leadership over the last twenty years all started with ambitions that were out of proportion to their resources and capabilities, but they have used an obsession with winning at all levels of the organization and they have maintained this obsession over the ten or twenty years during which they have achieved global leadership.

The performance is then that of maintaining a 'distance' from competitors through a logic of long-term development maintained by a strong motivation (basis of the reward system) of all members of the organization.

Long-term performance is therefore associated with the ability to question acquired advantages in order to avoid the failure of a good concept, with the definition of a system of will aimed at the long term and with the company's ability to find sources of value that create margins.

The search for performance no longer depends solely on the actions of the firm, but also on its ability to adapt to, and even appropriate, the rules of the competitive game in a sector.

The nature of the competitive system determines the way in which performance can be achieved, taking into account the modes of competition. It is by detecting sufficiently finely the changing characteristics of the competitive systems of each of the company's activities or by anticipating on new bases of differentiation (value creation) that companies can appropriate potential sources of performance.

Performance can be both the exploitation of an existing potential (which allows to maintain a favorable position) and the development of new forms of competitive advantage by anticipating/constructing the rules of the game that will prevail in the future.

Competitive performance depends largely on the strategic analysis of the rules of the competitive game. Emphasizing the quality of the strategy, and therefore of the strategist, focused on understanding the environment, this approach has spontaneously tended to identify performance with competitiveness.

1.5.3 Human performance

It is increasingly recognized that a company cannot be financially successful in the long term if it does not perform well in human and social terms. Issues related to skills, capacity for initiative, employee support and the achievement of objectives. The famous formula of EINSTEIN, $E = MC^2$, is considered. In 1985, taking up the famous formula, $E = M.C^2$, P. CHARPENTIER, suggested that human effectiveness (Eh, efficacité humaine) should always be considered as resulting from the gathering of employees¹:

-Motivated,

-competent,

-communicating well with each other through a common language and values.

¹ CHARPENTIER.P, « *organisation et gestion de l'entreprise* », édition : Agnès fieux, novembre 2004.

The human efficiency (Eh), likely to be released by a human group would thus be expressed by :
 $Eh = M.C.C$.where:

M: motivation to act and succeed dynamic adhesion of each person.

C: professional competence, knowledge and know-how (this is the condition for individual effectiveness)

C: culture, common language, shared values, mutual recognition (this is the condition for collective effectiveness)

Since 1985, a great deal of research has been carried out to better understand this notion of effectiveness and performance by people. These various studies show that competence, its acquisition, development, and management are now a decisive factor in achieving human effectiveness, whatever its form the form it takes

For the achievement of performance in an organization, MICHEL S. and LEDRU M. consider that although skills are always a source of performance, they are not sufficient in themselves to determine the level of performance¹.

For the same level of competence, performance can be different. This is because, if competence is know-how, performance always presupposes the existence of a will to do or motivation. This motivation (i.e., what will lead the actor to effectively engage in the action proposed by the company) determines the action strategies chosen by the actor, strategies subject to the data of the work environment which make it possible to carry out the action (pouvoir-faire). This environment can itself be characterized by organizational data (prescribed roles, injunctions, means, ...) and cultural data (dominant representation).

1.6 Theories of performance

There are two main theories:

¹ Claude Alazard, Sabine SEPARI, « *contrôle de gestion* », DUNOD, paris ,2007.

1.6.1 The goal theory¹

LEVY LEBOYER defines the goal as the setting of objectives at both the personal and organizational levels.

LOCKE defines the goal as the desire to achieve a certain level of performance. He demonstrates that goals are powerful determinants of the supply and activity that leads to that performance.

This is valid even if the goal itself is unattainable.

This notion is subjective and is defined in relation to the probability of achieving a given result, a probability estimated based on performance observed in the past.

1.6.2 Reinforcement theory

This theory states that any behavior, whether positive or negative, can be controlled or even modified according to the desired outcome. It is based on the postulate that our behaviors are controlled by their consequences, and our steps, by internal phenomena such as needs, attitudes, values, etc.

1.7 The characteristics of performance

Performance is a set of characteristics that can be listed in the following points:

1.7.1 Judgement support

It implies a value judgement on its environment, i.e. the activities, results, products and effects of the organization on its environment. As a social construct, this concept has as many meanings as there are individuals or groups who use it.

So, performance remains a matter of perception. For a manager, it could be the profitability or competitiveness of the company; for an employee, it could be the work climate, and for a customer, the quality of the service provided. For an employee, it could be the work climate, and for a customer, the quality of the services provided.

¹ LEVY-LEBOYER : « *la motivation dans l'entreprise modèle et stratégie* », édition des EDITIONS D'ORGANISATION, Paris ,2001.

1.7.2 Evolution over time

The internal evaluation criteria and those defined by the environment change. Thus, factors which condition the success of the company during an innovation phase may be incompatible with those required during a development phase.

It must be admitted that there are combinations of human, technical, financial, and organizational factors which are effective in one context and no longer effective in another. These combinations are multiple and change over time.

1.7.3 Performance is controlled

Financial criteria are no longer sufficient for managers, and in practice, non-financial indicators complement the former, they are the driving force behind future success, they provide pilots with a global vision of performance in several areas simultaneously.

As a result, performance has a retroactive effect on the organization, it affects the behavior of managers if the results are below the objectives, managers will reconsider strategic choices.

1.7.4 Opposing components

Opposite components are a set of complementary and sometimes contradictory parameters. This can be seen when the manager seeks to minimize costs, while at the same time ensuring that product quality is improved, and employee morale is maintained. These criteria therefore impose permanent trade-offs. Not all components are equally important.

1.8 Dimensions of performance

In general, there is a distinction between external performance, which is aimed at actors in a contractual relationship with the organization, and internal performance, which is primarily concerned with actors within the organization. The differences are shown in the table below.

Table 1: external and internal performance

External performance	Internal performance
-Is mainly oriented towards shareholders and financial institutions.	-Is oriented towards managers
-Relates to the outcome, present or future	-Focuses on the process of building the result from the organisation's resources
-Need to produce and report financial information	-Requires the provision of information necessary for decision making
-Generate the financial analysis of major balances	- Achieving the definition of action variables
-Gives rise to a debate between the different stakeholders	-Requires a single vision of performance to coordinate everyone's actions towards the same goal actions towards a common goal

Source: DORATH Brigitte, GOUJET Christian, « *gestion prévisionnelle et mesure de la performance* », DUNOD, Paris, p173

1.9 Forms of performance

- **Customer performance**

Customer satisfaction ensures a certain durability of the company's industrial or commercial sector. This satisfaction requires the mobilization of all the company's resources over a fairly long period of time. Companies have understood that in order to be competitive they must make consistent efforts to capture and retain market share. These efforts take the form of anticipating customers' expectations and seeking to win their loyalty¹.

¹ FERNANDEZ Alain, « *les nouveaux tableaux de bord des manages* », édition d'organisation, paris, 2005. P39

- **Shareholder performance**

Access to capital has become a strategic issue for the company due to several interdependent developments, in particular, the growth in capital requirements, linked to technological developments and more recently, a return in force of shareholders and an increase in the role of institutional investors. In addition, the need for companies to expand has driven them to continually seek capital to support their economic growth. According to the financial markets, the performance of a company is measured by the creation of shareholder wealth.

- **Personal performance**

In order to innovate and serve the customer better, it is necessary for the company to motivate their employees in such a way that each employee feels involved and responsible for the future of the company. Since then, the competition for a particular know-how forces companies to effectively retain their human capital. Moreover, if they have been able to maintain a good performance in human resources management, they will have understood the relationship of trust between employee and company¹.

- **Partner performance**

Today, companies are increasingly entrusting high value-added activities to partners. These activities, such as design or transport, represent an important strategic impact in the value chain of companies. The optimization of the value chain becomes partly dependent on the efficiency of the supplier (partner) in question. Thus, the relationship between company and supplier is not limited to a simple contractual agreement but a long-term strategic relationship. Therefore, strategic management is the search for a permanent exchange of information between the partners, which makes it possible to save important costs that make the difference with respect to the competition. This relationship between the companies and the partner is a source of synergies within the same value chain.

- **Social performance**

To be successful, today's company must have a strategic vision that is shared by all, employees and managers alike. In other words, it is not possible for a company to succeed by focusing solely

¹ FERNANDEZ Alain, op.cit.p 39

on the economic aspect without taking into account the social aspect. Moreover, the globalization of information and the pressures of the surrounding society have made the activity of companies increasingly complex, because, in order to evaluate their social environment, several variables such as the environment and labor rights have become an integral part of company strategies. Therefore, it is no longer enough to minimize costs without taking into account the value of the social risk incurred by the company.

Section 02: ERP and Business performance

2.1 Business performance management¹

Achieving the best possible level of performance for each employee is the objective of performance management, which ensures that the company maximizes profits and minimizes costs. Performance management therefore includes the processes, actions, and means likely to enable profitability, and can be defined as "*the implementation of actions and means likely to lead to profitability²*".

To manage the performance of the company, it is necessary to take into account the different levels of management and their articulation, in other words, management concerns everything that affects the performance of the company and its results. To do this, management must plan, organize and control the company's activities. The planning of the company's activities consists of setting the objectives that it will have to achieve in line with the strategy that has been constructed. It also involves defining the means (performance tools) that it will use to achieve them. And the organization needs to mobilize material and human resources in order to achieve the objectives, and then performance monitoring is a necessity in order to be able to adjust the management with regard to the results obtained by the company.

Performance management can be broken down, according to the time horizon, as follows:

¹ Stéphane Jacquet, *Management de la performance : des concepts aux outils*

² Cohanier., Lafarge. & Loiseau., 2010. *Management de la performance : des représentations à la mesure*, Rouen business school.

- In the long term: the company must achieve the strategic objectives it has set itself, which depend on the overall strategy defined by the firm. Among the strategic objectives, for example: doubling gross operating profit, doubling the value of new business, maintaining the company's market share in a targeted market.
- In the short term, it is about managing the operational dimension. The company transforms the strategic objectives into short-term operational objectives implemented by the firm's operational departments
- The two levels of management, strategic and operational, are complementary and must be coherent to avoid creating dysfunctions.

2.2 Impact of ERP on Business performance

2.2.1 Impact of ERP on economic performance

ERP enables the automation of transactions which leads to an acceleration of processes and an increase in the volume of operations. Furthermore, thanks to the integration of the various applications, ERP harmonizes the different processes of the company. According to Shang and Seddon (2002)¹, this leads to a reduction in costs, a reduction in operational cycle time and an improvement in productivity and quality.

In addition, the installation of ERP reduces the maintenance costs of the information system and increases the firm's ability to deploy new information system functionality (Gattiker and Goodhue, 2000)².

Therefore, it can be concluded that ERP promotes resource and cost optimization, time control and increased productivity. As a result, customers will benefit from reduced lead times, lower prices, and improved quality of service. Sales will therefore increase, and the company will become more competitive. Indeed, according to Shang and Seddon (2002), through ERP, the company can

¹SHANG, S., SEDDON, P., (2002), « *Assessing and managing the benefits of enterprise systems: the business manager's perspective* », Journal of Information Systems, vol 12.

²GATTIKER, T.F., GOOGHUE, D.L., (2000), « *Understanding the Plant Level Costs and Benefits of ERP: Will the Ugly Duckling Always Turn into a Swan?* », Proceedings of the 33rd Hawaii International Conference on System Sciences, Vol 7.

gain competitive advantages by offering low-cost products and improving the company's relationship with its customers and stakeholders.

2.2.2 Impact of ERP on organizational performance

ERP provides organizational actors with a common language and a common database. This improves the quality of the information communicated and therefore reduces conflicts and promotes coordination between different departments. Indeed, the integration that exists between the different ERP modules facilitates cooperation within the organization (Shang and Seddon, 2002). Thus, ERP opens up new organizational perspectives by facilitating the transition from forms of organization based on functional specialization, hierarchical coordination and sequential decision-making processes to more versatile organizations that value horizontal coordination and more decentralized decision-making processes (Brousseau and Rallet, 2000)¹.

Furthermore, the implementation of ERP facilitates control activities in the company. Indeed, by eliminating manual re-entry of information, ERP makes it possible to eliminate data entry errors. As a result, most control activities are carried out further upstream, i.e. as soon as the basic data is created (new customers, new items, etc.). In addition, the existence of a single database shared by all the functional modules of the ERP facilitates the control and validation of accounting transactions from the operational processes.

In summary, ERP improves the quality of information communicated, promotes coordination, decentralizes decisions, and facilitates control. With reference to the criteria for measuring organizational performance, it can be concluded that ERP improves organizational performance.

2.2.3 Impact of ERP on human performance

Through its centralized database, real-time information and data analysis capability, ERP assists managers in the decision-making and planning process, subsequently enabling them to improve the direction of resources and enhance the performance of various operational decisions (Shang and Seddon, 2002)².

¹BROUSSEAU, E. et RALLET, A. (1999), *Technologies de l'information et de la communication et performances économiques*, Editions du Commissariat Général du Plan, Paris.

²ibid,

In addition, ERP also contributes to the improvement of staff knowledge. Indeed, the introduction of ERP implies that end-users of this new technology have to acquire new skills to handle it better. They thus achieve a certain level of confidence and efficiency when using ERP, enabling them to improve their productivity (Fourati, 2006)¹.

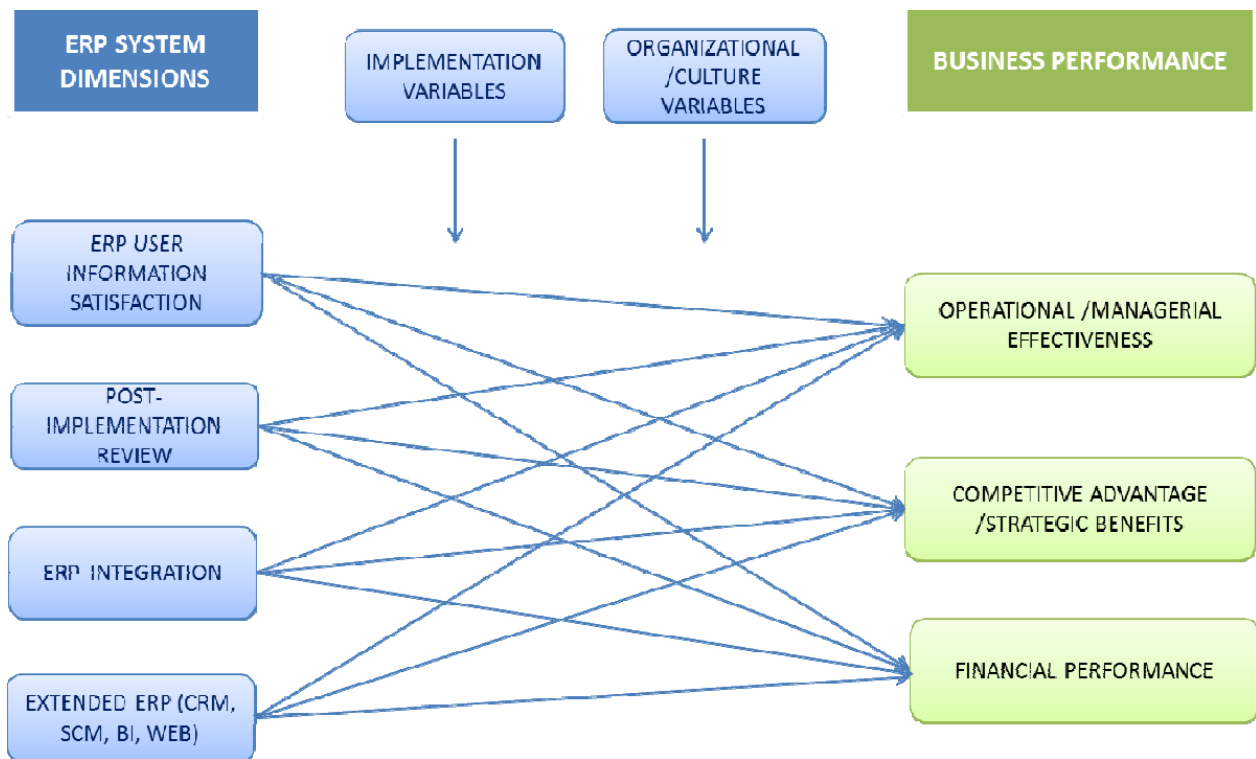
It should be noted that staff may show some resistance to the implementation of ERP. This resistance to change could be explained by the concern expressed by the staff due to the risk of job losses caused by the automation of tasks. In addition, the employee is often used to a way of working that involves a high degree of specialization and working in a group in the presence of the ERP could be a problem for them. Moreover, this resistance is also a consequence of the lack of information from the staff about the project (Berghman, 2003)².

For this reason, training is necessary when introducing ERP. In fact, apart from its scientific contribution, this training should also inform the staff of the various advantages of ERP that they could benefit from when performing their task. In conclusion, ERP makes management decisions more effective and improves employee skills and productivity. By referring to the criteria for measuring human performance, it can be concluded that ERP improves human performance.

Therefore, we can see the figure below the different dimensions of ERP that have an impact on business performance, whether it's the satisfaction of users with information, review after implementation, ERP integration or the vast modules of extended ERP.

¹FOURATI, F. (2006), «*Veille stratégique : de l'évaluation de l'utilisation des agents intelligents à la prise de décision* », doctoral thesis, University Paris Dauphine.

²BERGHMAN, I. (2003), «*L'accompagnement du changement : facteur clé de succès d'un projet d'ERP* », doctoral thesis, HEC - Mines.

Figure 14: Impact of ERP on Business performance

Source:THE ERP SYSTEMS IMPACT ON BUSINESS PERFORMANCE by Stefanou J. Constantinos available on <https://www.semanticscholar.org> accessed 28/05/2022

2.3 The choice of an ERP

The choice of an ERP systems depends on the nature of the company, its sector of activity, its size, its short, medium, long-term objectives and above all its existing functional, operational and IT requirements¹.

It is therefore easy to understand that the choice of solution is a critical factor in the success of an ERP implementation project, so this choice should not be made at random. Therefore, the first step in an ERP project, and the first task of the consultant, is to properly advise the client in his choice. A longer development and testing time than originally planned, or the need to hire more competent people to manage certain aspects of the implementation, are two examples of consequences that increase the final cost and development of the project, or in the most complicated

¹ SIOUDA Ghada. *La contribution des ERP dans l'amélioration de gestion d'une entreprise*. Mémoire de Master. Ecole des Hautes Etudes Commerciales d'Alger (EHEC). Alger : 2018.

cases, jeopardize the success of the project. For these reasons, there are a number of specific variables and criteria, to be considered when selecting an ERP solution, and that any consultant on such a project should be aware of¹.

2.3.1 ERP selection criteria:

The ERP selection criteria are specific to the company in which the ERP will be implemented, and it is therefore up to the company to define them through an evaluation of its needs and assets. The more the company decides to use a high number of selection criteria, the smaller the final short list of partners will be. According to Jean-Louis TOMAS², there are six different families of criteria that could help the company make its choice in terms of ERP solution which are: strategic, functional, technological, technical, commercial, and methodological. The aim here is not to detail all the characteristics, functions, options and parameters that should be reviewed in order to evaluate the ERPs of the various publishers; therefore we will mainly present the major areas for consideration in each of these six categories.

- **Strategic criteria:**

These are the most important criteria known as the "political criteria". They influence the directions that the company can take, and they highlight the different pressures, conflicts and influences that can exist within the company, as they must be defined and verified by the company's general management. It is therefore a question of taking into consideration all the strategic aspects of the company. Its long-term vision and objectives, its past alliances, its possible partnerships with an IT solutions provider, the existence of subsidiary companies or divisions and therefore its desire to unify the solution at the level of all entities or not, or its preference for respecting the specific needs of each entity, etc. All these variables have important consequences on the health of the company.

¹ DALA Jean, MANDON Céline, TUGLA Gulay, SHAPKOTA Prakash. Consultant ERP : *Au cœur de la gestion des entreprises*. Université Paris 13. 2009. p. 15.

²TOMAS Jean-Louis, GAL Yossi. *ERP et conduite des changements : Alignement, sélection et déploiement*. Editions Dunod, 6e édition. Paris : 2011. p.50, 51.

- **Functional criteria:**

These are the criteria we think of first and most easily. It is about knowing and understanding how the ERP will cover the functional or specific needs of the company. These criteria are not just for one operational area but for the whole company. It is therefore important that the company refocuses on its current and future needs, identifying and documenting them, so that they can be reviewed during the evaluation of different ERP solutions.

- **Technological criteria:**

These are the factors that will enable the pre-selected ERPs to be evaluated on their technological characteristics. The evaluation team will then have to assess and judge the flexibility, reactivity and capacity of the ERP to adapt to the environment and to the environment and the company's needs and expectations.

- **Technical criteria:**

The components of the ERP technical environment do not all come from the vendor itself, they come from four distinct types of vendors who provide the platform, the operating system, the middleware tools (responsible for creating an information exchange network between applications), the database management system (DBMS) and the ERP. The combination of these components will make the implementation of ERP more or less easy, and the tool will adapt to the characteristics of the company.

- **Business criteria:**

This involves evaluating the various ERPs according to the stability of the publishing company over time. An ERP is a substantial investment, so we are looking for the durability of the solution. If the publisher is bought out or disappears, the health of the host company is called into question because it relies significantly on the health of its management system and IT tool, which in this case is based on the ERP.

- **Methodological criteria:**

These criteria essentially come down to the method of implementing the ERP within the host company. If a company has never implemented ERP before, it is in a situation where it expects to invest a lot and have convincing results quickly, but the actual implementation often does not

happen in this way. Additional time and costs may arise, the company's internal implementation method does not match the ERP solution, or the method recommended by the publisher is not suitable for the company, these are problems that can be encountered. Nevertheless, the implementation of the solution must follow a precise methodology, which must adapt the method recommended by the editor to the reality of the company. to obtain an optimal result.

2.3.2 The evaluation of solutions, choice and acquisition:

Having identified the selection criteria, it is now time to evaluate the different solutions available on the market. Following the creation of a list of criteria that the ERP solution must meet, the evaluation team will create a short list of ERP solution vendors that can meet the established criteria.

The team will then meet with the various vendors on the short list for demonstrations of how the solutions work, and will then evaluate the suitability of the ERPs for the selected criteria, next, the vendors are ranked according to these results. At the end of this phase, the evaluation team will be left with a final ranking chart which could look like the following Table.

Figure 15: The evaluation of solutions, choice, and acquisition

Critères de sélection	Éditeur # 1	Éditeur # 2	Éditeur # 3
Critères stratégiques			
Critère 1	●	○	○
Critère 2	○	○	●
...
Critères fonctionnels			
Critère 1	○	●	○
Critère 2	●	○	○
etc.
Critères technologiques			
Critère 1	●	○	○
Critère 2	○	○	●
etc.
Critères techniques			
Critère 1	○	●	○
Critère 2	○	●	○
etc.
Critères commerciaux			
Critère 1	○	●	○
Critère 2	●	○	○
etc.
Critères méthodologiques			
Critère 1	○	○	●
Critère 2	●	○	○
etc.

● Première position ○ Deuxième position ○ Troisième position

Source: TOMAS Jean-Louis. ERP et PGI : Sélection, déploiement et utilisation opérationnelle. Editions Dunod, 4^eédition. Paris : 2005. p. 134.

2.3.3 The main ERP publishers:

With this information in mind, here is a list of the major proprietary ERP vendors on the market:

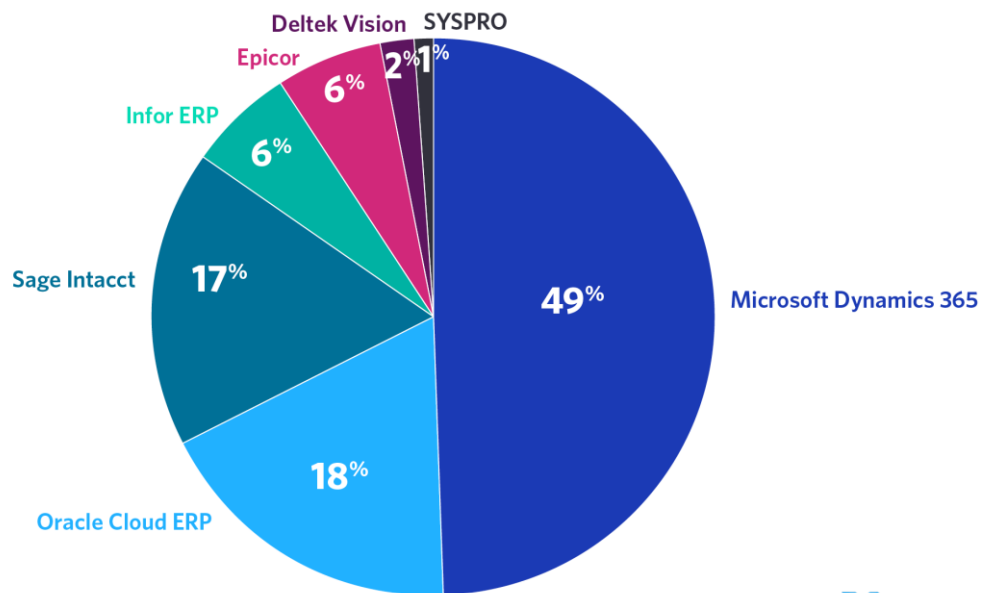
- SAP (Systems, Applications and Products for Data Processing) ;
- Oracle Cloud ERP ;
- Sage Inacct ;
- Microsoft Dynamics 365;

- Epicor ;
- Deltek Vision ;
- Infor Global Solutions.

The figure below shows the market share distribution of the main ERP vendors in 2021 at the global level, according to a study carried out by Trust Radius. The study reveals that 49% of customers surveyed chose Microsoft Dynamics 365, followed by Oracle Cloud (18%), sage (17%), Infor and Epicor (6%) ,with Microsoft Dynamics still leading the market but closely followed by its competitors.

Figure 16: Market share of ERP vendors 2021

Market Share of Leading ERP Software 2021



Source: TrustRadius platform data collected in July 2021

© TrustRadius

Source: <<https://www.trustradius.com/vendor-blog/erp-statistics-trends>> accessed 28/05/2022

Section 03: performance measurement

3.1 Key Performance Indicators:

a) Definition

“A performance indicator or key performance indicator (KPI) is a type of performance measurement¹. KPIs evaluate the success of an organization or of a particular activity (such as projects, programs, products and other initiatives) in which it engages²”

b) Categorization of indicators

Quantitative facts presented with a specific objective numeric value measured against a standard. Usually, they are not subject to distortion, personal feelings, prejudices, or interpretations.

Qualitative represents non-numeric conformance to a standard, or interpretation of personal feelings, tastes, opinions, or experiences.

Because an 'indicator' can only measure what 'has' happened in the past tense, the only form of measurement available is descriptive or lagging. Any KPI that seeks to predict, diagnose, or prescribe something in the future is no longer a 'indicator,' but a 'prognosticator' - at this point, it is analytics (perhaps based on a KPI), but leading KPIs are also used to signal the quantity of front end loading operations.

3.2 How to measure performance of a company

The issue of business performance, and thus its measurement, has been a recurring concern over the years. In a hyper-competitive world, it is prudent to evaluate oneself on a regular basis to ensure that one is heading in the right direction and keeping up with the right pace (a high-performance company), provided, of course, that one has taken care to implement the right actions and has the adequate means to achieve the objectives³.

Performance is assessed using qualitative or quantitative outcome criteria (or indicators). To assess effectiveness, a criterion is used which expresses a link between the outcome and the goal

¹ Carol Fitz-Gibbon (1990), "Performance indicators", BERA Dialogues (2), ISBN 978-1-85359-092-4

²Weilkiens, Tim;et al. (2016). "Frameworks". OCEB 2 Certification Guide. Elsevier. pp. 149–169.

³Alain Fernandez, Mesurer la performance

desired. A criterion is used to measure efficiency, which expresses a relationship between the outcome attained and the means used¹.

Furthermore, the organization requires strategies to fulfill its goals, such as budget strategies (monetary strategies) or continuous improvement strategies for each of the manufacturing or managerial processes (value-added management). And inside these plans, there are indicators to diagnose the company's reality and the goals to be attained.

A performance indicator provides for the measurement of the difference between actual and planned objectives in order to assess if the latter are being met, and they must also be intelligent. SMART²:

S: Specific, well described, understandable by the operators.

M: Measurable, quantifiable in quantity or quality.

A: Achievable.

R: Reasonable.

T: Temporal (it is very important that the indicator is fixed in time).

¹<https://www.conseils-plus.com/fr/la-strategie-damelioration-continue/> accessed 28/05/2022

²<http://idconseil21.com/la-performance/> accessed 28/05/2022

Figure 17: the 5s of Key performance indicators



Source: <https://matthewatkin.actioncoach.co.uk/2018/07/09/the-importance-of-kpis/> accessed: [28/05/2022]

There are several performance indicators. Generally, there are three main families of indicators: financial, market and organizational:

a) Financial Indicators:

Traditionally, according to A. SLOAN¹, financial performance is measured using ROI (return on investment) and ROE (return on equity) indicators, which are a set of ratios used to determine the financial health of the company. These indicators concern the solvency and even the growth of the business. They offer the possibility of comparing the general performance of a company with its sector of activity to identify possible investment opportunities.

- **ROI (Return On Investment)²:**

This ratio measures the economic profitability of the capital used by the company. It is the ratio between the operating result and the capital invested by investors to select a successful project among several others, for this reason its objective is to determine whether the investment has been

¹A.Sloan: an American businessman, chairman of General Motors for nearly 30 years, and management theorist.

²<https://www.manager-go.com/finance/ROI-retour-sur-investissement.htm> accessed : [28/05/2022]

profitable and to study the points to be improved for a better performance, therefore, the two main functions of this indicator are decision support and performance analysis.

- **ROE (Return On Equity):**

This ratio measures the financial profitability of the capital contributed by the owners of the company. It is the ratio of net income to equity. Simply put, it expresses how much profit the company can generate each year for a unit of capital invested by the shareholders. In recent years, new indicators for measuring financial performance have emerged:

- **EVA (Economic Value Added)¹:**

Developed by the consulting firm Stern Stewart & Co (specialized in managing the portfolio strategy of American companies), this ratio makes it possible to measure value creation. It is the difference between the operating result and the capital invested. This financial indicator is becoming increasingly popular not only for assessing the value created, but also for measuring the impact of management action, and it also helps in the periodic evaluation of performance.

Figure 18: Financial Performance Indicators

Performance Area	Indicator	Calculation
<i>Economic profitability—overall management's performance</i>	1. Return on assets (ROA)	$ROA = \frac{\text{Net profit after tax}}{\text{Net revenue}}$
<i>Shareholder profitability—return available to shareholders</i>	2. Return on equity (ROE)	$ROE = \frac{\text{Net profit after tax}}{\text{Shareholders's equity}}$
<i>Investment performance—return obtained from invested capital</i>	3. Return on invested capital (ROIC)	$ROIC = \frac{\text{Net operating profit after tax}}{\text{Capital invested}}$
<i>Market assessment of corporate performance—shows how capital market investors value a firm's activity and operations</i>	4. Tobin's Q ratio (TQ)	$TQ = \frac{\text{Market capitalization}}{\text{Total assets}}$

Source: Horobet, Alexandra & Belascu, Lucian & Curea, Stefania-Cristina & Pentescu, Alma. (2019). Ownership Concentration and Performance Recovery Patterns in the European Union. Sustainability. 11. 953. 10.3390/su11040953.

¹<https://culturefinanciere.com/le-roe-un-bon-indicateur-de-profitabilite/> accessed :[28/05/2022]

b) Market indicators¹:

These are set up to identify the detailed origin of turnover and where it comes from, which may be turnover generated by old or new customers. With these indicators, the company will be able to determine the performance of sales and marketing activities within its business area. It will also be able to assess its market share in the targeted sector or segment.

The main indicators are: the share of sales of loyal customers and new ones (the turnover generated); the degree of customer satisfaction which is done by studying the competition. It is a question of measuring the components of the company's competitiveness; there is **price competitiveness** and **non-price competitiveness**. The first component refers to the ability of a product to attract customers at the expense of competing products because of its price. Its measurement makes it possible to situate the company's position on the market in relation to its competitors. The second component designates the capacity of a product to attract customers to the detriment of competing products due to independent elements of price. It is achieved through elements such as product quality, innovation, service, design, and the profitability of advertising campaigns².

c) Organizational indicators³:

These are more particular to the company's human resources and overall productivity. They are a collection of ratios used to assess the quality of internal processes and human resources. These ratios combine findings from numerous studies, including after-sales service, research and development, governance, and personnel skill analysis. These indicators also allow for the determination of production costs and savings margins, the level of quality (of the good or service), or the incentive mechanisms for employees to perform, such as production costs; the evolution of spending on innovation; the volume of calls or consultations with after-sales services; and employee satisfaction.

The evaluation of company performance requires the use of tools and methods. In recent years, these business management methods and tools have undergone a profound transformation,

¹<https://www.netpme.fr/conseil/indicateurs-cles-performance/> accessed :[28/05/2022]

²<https://www.investopedia.com/terms/c/competitive-pricing.asp> accessed [04/07/2022]

³Ibid

increasingly focused on performance improvement, and have enabled companies to significantly improve the quality and reliability of their services and production while making significant savings, which implies regular performance improvement. Performance improvement methods and tools include:

- **Benchmarking:**

The need for a benchmarking approach is no longer in question for successful companies. Indeed, benchmarking or the measurement of company information is considered to be one of the critical determinants of a performance improvement process, allowing the company to measure and compare itself to other similar companies or to established standards in order to identify its strengths and areas for improvement¹. The following are the typical steps in a benchmarking exercise²:

- Identify the object of the benchmarking: this is the identification of the process to be improved in order to hope for a return on investment.
- Define the benchmarking measures: once the company has defined the process to be benchmarked, it is necessary to set up relevant performance indicators, in accordance with the objectives set at the outset.
- Identify the benchmark: once the process has been defined, the company must identify the reference to be copied. It can call on a consultant, or look at professional magazines, search engines on the web, consult databases, national statistics, etc.
- Collect the data of the benchmark target: at this stage, the company has in principle all the information on the benchmark (the target company) after having collected all the data it needs.
- Analyse and compare the data and determine the gap: the company compares the collected information with its internal information.

¹Josée St-Pierre, Louis Raymond et al, *Le benchmarking comme outil d'aide à l'amélioration de la compétitivité et de la productivité des PME Québécoises*, report presented at the ministry of industry and commerce of Québec, University of Québec, mars 2001, p. 3.

²Yvon Mougins, *Processus : Les outils d'optimisation de la performance*, édition d'organisation, 2004, p.97-98.

- Define an action plan and objectives to be achieved: this step is a classic phase of problem-solving methods. Each internal performance measurement shows a performance deficit on its part, which should in principle be the subject of an improvement target.

- Checking the implementation of the progress targets: it is necessary to check that the actions are implemented and that the results they produce are in line with expectations. The indicators that the company set up at the beginning and which were used to compare itself to the benchmark will be used again to check and evaluate the progress made.

In short, benchmarking is a marketing or quality management technique and tool which consists of studying and analyzing the management techniques and organizational methods of other companies in order to draw inspiration from them and to make the best of them. It is a continuous process of research, benchmarking, adaptation, and implementation of best practices to improve the performance of processes in an organization¹.

- **Quality Function Deployment (QFD):**

It is a tool that originated in Japan. It is also called "voice of the customer" because companies that operate using this method try to respond precisely to the needs expressed by customers. For example, when a technically perfect product does not sell, it is because it does not exactly match the market's expectations, since consumers prefer another product. The objective of the QFD is to provide the company with a method that enables it to identify the expectations of users regarding a product and, above all, to transmit these expectations. The principle of this tool is to transform them into functions, then into technical characteristics and then into manufacturing specifications.

- **The 5S:**

They have become the foundation of a state of mind oriented towards continuous improvement in industrial companies. Indeed, the 5S are an essential tool in any performance approach by optimizing working conditions and safety. This 5S training course provides the keys to this simple method which advocates order, tidiness, cleanliness, and visual organization. This tool appeared in Japan, 5S are the initials of the key words of the method: Seiri (Sort) for clearing: which means to remove useless work space; Seiton (Set in Order) for tidying: to organize space and to organize it

¹ <https://www.cairn.info/revue-pratiques-et-organisation-des-soins-2011-1-page-35.htm> Accessed 28/05/2022

in an efficient way; Seiso (Shine) for cleaning: a clean work place helps workers and motivates them for a performing output; Seiketsu (Standardize) for order: to standardize rules, to prevent the appearance of disorder; and Shitsuke (Sustain) for rigor: to follow up, to encourage efforts and to progress. The 5S methodology is relevant to many sectors of activity¹.

Figure 19: 5s Methodology



Source: Gapp, R., Fisher, R., Kobayashi, K. 2008. Implementing 5S within a Japanese Context: An Integrated Management System, Management Decision

¹<https://www.sesa-systems.com/methode-5s-demarche-pour-un-environnement-organise> Accessed 28/05/2022

In this chapter we have seen What a firm performance is, what are its different types and components, how it can be measured, and how can the ERP systems impact the performance of businesses.

The economic environment has been accelerating for several years, resulting in a competitive dynamic that is much more complex for companies to manage. This dynamic can be traced back to the rapid development of information and telecommunications technologies. From now on, in order to achieve performance, companies are obliged to adapt to the evolution of their environment, to adjust their production and distribution of goods and services and to adopt new strategies to meet the needs of their customers and finally to achieve performance.

**CHAPTER III: IMPACT OF ERP ON
BUSINESS PERFORMANCE – Case
Study SONATRACH**

Chapter III: Impact of ERP on Business Performance – Case Study SONATRACH

For more than 50 years, the national oil and gas company has played its role as the engine of the Algerian economy. SONATRACH, nicknamed the African Major, is ranked the first Hydrocarbon Group in Africa, and a major energy supplier in the world.

Today, it must project itself into the future by a global mutation of its organization and functioning in order to meet the numerous challenges it faces. This is why it has launched a development strategy for 2030 in order to define a clear and shared vision, a flexible, robust and efficient organisation and finally modern management methods.

In order to face this imperative need for transformation and the numerous challenges to be met, SONATRACH has many assets and considerable potential, and has designed a real strategy and a profound reorganisation of its macro-structure to strengthen the structure and skills of each activity.

This chapter will focus in the first section on the general organization of SONATRACH, then in the second we will present the SAP ERP System within the enterprise, lastly, we are going to present our research methodology and analyse the results of this study.

Section 01: Presentation of the enterprise

1.1 Presentation of SONATRACH

The national company for the transport, transformation and marketing of hydrocarbons, better known by its acronym "SONATRACH", is an Algerian public company involved in the exploration, production, transport by pipeline, transformation and marketing of hydrocarbons and their derivatives. The latter is a national company of great economic weight, operating in Algeria and in several regions of the world, notably in Africa (Mali, Tunisia, Niger, Libya, Egypt, Mauritania), in Europe (Spain, Italy, Portugal, Great Britain, France).

Today, SONATRACH's activities are not only limited to oil production, it is also developing in petrochemicals, electricity generation, new and renewable energies, seawater desalination and mining.

1.2 History of SONATRACH¹

SONATRACH (acronym for "Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures").

The national company for research, production, transport, transformation, and marketing (SONATRACH) was created on 31/12/1963 by decree N° 63/491 published in the official journal on 10/01/1964.

On 22 September 1966, the presidential decree (N°66/292) brought the first modifications to the statutes of SONATRACH.

SONATRACH's missions, which were limited to pipeline management and marketing, were subsequently extended to include the research, production, and processing of hydrocarbons. SONATRACH became the national company for research, production, transport, processing and marketing of hydrocarbons.

In February 1973, the nationalization of hydrocarbons placed the national hydrocarbon company in a new dynamic:

¹ <https://sonatrach.com/> accessed 10/06/2022

SONATRACH's objectives were to extend its activities to all gas and oil installations and to master the entire hydrocarbon chain.

From 1980 to 1985, SONATRACH embarked on a new five-year restructuring process, which led to the creation of 17 companies:

SONATRACH grew from a company with 33 employees in 1963, whose main objective was the transport and marketing of hydrocarbons, to a company with more than 103,300 employees in 1981, with a field of activity that encompassed the entire hydrocarbon chain;

From 1986 to 1990, the law 86/14 of August 19, 1986 defines the new legal forms of the activities of prospection, exploration, research and transport of hydrocarbons allowing SONATRACH to open up to partnership:¹

From 1991 to 1999, the amendments introduced by law 91/01 in December 1991, allow foreign companies operating in the gas sector, in particular, to recover the funds invested and grant them an equitable remuneration for the efforts made. More than 130 oil companies, including the majors, made contact with SONATRACH and 26 research and prospecting contracts were signed during the two years following the new institutional framework.

In 2014, SONATRACH was the first company to start producing shale gas on Algerian soil, following the government's agreement on 21 May 2014 to exploit unconventional hydrocarbons.

In March 2016, SONATRACH and ENI, the Italian oil giant, signed an agreement for the offshore exploration of new oil and gas resources.

On 20 March 2017 the Minister of Energy appointed A. OULD KADDOUR as the new CEO (Chief Executive Officer). He quickly drew a negative balance sheet of the state of SONATRACH, an inadequate organizational chart, an absence of a long-term strategy, an excessive number of subsidiaries. He then decided to reorganize the group in an "intelligent" way, to develop shale gas.

In May 2018, SONATRACH announced that it was buying the Italian refinery of Augusta, acquiring three oil terminals in Italy, and signed an agreement with the French oil company Total to build a petrochemical plant in the Arzew region.²

¹ http://www.ipemed.coop/adminIpemed/media/fich_article/1369907203_IPEMED_CEME_MAI-2013_FR.

² Jean-Guy Debord, « SONATRACH et NOC (Libye) signent un accord-cadre de coopération » [03/07/2022]

In 2019, the draft of the new hydrocarbon law does not foresee the exploitation of shale gas, which has been visibly abandoned in favor of renewable energies.

In 2019, the group is asked by the Libyan company National Oil Corporation to increase its production and intensify cooperation between the two companies.

In November 2019, the company's management announced that it had signed an agreement with the French company ENGIE (industrial energy company). Which is a medium and long-term agreement for the sale of LNG (Liquified Natural Gaz) in France.

On 8 January 2020, SONATRACH signed a \$3.7 billion contract with Tecnicas Reunidas and Samsung for the construction of a deep conversion crude oil refinery with a capacity of 5 million tonnes/year in Hassi-Messaoud.

In 2021, SONATRACH sees its export revenues increase by 75% compared to 2020. Over the same period, the company's turnover rises from \$20 billion to \$35 billion, increasing its production of tonnes of oil equivalent (TOE) from 176 million to 185 million euros.

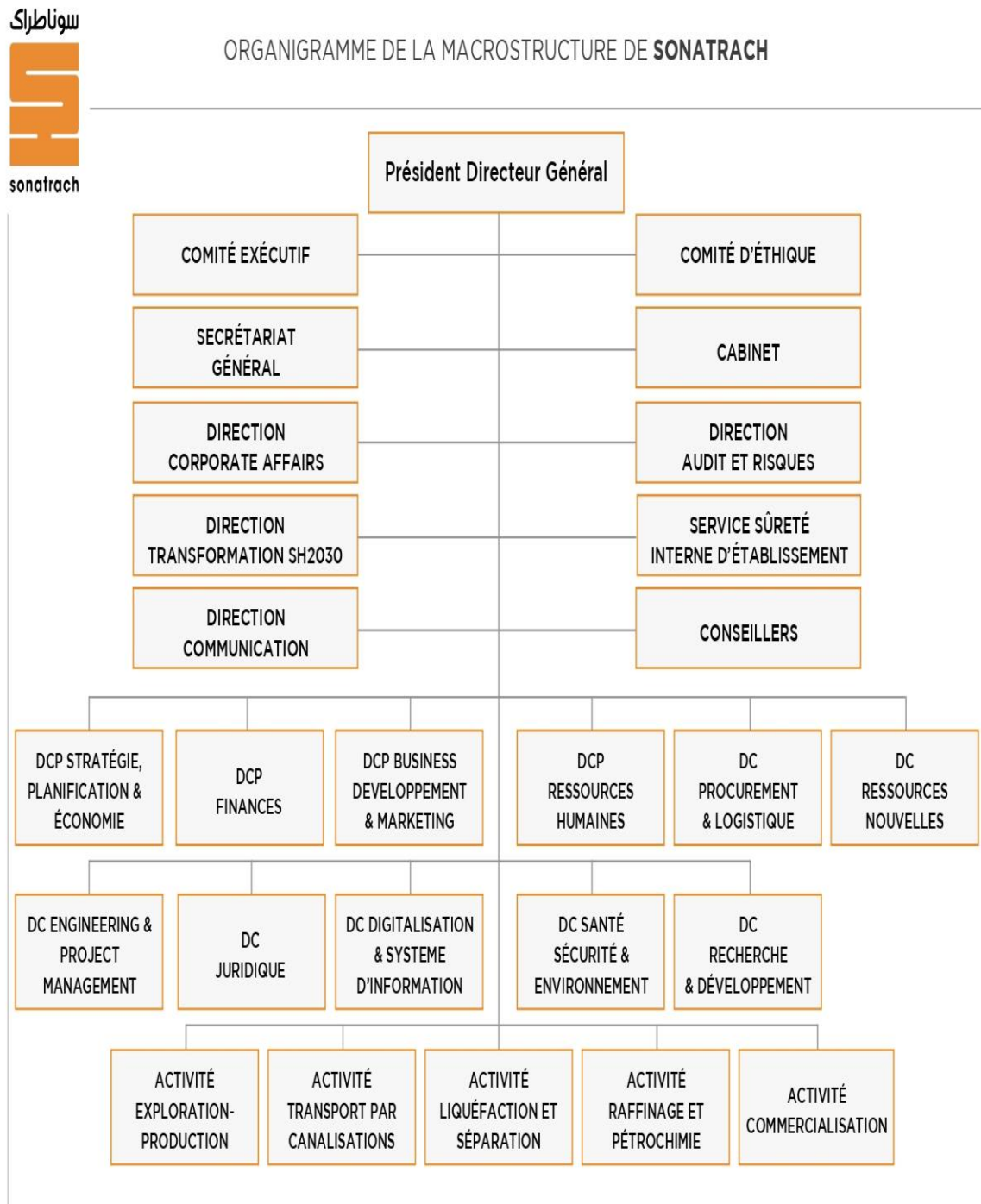
1.3 SONATRACH's Missions

Faced with the evolution of the current environment and the global economic situation, SONATRACH's mission is to:

- Prospecting, research, exploitation and development of oil and natural gas deposits as well as the reconstitution and increase of hydrocarbon reserves.
- The construction, industrial and commercial exploitation of all means of transport of hydrocarbons by land.
- The treatment, processing and marketing of hydrocarbons and derived products as well as their medium-term energy supply.
- The intensification of the efforts of exploitation and capitalization of the studies carried out in this field, for a better knowledge of the subsoil and the highlighting of the potential hydrocarbon reserves.
- The development, exploitation and management of transport, storage and loading networks of hydrocarbons.
- The development of modern national management techniques through continuous training.

1.4 SONATRACH's structures and organizational chart

Figure 20: Organization chart of SONATRACH



Source: internal company document

-**The SH2030 Transformation Department (TRF)** is responsible for coordinating and monitoring the implementation of SONATRACH's SH2030 transformation plan.

- **The Communication Department (CMN)** is in charge of developing and implementing SONATRACH's communication strategy.

- **The Corporate Strategy, Planning and Economics Department (SPE)** is responsible for the elaboration and development of medium and long term plans and for evaluating their implementation.

- **The Corporate Finance Department (FIN)** is responsible for developing policies and strategies in the area of finance. It evaluates their implementation and ensures the quality of financial information

- **The Corporate Business Development and Marketing Department (BDM)** is responsible for formulating the growth strategy and seeking investment opportunities for the Company

- **The Corporate Human Resources Department (RHD)** is responsible for developing human resources policies and strategies and monitoring their implementation

- **The Central Procurement & Logistics (P&L) Department** is responsible for steering the procurement and logistics processes for the Group

- **The New Resources (R&N) Central Division** is responsible for managing and operating the Non-Conventional Resources and Offshore projects from the center

- **The Central Engineering & Project Management (EPM) Department**, which manages and executes the Group's major industrial projects

- **The Central Legal Department (JUR)** is responsible for the development and harmonization of legal instruments and the control of their application

- **The Central Digitalization and Information System Department (DSI)** is responsible for defining and controlling the Company's IT and digitalization policy

- **The Central Health, Safety and Environment Department (HSE)** is responsible for drawing up policies on the environment, safety, and quality of life at work. It monitors their application

- **The Central Research and Development (R&D) Department** is responsible for promoting and implementing the policy of applied research and development of technologies in the Company's core businesses.

Our internship and study was done within The Central Digitalization and Information System Department

1.5 Partners and subsidiaries of SONATRACH

1.5.1 Partners of SONATRACH

Figure 21: Partners of SONATRACH

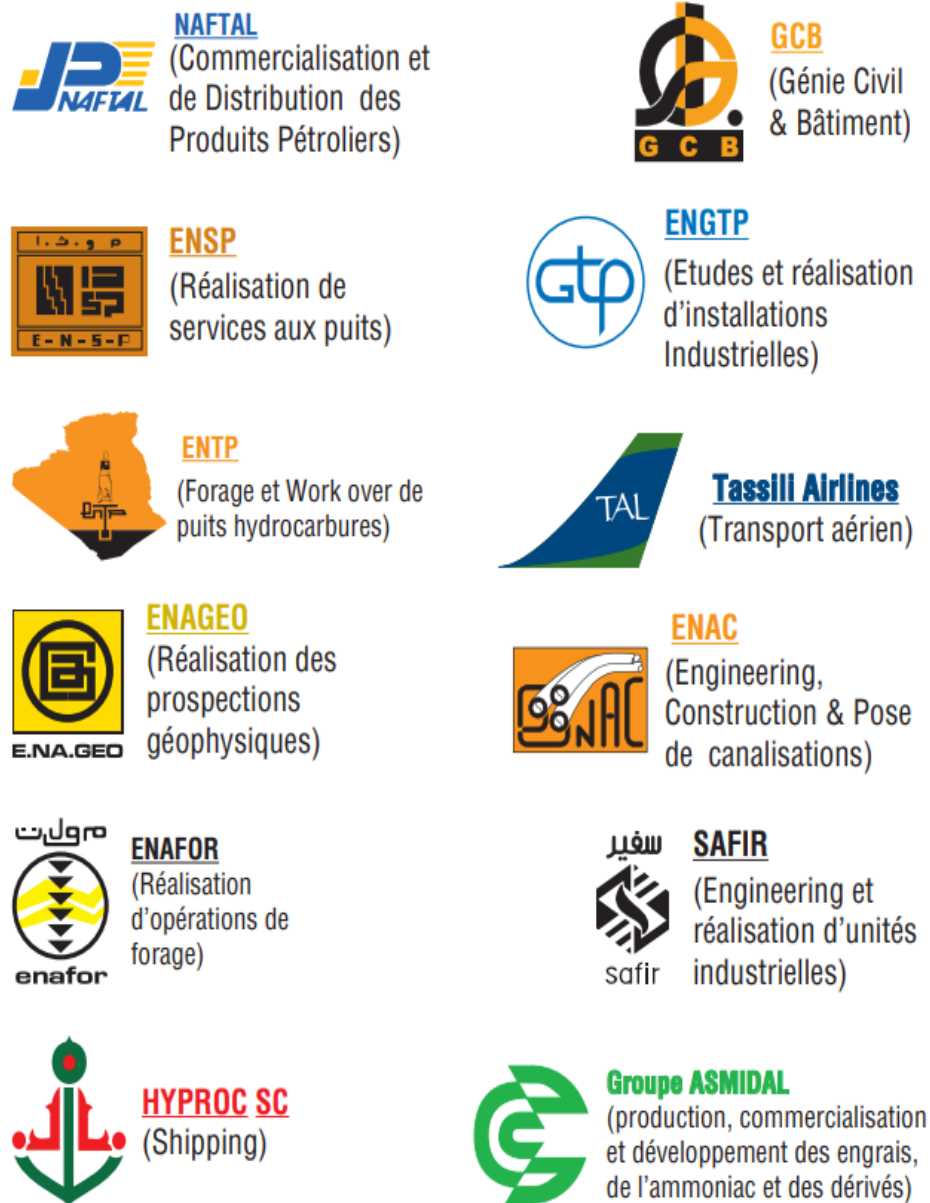
Partenaire	Nationalité
Anadarko (Occidental) USA	USA
BP	UK
Neptune Energy	
Edison	Italie
Eni	
Cepsa	Espagne
Repsol	
CNOOC	
CNPC	Chine
Sinopec	
DEA	
FCP	Allemagne
Gazprom	Canada
Rosneft	
TOTAL	Russie
BHPBilliton	France
Pertamina	Australie
Petroceltic	Indonésie
PTTEP	Irlande
PVEP	Thaïlande
Equinor	Vietnam
Teikoku	Norvège
Numhyd	Japon
	Tunisie

Les contrats en phase de développement et d'exploitation intègrent 112 gisements, dont 34 en phase de développement et 78 en exploitation.

Source: internal company document

1.5.2 Main subsidiaries of SONATRACH:

Figure 22: Subsidiaries of SONATRACH



Source: Internal company document

1.6 Vision of SONATRACH

SONATRACH's vision is to refocus on its core business by investing in the entire hydrocarbon chain (from Exploration-Production to Refining and Petrochemicals), with a firm commitment to create added value in Algeria, by involving the national production tool as much as possible in its investments and development plans, in order to reach a local content rate of 55% by 2030.

1.7 SONATRACH's strategic objectives

- Support the socio-economic development of the country.
- Boost the industrial sector of Algerian SMEs through the opportunities offered by its growth strategy.
- Promote and develop the transfer of technology and know-how by encouraging the development of partnerships.
- Participate in the development of skills through the strengthening of relations between the sectors of higher education, professional training and oil & gas companies.
- Strengthen the development of the local oil & gas supply chain.

Section 02: SAP ERP within SONATRACH

2.1 SAP ERP System:

2.1.1 History of SAP ERP

SAP SE is a German company incorporated under European law (SE stands for Societas Europaea in Latin) that develops and sells software, including management and maintenance systems, primarily to companies and institutions worldwide. SAP is the largest software company in Europe and the fourth largest in the world. It is headquartered in Walldorf, Germany, and has regional offices on five continents. Its best-known product is the SAP ERP enterprise resource planning system¹.

In 1979, SAP R/2, a two-tier architecture, was released to handle different languages and currencies. The three layers were installed on two separate servers (the first server for Presentation and the second for Application and Database)².

Naturally, SAP continued to offer better and better products and would upgrade the SAP R/2 version to offer the SAP R/3 version, the client/server version of the software in which the three layers, Presentation, Application, and Database, were installed on separate servers.

In the 1990s, several new modules were added to the core system FI CO for Financial accounting and COntrolling: MM for Material Management, WM for Warehouse Management, PP for Production Planning, SD for Sales and Distribution, HR for Human resources, and several others.

SAP continued its growth by creating several software products to complement the ERP: a business data warehousing software SAP BW Business Warehouse, a customer relationship management system CRM, a supply chain optimization application SCM among others.

From 2008, SAP continues to expand its offering with the acquisition of Business Objects, Ariba, SuccessFactors, Concur, hybris and others.

¹ <https://news.sap.com/> accessed 30/05/2022

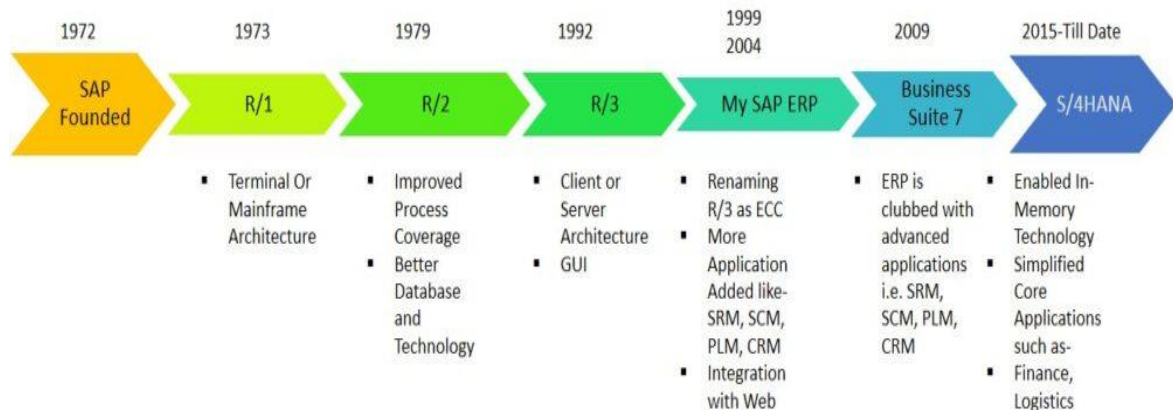
² <https://www.silicon.fr/resultats-sap-taille-sa-route-dans-le-cloud-en-2016-167988.html> accessed 02/06/2022

In 2010, they released a revolutionary in-memory database, SAP HANA, designed to support very large volumes of data and enable real-time analysis. The SAP HANA database would later become the foundation and technology platform for their cloud strategy with SAP Cloud Platform (SCP)¹.

The possibilities offered by SAP HANA allowed SAP to completely redesign the popular ERP to offer their customers the first ever intelligent ERP: SAP S/4HANA.

S/4HANA was released in 2015 and was designed to optimise the efficiency of ERP users through simpler processes, a better user interface (SAP Fiori), real-time alerts and analytics, automated and even predictive tasks, machine learning, and built-in AI features.

Figure 23: History of SAP ERP



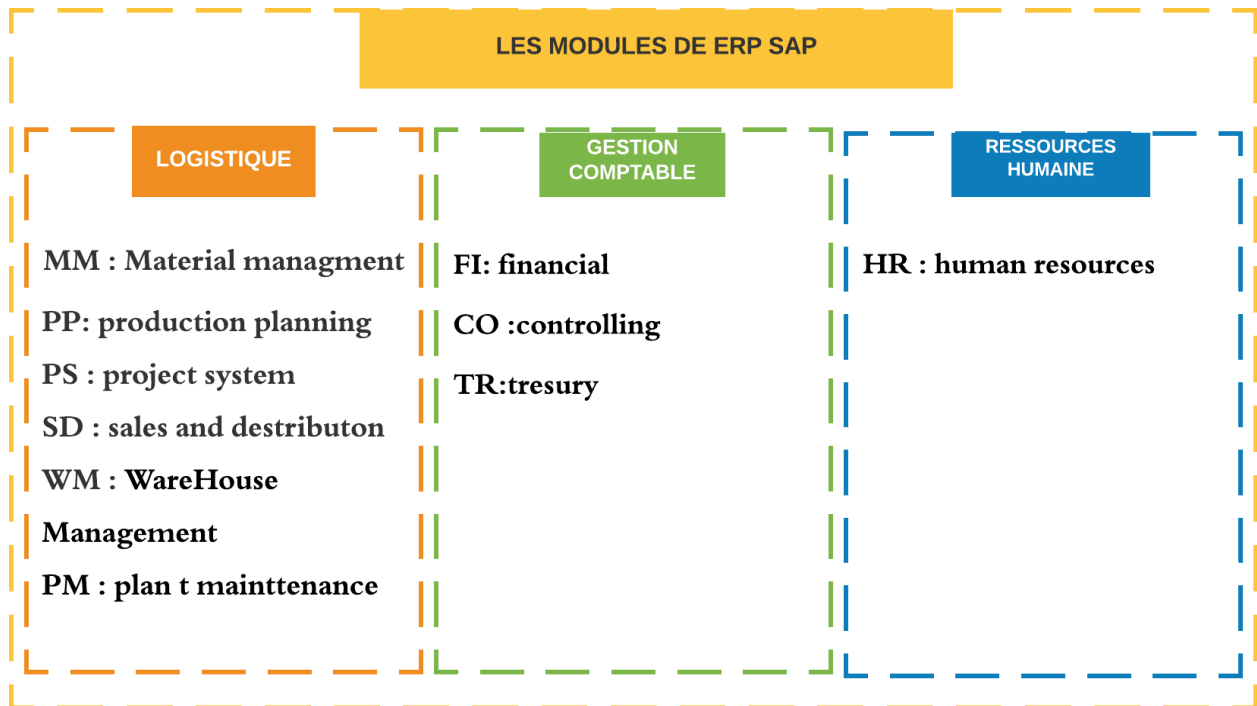
Source: <https://blogs.sap.com/2020/06/04/sap-hana-and-s-4-hana-a-simple-guide/> accessed 30/05/22

¹ <https://www.createch.ca/fr/blogue/sap-definition-guide-complet> 02/06/2022

2.1.2 Modules of SAP ERP

SAP contains 3 main families of functional modules, accounting and human resources.

Figure 24: Modules of SAP ERP



Source: Internal company document

2.1.3 Advantages of SAP ERP software¹

- **SAP ERP Visibility and Accessibility**

One of the most significant advantages of SAP ERP is its ease of use. Employees from various departments in the organization can access the data stored in the ERP software from any place and on any device.

Because the information is maintained in a centralized area that is visible and easily available to everybody, it enables better collaboration between departments. It also improves workflow consistency and speeds up task completion. Meanwhile, you can keep track of procedures more readily.

¹ <https://www.business-opportunities.biz/2019/12/17/9-advantages-sap-erp-system/> accessed 09/06/2022

- **Improved Efficiency**

Implementing an SAP ERP solution can greatly reduce the time and effort required by employees to complete their day-to-day tasks. Furthermore, it can decrease or eliminate time-consuming manual processes, allowing team members to focus on more vital duties.

Additionally, an ERP solution would enable the company to standardize its own systems and operations. This will improve efficiency and production even further. Furthermore, because most operations are automated, errors and expenses are greatly minimized.

- **SAP ERP System Customization**

Nowadays, most SAP ERP providers provide a number of applications that can combine to meet the specific demands of the business. In other words, the customer can select the components that are most appropriate for business and eliminate those that are unnecessary.

Another component of customization is the manner in which the program is implemented. The two main methods of deployment are via the cloud or on the company's premises.

- **Reduced Costs**

Even though ERP software is an expensive investment, it can reduce costs in the long term. Instead than investing in many systems that require infrastructure, people, licenses, and support, the firm can focus on a single effective SAP ERP solution. Furthermore, using a single system reduces end-user training requirements.

- **Improved Collaboration**

An SAP ERP solution will streamline the collaboration process by giving employees from all departments access to the information they require at any time and from any location.

Because data from each department is concentrated in a single area, communication throughout the entire firm is considerably more efficient. This is because every employee has access to company data and can see the larger picture more clearly. As a result, they can become more engaged and proactive. Overall staff productivity improves as well.

- **Better Planning and Reporting**

By implementing SAP ERP software, the business will have an unified reporting system for all processes. SAP ERP can provide valuable analytics and reports at any time and without the assistance of an IT specialist because there is a single source of reliable, up-to-date data. This enables the company to compare and examine the work of several departments without the need for emails and spreadsheets.

- **Customer Service**

Employees aren't the only ones who will experience the benefits of using a SAP ERP system. It will also assist the clients. sales professionals will be able to focus on creating strong relationships with clients instead of continually working on spreadsheets since client information is streamlined and centralized.

The marketing team may gain clear insights, improve relationships with customers, and focus on building more targeted marketing campaigns by tracking customer data.

- **Data Quality and Security**

Data security is one of the most crucial advantages of utilizing a SAP ERP solution. Both cloud-based and on-premises ERP software provide a high level of protection.

Data sharing across departments enhances overall organizational collaboration. However, SAP ERP solutions include inherent controls that allow businesses to limit who can share and see data, maintaining its security. Furthermore, the database system provides centralized backups of sensitive and vital data.

- **Easy Scalability**

To secure its success, a company must think about and plan for the future. Businesses that fail to plan for the future frequently encounter issues that can lead to serious setbacks.

Implementing an SAP ERP solution means having a system that can readily and efficiently react to your company's growth. SAP software will ease the transfer whether the business is entering a new market or growing the consumer base. Furthermore, if its are introducing new goods, processes, or departments, the company will be able to effortlessly add new users or functionality to SAP ERP software.

2.2 SAP ERP within SONATRACH

The growth phases of a company must be accompanied by strategic changes. New organizational needs arise, and among the aspects proposed to meet these needs is the implementation of an ERP, defined according to the famous publisher, SAP, as a tool for managing company resources that allows all activities to be assembled in a model or process that automates and matches all the transactions associated with it.

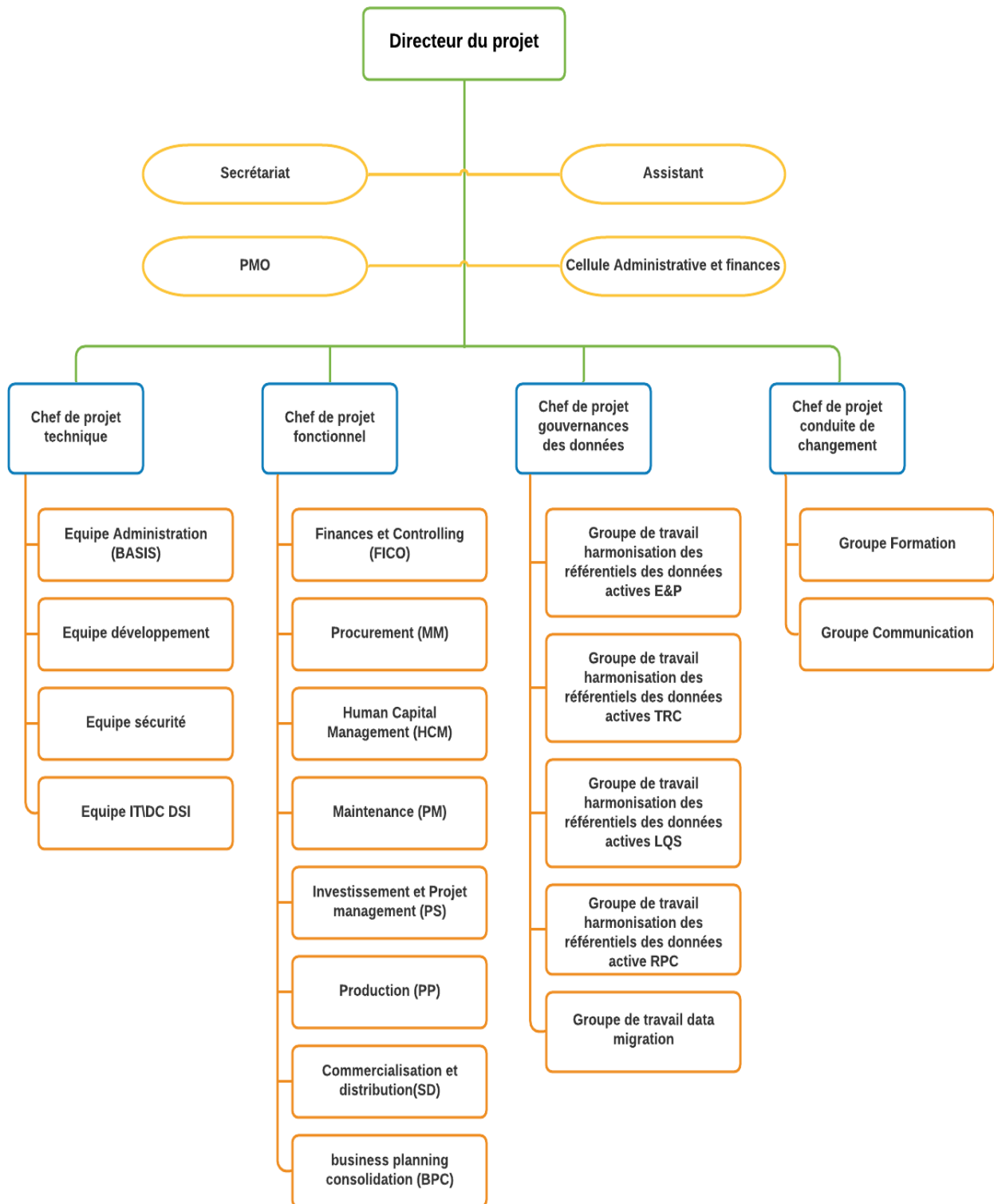
In order to improve performance and customer satisfaction, SONATRACH decided to implement this solution and install an SAP ERP to manage its information system. To date, several steps have been finalized: the detailed design of the solution, the configuration of the system and the validation tests by the project team¹.

The SAP project consists of a Project Director, Assistant Director, PMO and four Project Managers (Functional, Technical, Data Governance and Change Management).

In Appendix A we show the different modules of SAP ERP in SONATRACH.

¹ <https://sonatrach.com/> accessed 09/06/2022

Figure 25: PROJECT SAP Organizational chart



Source: Internal company document

Section 03: Survey on the impact of ERP on the performance of SONATRACH

3.1 Survey methodology

We conducted a field survey among SONATRACH employees, and as such, for any qualitative and quantitative study (questionnaire, interview), a methodological approach must be followed by the investigator, based on

- The definition of the objective of the survey.
- The plan of the study.
- The presentation of the results.

3.2 The objective of the study

Our research focuses on the analysis of the change brought by the adoption of SAP ERP and its contribution to the continuous development of an enterprise's performance.

3.3 The questionnaire

“A questionnaire is a research tool featuring a series of questions used to collect useful information from respondents. These instruments include either written or oral questions and comprise an interview-style format. Questionnaires may be qualitative or quantitative and can be conducted online, by phone, on paper or face-to-face, and questions don't necessarily have to be administered with a researcher present”¹.

Thus, the drafting of our questionnaire was done primarily in accordance with the purpose, the methods of the survey, and which might provide us with elements of answers to our main objective and which could steer our survey in the right direction.

¹ <https://luc.id/knowledgehub/what-is-a-questionnaire/> accessed 06/06/2022

3.3.1 Analysis of the questionnaire

3.3.1.1 Survey population

The population of our survey is made up of 15 employees in the headquarters of SONATRACH -Djenane El Malik Hydra, Algiers- under the SAP PROJECT in the department of digitalization and information systems.

3.3.1.2 The structure of the questionnaire

- **An introduction**

This is vital to acquire the respondent's trust, therefore we introduced ourselves and the subject of our study. (See Appendix A.)

- **Questionnaire axes**

First and foremost, a description sheet was created in order to get to know the respondents well (gender, age, seniority in the field and position held).

We created a questionnaire with four sets of questions:

- Axis 1: The use and perception of ERP
- Axis 2: Impact of ERP on economic performance
- Axis 3: Impact of ERP on organizational performance
- Axis 4: Impact of ERP on human performance

Each part has a variety of questions that allow us to acquire the information we need from the respondent population for our research.

- Dichotomous questions in which the respondent must select one of two possible answers.
- Closed questions with several options from those presented.
- An open question.

3.4 Results of the survey

3.4.1 Processing the questionnaire

The information is analyzed after the fieldwork is completed and all questionnaire responses have been gathered.

Axis 1: The use and perception of ERP

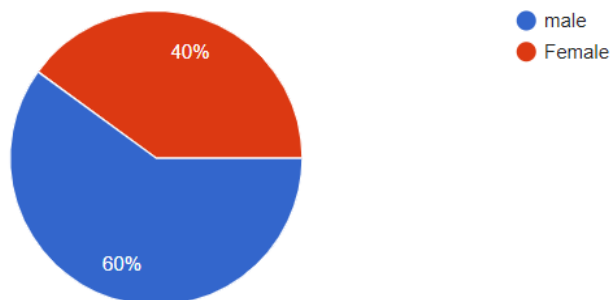
1- Gender

Table 2: distribution by gender

Answers	Employees	percentage
Male	9	60%
Female	6	40%
Total	15	100%

Source: Search results

Figure 26: distribution by gender



Source: Search results

Comment:

We note that the majority of respondents (60%) are male, and the rest (40%) are female.

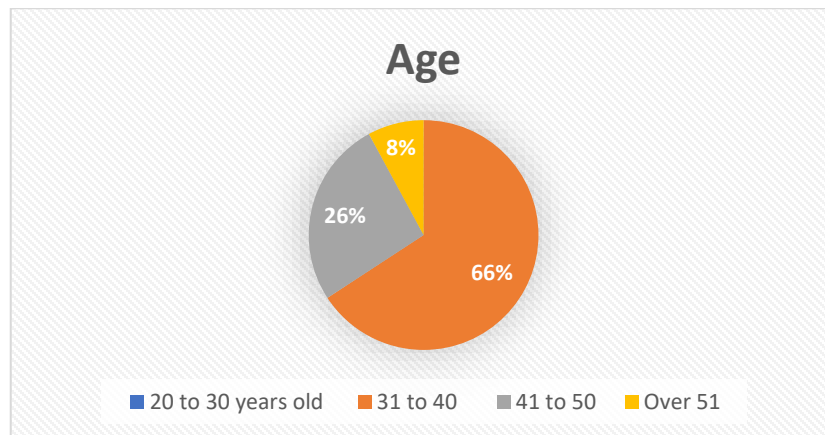
2- Age

Table 3: Age distribution

Answers	Employees	Percentage
20 to 30 years old	0	0%
31 to 40	10	66%
41 to 50	4	26%
Over 51	1	8%
Total	15	100%

Source: Search results

Figure 27: Age distribution



Source: Developed by us using Excel

Comment:

We see that more than half of the respondents (66%) are aged between 30 and 40, 26% between the age of 41 and 50, while only one respondent (8%) is over 51.

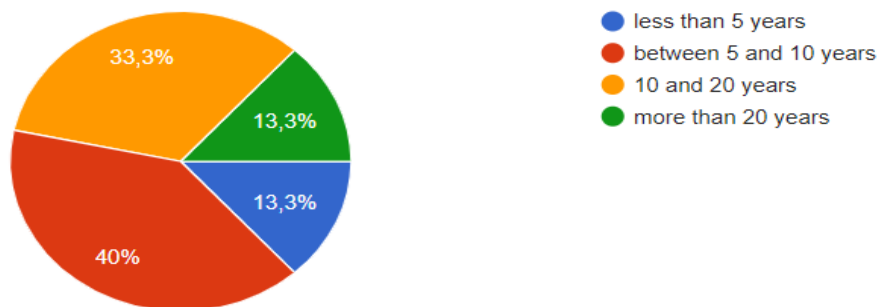
3- for how long have you been in your current occupation with SONATRACH?

Table 4: distribution by seniority

Answers	Employees	Percentage
Less than 5 years	2	13.3%
Between 5 and 10 years	6	40%
10 to 20 years	5	33.3%
More than 20 years	2	13.3%
Total	12	100%

Source: Search results

Figure 28: distribution by seniority



Source: Search results

Comment:

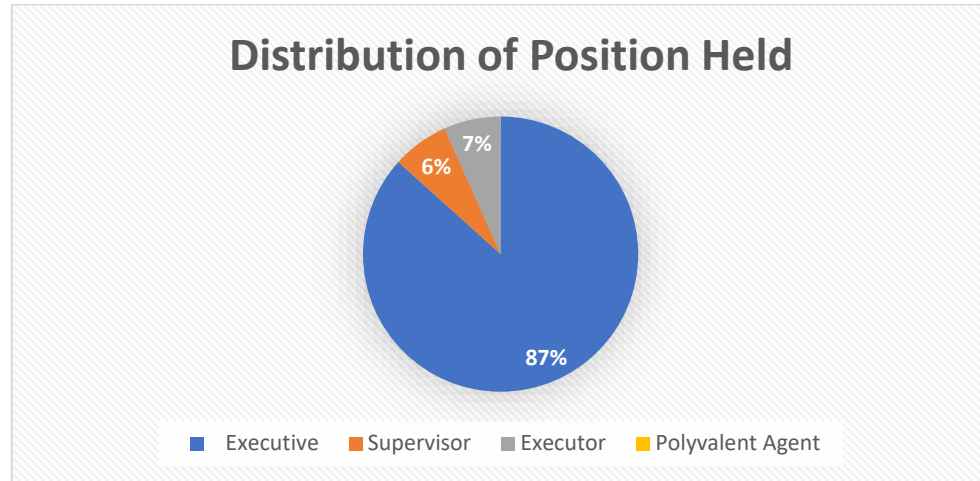
We found that 13.3% of respondents have fewer than 5 years of experience at their current occupation, 40% have between 5 and 10 years of experience, 33.3% have between 10 and 20 years of experience, while 13.3% of respondents have over 20 years of experience.

4- The socio-professional category

Table 5: Distribution of Position held

Answers	Respondents	Percentage
Executive	13	86.7%
Supervisor	1	6.7%
Executor	1	6.7%
Polyvalent Agent	0	0%
Total	15	100%

Source: Search results

Figure 29: Distribution of Position held

Source: Developed by us using Excel

Comment:

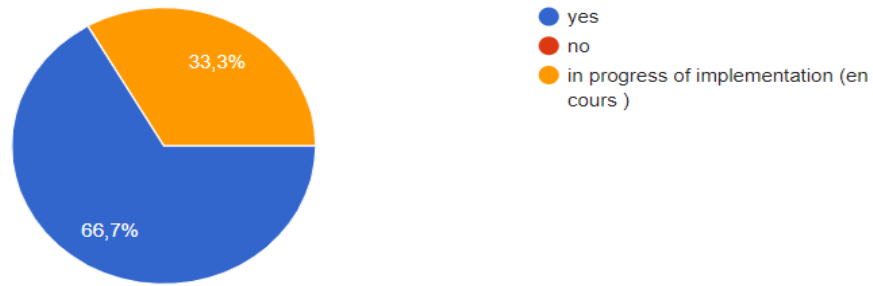
Out of a sample of 15 people, we can see that the Executive position is dominating with 87%, and the rest is distributed between supervisors (6%) and executors (7%), while there's an absence of polyvalent agents in our sample.

5- do you use an ERP system?**Table 6: answer of the respondents**

Answers	Employees	percentage
Yes	10	66.7%
No	0	0%
In progress of implementation	5	33.3%
Total	15	100%

Source: Search results

Figure 30: Answer of the respondents



Source: Search results

Comment:

The majority of the respondents (66.7%) are users of an ERP systems, while (33.3%) said it's still in the process of implementation.

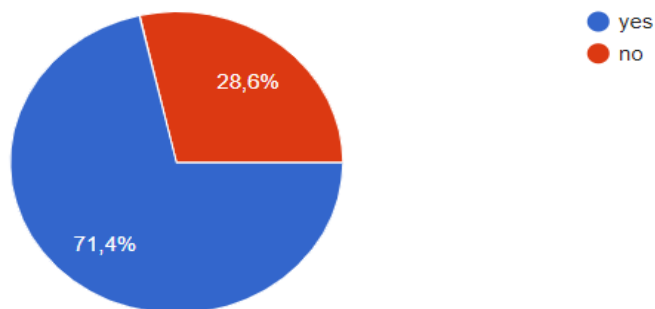
6- did you use another information system -software- before ERP?

Table 7: answer of the respondents

Answers	Employees	percentage
Yes	10	71.4%
No	4	28.6%
Total	14	100%

Source: Search results

Figure 31: answer of the respondents



Source: Search results

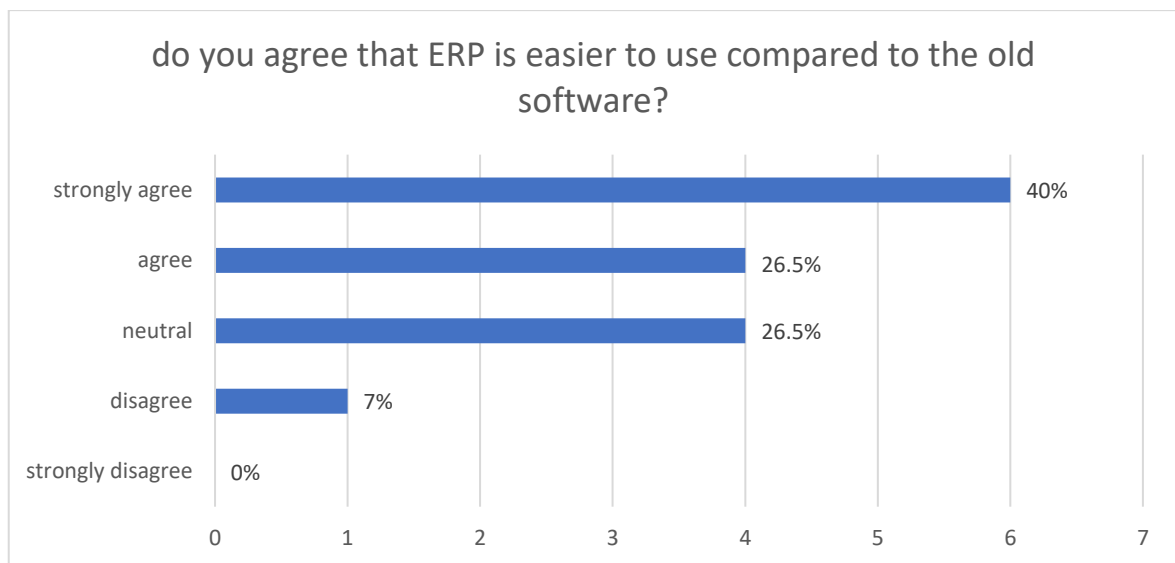
Comment:

We notice that out of 14 respondents, 10 of them (71.4%) used to work on a management software before the implementation of ERP, while the rest (28.6%) said ERP was their first management software.

7- do you agree that ERP is easier to use compared to the old software?**Table 8: answer of the respondents**

Answers	Employees	percentage
Strongly disagree	0	0%
Disagree	1	7%
Neutral	4	26.5%
Agree	4	26.5%
Strongly agree	6	40%
Total	15	100%

Source: Search results

Figure 32: answer of the respondents

Source: Developed by us using Excel

Comment:

From the chart above we can see that almost half of the respondents (40%) strongly agree that ERP

is easier to use compared to the old software, while 8 respondents are evenly split between agreeing (26.5%) and staying neutral (26.5%), And just 1 respondent (7%) disagree that ERP is easier to use.

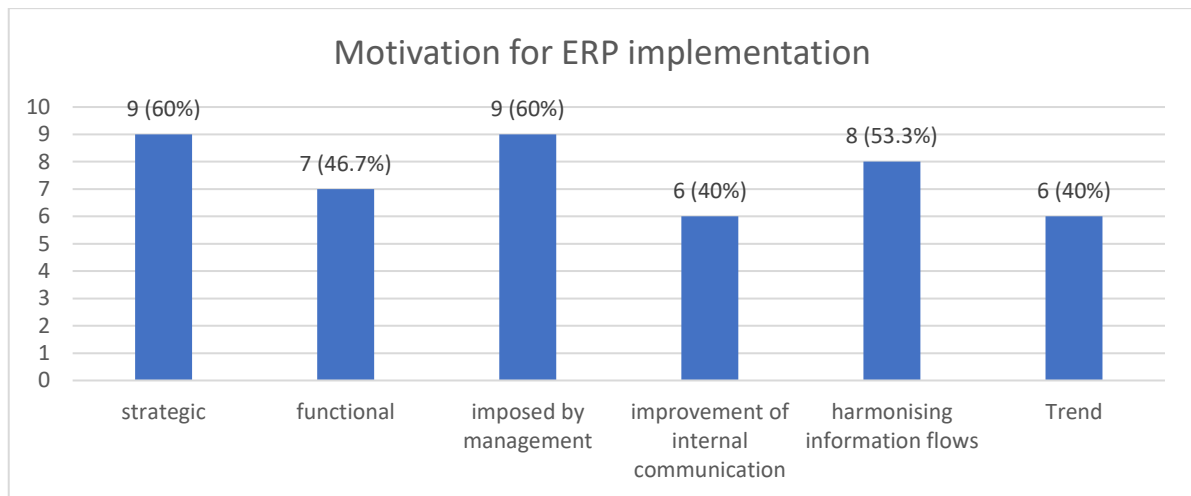
8- What is/was the motivation for implementing ERP?

Table 9: motivation for ERP implementation

Answers	Frequencies	Percentage of responses	Percentage of observations
Strategic	9	20%	60%
Functional	7	16%	46.7%
Imposed by management	9	20%	60%
Improvement of internal communication	6	13%	40%
Harmonizing information flows	8	18%	53.3%
Trend	6	13%	40%
Total	45	100%	-

Source: Search results

Figure 33: motivation for ERP implementation



Source: Developed by us using Excel

Comment:

According to the results in the previous table, 40% of the employees surveyed felt that the reasons for implementing the ERP system are both strategic (20%) and imposed by management (20%).

(16%) believe that the functional incentive is the reason for introducing ERP.

A sizable proportion of respondents (13%) favor enhancing internal communication.

(18%) of employees surveyed believe that ERP integration improves information flow organization.

Finally, 13% of respondents believe that ERP adoption is a trend, despite the fact that the majority of organizations worldwide have an ERP solution.

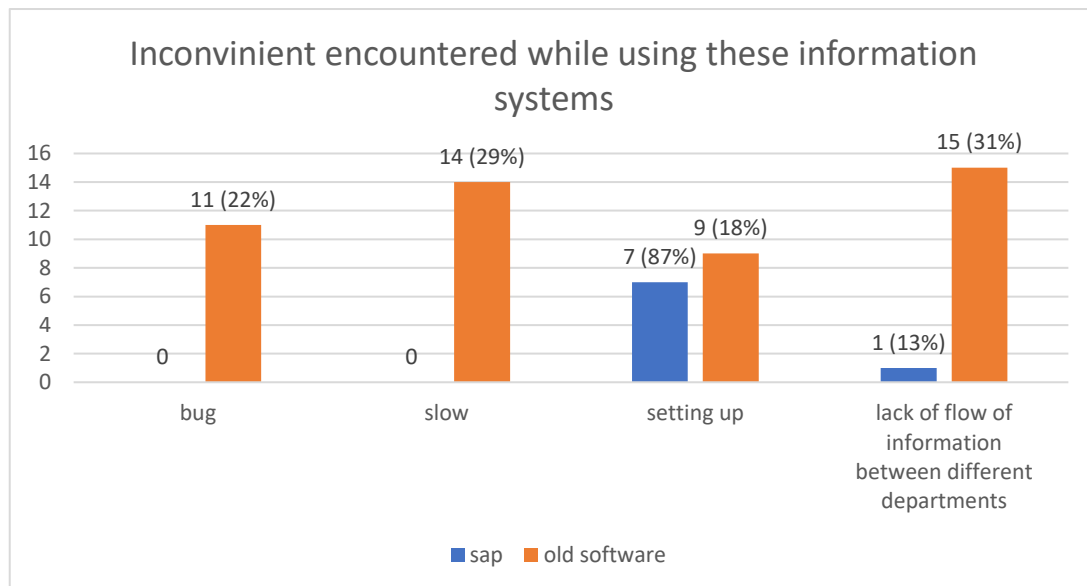
9- Inconvenient encountered while using these information systems

Table 10: Inconvenient encountered while using these information systems

	SAP	SAP percentage	Old software	Old software Percentage
Bug	0	0%	11	22%
Slow	0	0%	14	29%
Setting up	7	87%	9	18%
Information flow	1	13%	15	31%
Total	8	100%	39	100%

Source: Search results

Figure 34: Inconvenient encountered while using these information systems



Source: Developed by us using Excel

Comment:

We might conclude from the above results that:

Most of respondents (87%) confirm that they encounter issues with setting up the ERP system, and only one respondent (13%) stated that there's a lack of flow of information between departments while using an ERP system

For the old software, (22%) of respondents said that faced bugs, (29%) voted for slowness in the old system, (18%) encountered parametrization issues, and lastly, the biggest portion of the respondents (31%) voted for lack of information flow between different departments of the enterprise.

10- What are the advantages of ERP system?

We received 9 answers to this question:

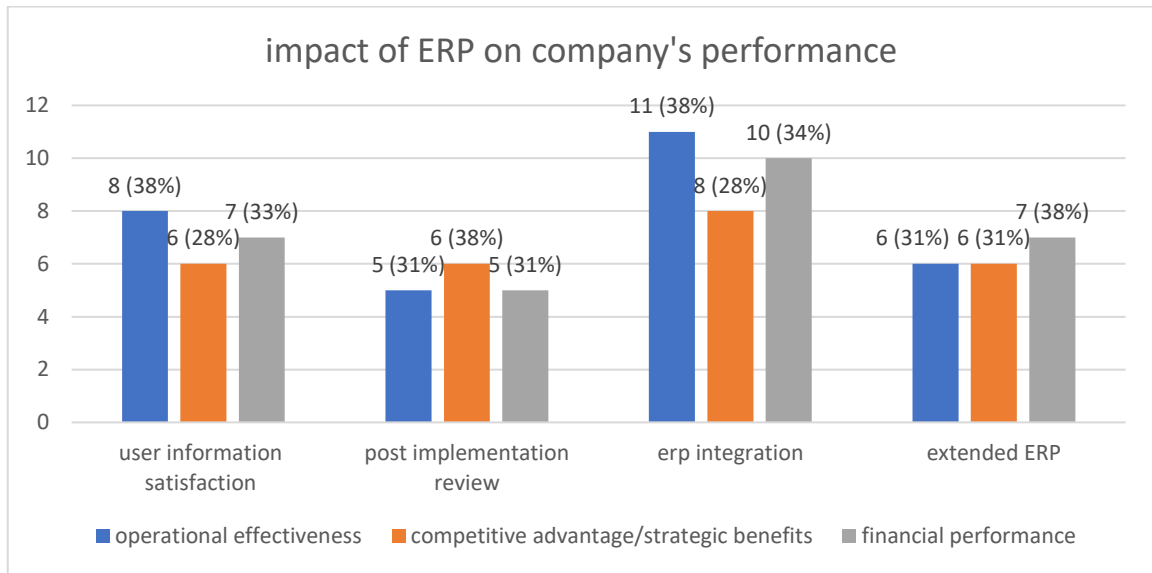
- 5 respondents mentioned that the aspect of integration between modules is the most important advantage
- 3 respondents mentioned harmonization of information flow, while the rest of answers varied with different advantages like Decision-making support, the sharing of information in real time.

11- Impact of ERP on company's performance

Table 11: Impact of ERP on Business performance

	Operational effectiveness	competitive advantage/strategic benefits	financial performance	Total
user information satisfaction	8 (38%)	6 (28%)	7 (33%)	21 (100%)
post implementation review	5 (31%)	6 (38%)	5 (31%)	16 (100%)
ERP integration	11 (38%)	8 (28%)	10 (34%)	29 (100%)
Extended ERP	6 (31%)	6 (38%)	7 (31%)	19 (100%)

Source: Search results

Figure 35: Impact of ERP on company's performance

Source: Developed by us using Excel

Comment:

From the table and the chart above we can see that:

Respondents say that User information satisfaction improves mostly operational effectiveness (38%), (33%) believes that it impacts financial performance, while the rest of them think that it has an effect on strategic benefits and competitive advantage.)

For post implementation review, 6 employees surveyed (38%) believe that it has a strategic benefit/competitive advantage, while the rest were divided between operational effectiveness (31%) and financial performance (31%).

A big portion of the respondents chose both operational effectiveness (38%) and financial performance (34%) to express the impact ERP integration has on the business performance, while (28%) added that it has an impact on competitive advantage as well.

Finally, for extended ERP, (38%) of respondents went for financial performance, (31%) chose operational effectiveness, while (31%) wanted to show that extended ERP has an impact on competitive advantage/strategic benefits.

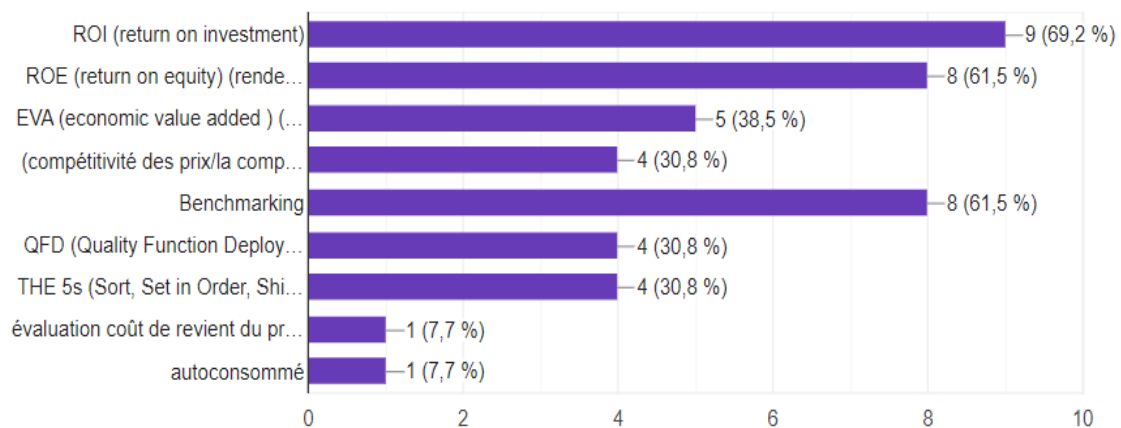
12- what Key Performance Indicators -KPI- are used to measure the performance of the enterprise?

Table 12: Key performance indicators

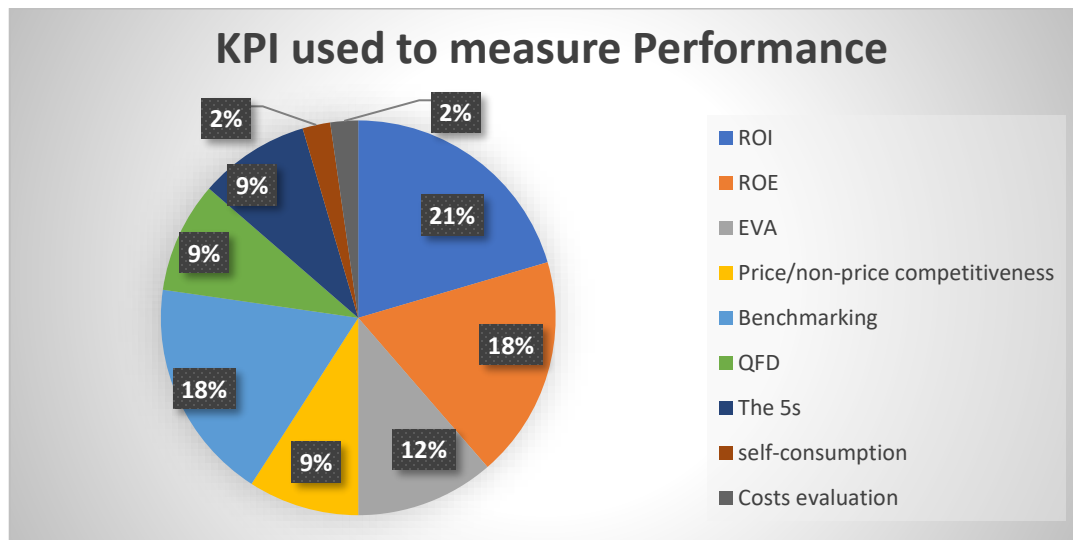
Answers	Frequencies	Percentage of responses	Percentage of observation
ROI	9	21%	69.2%
ROE	8	18%	61.5%
EVA	5	12%	38.5%
Price/non-price competitiveness	4	9%	30.8%
Benchmarking	8	18%	61.5%
QFD	4	9%	30.8%
The 5s	4	9%	30.8%
Self-consumption	1	2%	7.7%
Costs evaluation	1	2%	7.7%
Total	44	100%	-

Source: Search results

Figure 36: Key performance indicators



Source: Developed by us using Excel

Figure 37: KPI used to measure performance

Source: Developed by us using Excel

Comment:

The results of the survey question above show that (69%) of the respondents said that ROI is the most used KPI, therefore it holds a portion of (21%) of all the KPIs mentioned.

Both ROE (18%) and Benchmarking (18%) share the same percentages of KPI used to measure performance, since 8 respondents voted evenly for these two KPIs (both 61.5%).

Five of our respondents (38.5%) voted for EVA as a critical key performance indicator, therefore it holds the 3rd position between the rest of KPIs with 12%.

Three different KPIs have been chosen evenly by four of our respondents; Price/non-price competitiveness (30.8%), QFDs (30.8%), and the 5s (30.8%). Therefore, they are distributed equally alongside the other KPIs, with a percentage of 9% each.

Lastly, our question was a multiple choice one, but we left the option for respondents to add extra KPIs they believe are used to measure performance, so we received two other answers from two different respondents: self-consumption (7.7%), and costs evaluation (7.7%), and both of them hold the same portion between the other KPIs with 2% each.

Axis 2: Impact of ERP on economic performance

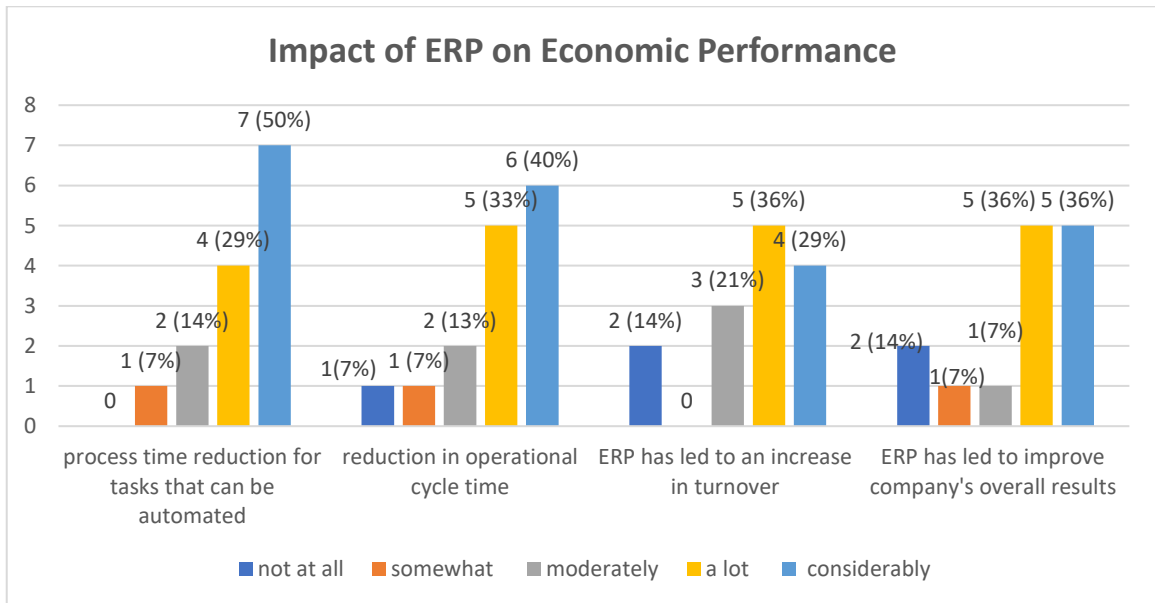
13- Rate the Impact of ERP on Economic Performance

Table 13: answer of the respondents

	ERP helped reduce process time for tasks that can be automated	ERP helped reduce operational cycle time	ERP has increased turnover	ERP has led to improvement of company's overall results
Not at all	0 (0%)	1 (7%)	2 (14%)	2 (14%)
Somewhat	1 (7%)	1 (7%)	0 (0%)	1 (7%)
moderately	2 (14%)	2 (13%)	3 (21%)	1 (7%)
A lot	4 (29%)	5 (33%)	5 (36%)	5 (36%)
Considerably	7 (50%)	6 (40%)	4 (29%)	5 (36%)

Source: search results

Figure 38: Impact of ERP on Economic Performance



Source: Developed by us using Excel

Comment:

From the chart and table above, we notice that there are four different axes that play a major role in the impact of ERP on economic performance.

Firstly, for we can see that half of respondents say that ERP (considerably 50%, a lot 29%), helped reduce process time for tasks that can be automated, while the other half of respondents chose somewhat (7%) and moderately (14%).

Secondly, the majority of respondents think that ERP (considerably 40%, a lot 33%) helped reduce process operational cycle time, while others stated that its moderately (13%) and somewhat (14%) true, and one respondent (7%) believes that it doesn't reduce operational cycle time.

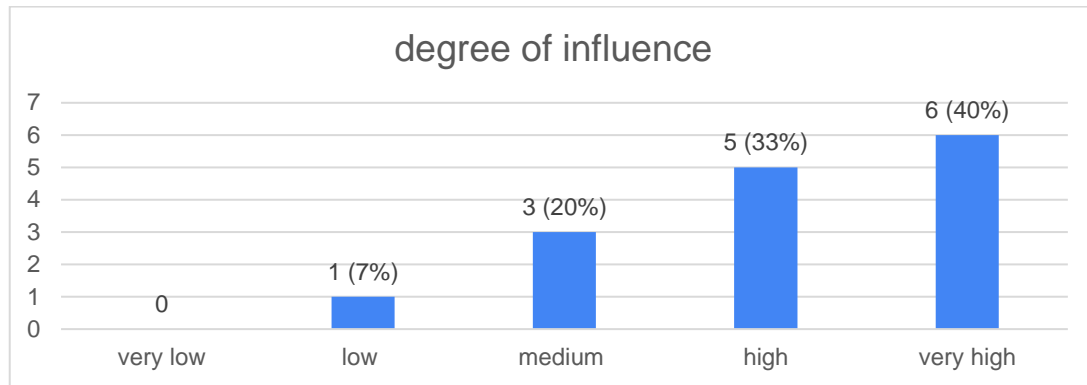
Thirdly, saying that ERP has led to an increase in turnover, most of respondents went with considerably (36%) and a lot (36%). While the rest varied between the choices of "moderately (7%)", "somewhat (7%)" and two respondents (14%) said that it does not increase turnover at all.

Finally, 10 respondents chose that ERP led to improve company's overall results a lot (36%) and in a considerable way (36%), while two of respondents chose moderately (7%), somewhat (7%), the last two (14%) chose both that ERP did not lead to improve company's overall results at all.

14- The degree of influence of ERP on the quality of your company's services**Table 14: degree of influence of ERP on quality of services**

	Employees	Percentage
Very low	0	0%
Low	1	7%
Medium	3	20%
High	5	33%
Very high	6	40%
Total	15	100%

Source: Search result

Figure 39: degree of influence

Source: Developed by us using Excel

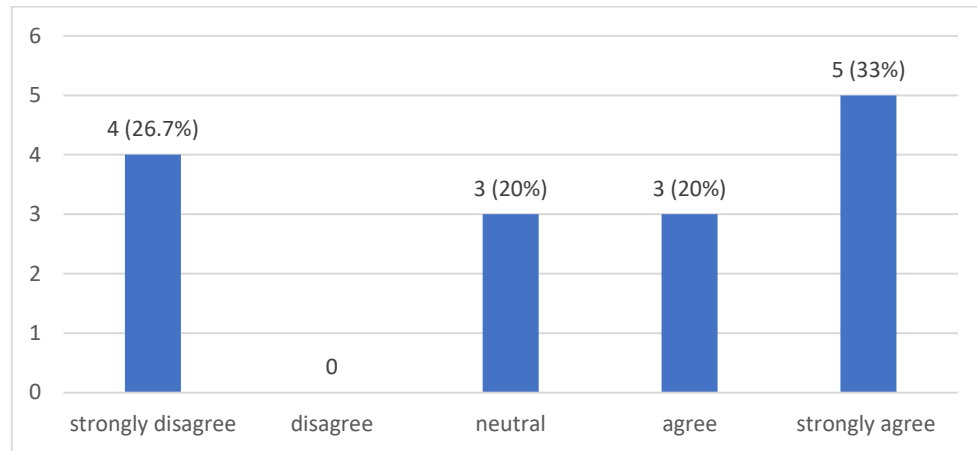
Comment:

From the results of the table above, out of our sample of 15 employees, (40%) think that the degree of influence of ERP on the quality of SONATRACH's services is very high, (30%) of them chose high, 3 respondents (20%) went with medium, and only one respondent (7%) thought that the degree of influence was low.

15- ERP helped retain existing clients and manage to attract new ones**Table 15: answers of respondents**

Answers	Employees	percentage
Strongly disagree	4	26.7%
Disagree	0	0%
Neutral	3	20%
Agree	3	20%
Strongly agree	5	33%
Total	15	100%

Source: Search result

Figure 40: answers of respondents

Source: Developed by us using Excel

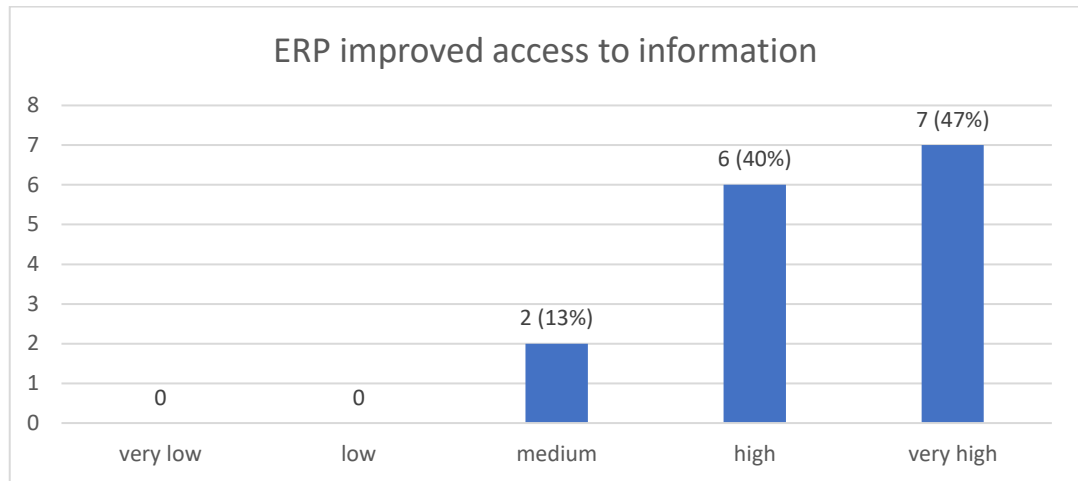
Comment:

According to the table and figure above, 4 out of 15 surveyed employees strongly disagree with the idea that ERP helped retain existing clients and attract new ones, 3 respondents were neutral (3 respondents 20%) and 8 (53%) respondents decided to agree and strongly agree.

Axis 3: Impact of ERP on organizational performance**16- ERP has improved access to information in a way that is:****Table 16: answer of respondents**

	Employees	Percentage
Very low	0	0%
Low	0	0%
Medium	2	13%
High	6	40%
Very high	7	47%
Total	15	100%

Source: Search results

Figure 41: answer of respondents

Source: Developed by us using Excel

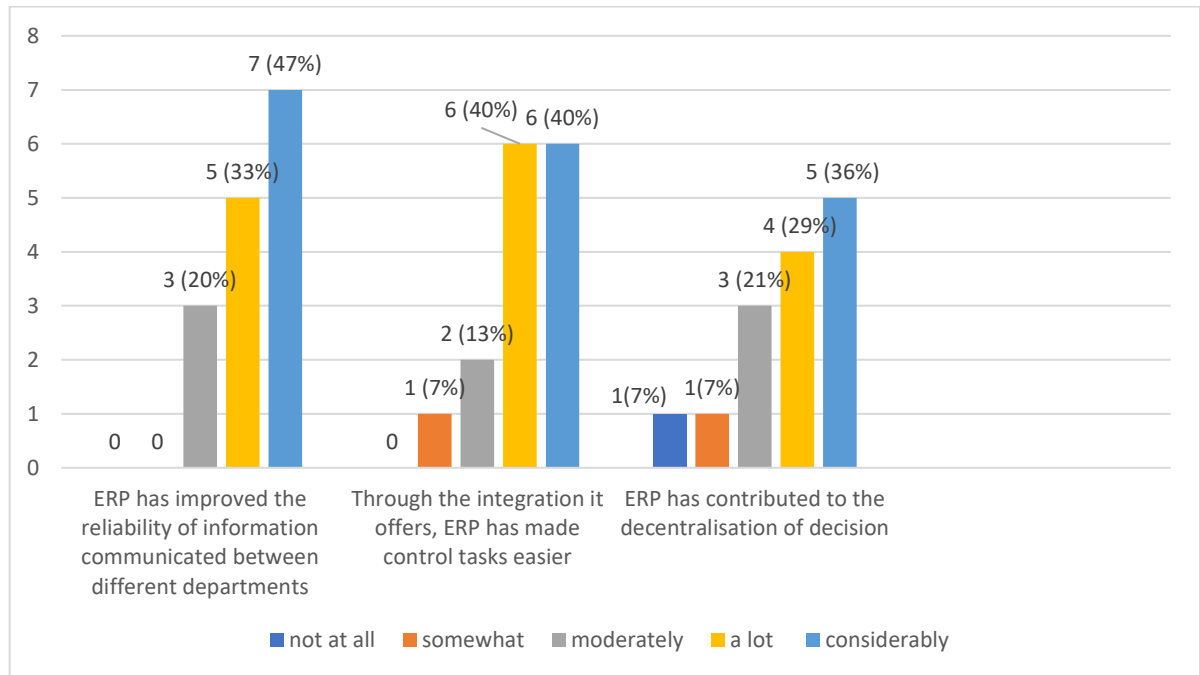
Comment:

From the results above, we notice that the majority of the respondents (87%) think that ERP helped improve access to information highly, and only (13%) think that the impact ERP has on access to information is medium.

17- Impact of ERP on organizational performance**Table 17: Impact of ERP on organizational performance**

	improved the reliability of information	ERP has made control tasks easier	ERP has contributed to the decentralization of decision
Not at all	0 (0%)	0 (0%)	1 (7%)
Somewhat	0 (0%)	1 (7%)	1 (7%)
moderately	3 (20%)	2 (13%)	3 (21%)
A lot	5 (33%)	6 (40%)	4 (29%)
Considerably	7 (47%)	6 (40%)	5 (36%)

Source: Search results

Figure 42: Impact of ERP on organizational performance

Source: Developed by us using Excel

Comment:

According to the chart above, we can see that there are three axes questioned in our survey for ERP impact on organizational performance.

Firstly, 5 respondents (33%) think that ERP improved the reliability of information communicated between different departments a lot, 7 respondents (47%) say the same considerably, and the rest in a moderate way.

Secondly, respondents chose both “considerably” and “a lot” in an equal way (both 40%) to show that ERP has made control tasks easier. Others chose “moderately” (40%) and “somewhat” (7%) to express how they feel about the idea.

Lastly, 9 respondents chose to answer with “considerably” (36%) and “a lot” (29%) to prove that ERP has contributed to the decentralization of decision, while the rest had different opinions; 3 respondents chose “moderately” (21%), one went with “somewhat” (7%), and the last respondent chose “not at all” to show their disagreement.

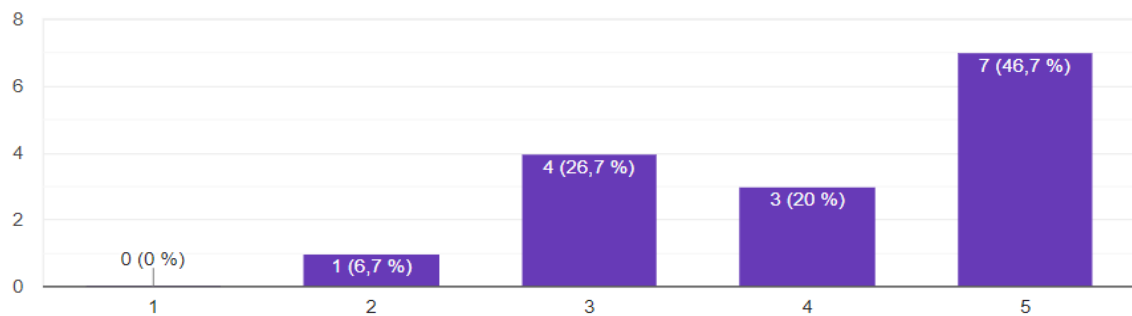
18- Following the introduction of ERP, the organization has become more flexible

Table 18: Firm flexibility

Answers	Employees	percentage
Strongly disagree	0	0%
Disagree	1	7%
Neutral	4	27%
Agree	3	20%
Strongly agree	7	46%
Total	15	100%

Source: Search results

Figure 43: ERP affected Firm flexibility



Source: Search results

Comment:

The figure above shows that almost half of the respondents strongly agree (46.7%) and agree (20%) that ERP has made the company more flexible, while 4 respondents (26.7%) decided to stay neutral, and only one respondent (6.7%) disagree.

Axis 4: Impact of ERP on Human Performance

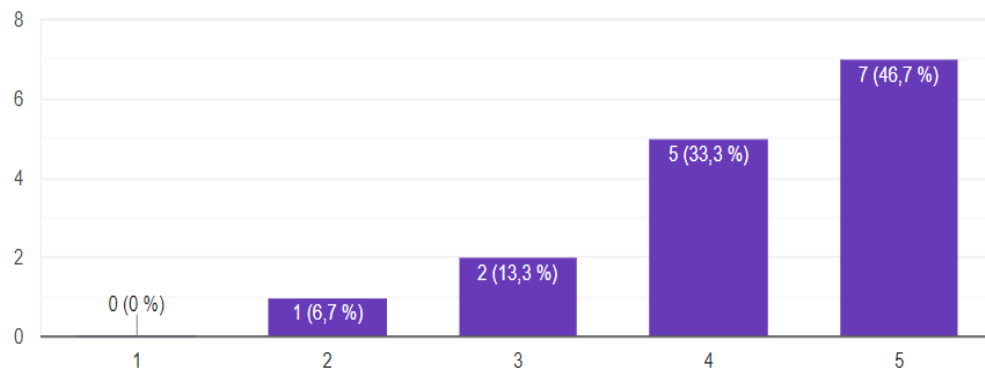
19- Do you agree that the choice of the ERP implementation was decisive for the follow-up of the objectives set by the company?

Table 19: answer of respondents

Answers	Employees	percentage
Strongly disagree	0	0%
Disagree	1	7%
Neutral	2	13%
Agree	5	33%
Strongly agree	7	47%
Total	15	100%

Source: Search results

Figure 44: answer of respondents



Source: Search results

Comment:

According to the figure above, the majority of the respondents chose to agree (80 %) with the theory that ERP implementation was decisive for the follow-up of company's objectives, while two respondents (13.3%) were neutral about it and only one respondent (6.7%) decided to disagree.

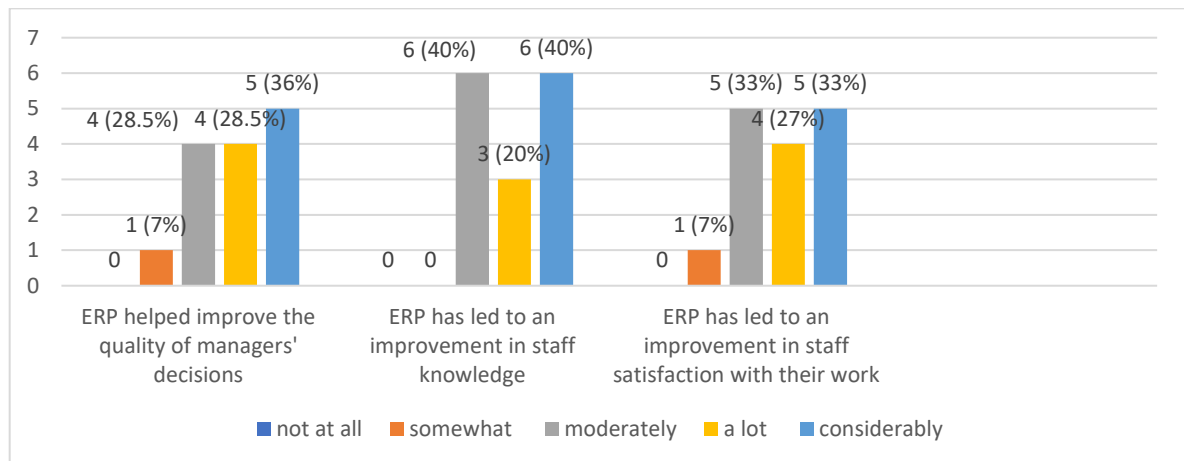
20- Impact of ERP on Human Performance

Table 20: Impact of ERP on human performance

	improve the quality of managers' decisions	improvement in staff knowledge	Improvement in staff satisfaction
Not at all	0 (0%)	0 (0%)	0 (0%)
Somewhat	1 (7%)	0 (0%)	1 (7%)
moderately	4 (28.5%)	6 (40%)	5 (33%)
A lot	4 (28.5%)	3 (20%)	4 (27%)
Considerably	5 (36%)	6 (40%)	3 (33%)

Source: Search results

Figure 45: Impact of ERP on human performance



Source: Developed by us using Excel

Comment:

In our study of the impact of ERP on human performance, we had the surveyed employees choose the level of effectiveness of ERP on three major points:

Firstly, over half of respondents chose “a lot” (28.5%) and “considerably” (36%) to express that ERP really helped improve the quality of managers’ decisions, while (28.5%) agreed in a moderate way, and one respondent (7%) chose “somewhat” to express their opinion.

Secondly, (40%) of the staff interviewed believe that ERP considerably led to an improvement in staff knowledge. The rest of the respondents varied between choosing “a lot” (20%) and “moderately” (40%).

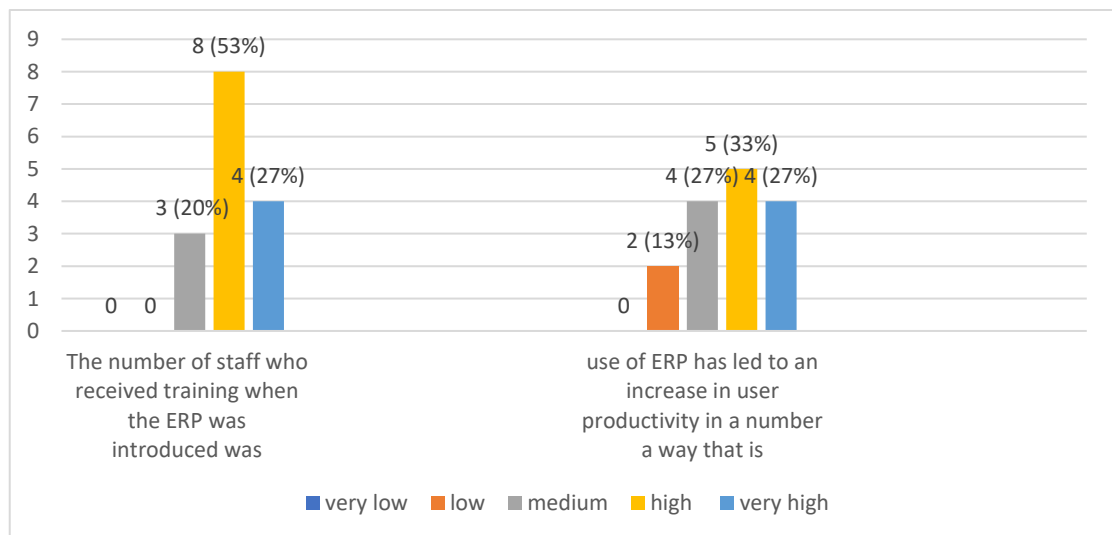
Finally, saying that ERP has led to an improvement in staff satisfaction with their work, more than half of the respondents chose “considerably” and “a lot” to express their approval, while (33%) think that the improvement is moderate, and one respondent chose “somewhat” to show that the improvement was partial.

Table 21: Impact of ERP on human performance

	The number of staff who received training For ERP was:	ERP has led to an increase in user productivity in a way that is
Very low	0	0%
Low	0	0%
Medium	2	13%
High	6	40%
Very high	7	47%
Total	15	100%

Source: Search results

Figure 46: impact of ERP on human performance



Source: Developed by us using Excel

Comment:

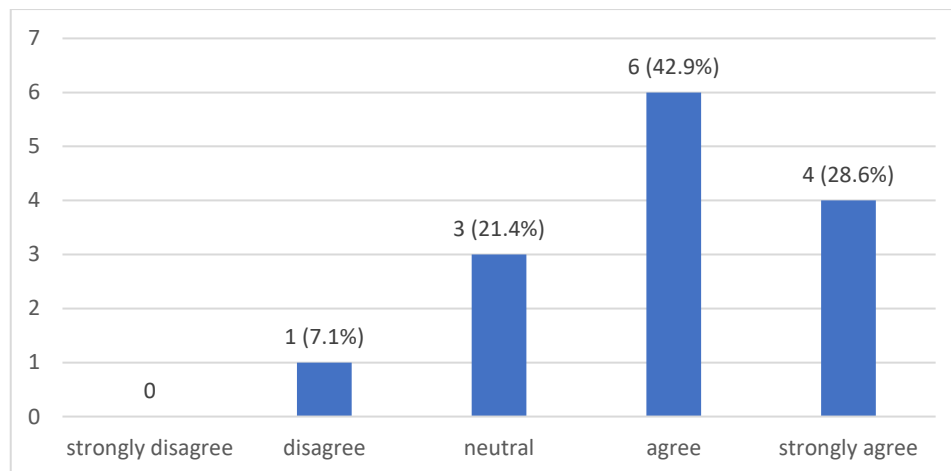
From the chart and table above, the biggest portion of respondents admits that the number of staff who received training for ERP when it was introduced was either high (53%) or very high (27%), while the rest (20%) chose medium as an answer.

On the other hand, when we asked about the way ERP increased productivity the answers were close to each other, (33%) think that it was high, (27%) believe it was very high, another (27%) went with “medium”, while 2 respondents (13%) think that the use of ERP led to an increase in productivity in a way that is low.

21- do you agree that ERP has led to a simplification of work tasks?**Table 22: answer of respondents**

Answers	Employees	percentage
Strongly disagree	0	0%
Disagree	1	7.1%
Neutral	3	21.4%
Agree	6	42.9%
Strongly agree	4	28.6%
Total	14	100%

Source: Search results

Figure 47: answer of respondents

Source: Developed by us using Excel

Comment:

According to the figure above, the majority of respondents either agree (42.9%) or strongly agree (28.6%) that the ERP has led to simplification of work tasks, while 3 respondents (21.4%) decided to stay neutral and only one respondent (7.1%) disagrees.

3.3.2 Summary of the survey

Based on the findings of our study in SONATRACH with 15 employees we note the following:

- 66% of our interviewees are aged between 31 and 40 years old
- 40% of them have an experience of 5 to 10 years in their current occupation.
- Our survey was destined mostly to Executives in the firm (87%)
- 66.7% are users of ERP system, while 71.4% of all the sample used an information system before ERP.
- Over half of respondents agreed that ERP is easier to use compared to the old management software.
- The choice of an ERP solution was imposed by management as a strategic decision.
- Setting up an ERP solution is the difficult part according to the respondents, while the software used before had many problems but most importantly the lack of flow of information between departments
- The most important advantages of an ERP system are integration and ease of information flow.
- ERP integration is the most important dimension because it has the biggest impact on operational effectiveness 38%, competitive advantage/strategic benefits 28% and on financial performance 34%.
- Between all KPIs mentioned in the questionnaire, 21% of respondents chose ROI and 18% chose ROE, which makes economic indicators the most important KPIs for measuring SONATRACH's performance.
- ERP has obviously resulted in time savings for automatable tasks, reduced operational cycle time. It has also helped improve service quality.

It should be observed, however, that ERP has not considerably increased turnover. As a result, its contribution to enhancing the outcome remains minimal.

- The respondents were split between strongly disagreeing and strongly agreeing that ERP helped attract new customers and attract new ones that is because SONATRACH is the biggest oil and gas nationally and one of the biggest and well-known ones internationally, therefore, it has no competitors in Algeria to take away their clients.
- 47% agree that access to information was very high after implementing an ERP system
- In a considerable way, ERP improved reliability of information communicated between departments, made control tasks easier, and contributed to the decentralization of decision.
- 46.7% strongly agree that ERP made the company more flexible.
- 46.7 of respondents strongly agree That the choice of ERP implementation was decisive for following up company's objectives.
- ERP considerably improved the quality of managers' decisions as well as staff knowledge and satisfaction with their work
- 53% of employees surveyed confirm that the number of staff who received training after the introduction of ERP is high, while the use of ERP generally led to an increase in productivity.
- Most respondents agree that ERP simplified work tasks.

Answers to questions 9 and 10 can lead us to confirm **Hypothesis 01** which states that *ERP is an integrated management software that gives fewer disadvantages and better advantages compared to the old management software.*

From question number 12, we confirmed **Hypothesis 02**, which mentions that *Economic indicators (ROI, ROE...) are the most critical KPIs in measurement of firm's performance.*

According to Chapter 2, and from answers to question 11, the overall performance of a corporation can be divided into three categories: economic, organizational, and human. As a result, it is possible to conclude that by improving these three components of SONATRACH performance, ERP enhances the firm's overall performance, so confirming **Hypothesis 03** "*ERP with its dimensions have an impact on all the aspects of company's performance (economic, organizational, and human performance).*"

3.3.4 Recommendations

After analyzing our search results and in order to improve performance of SONATRACH we recommend the following notes:

- Full implementation of the ERP system in all the departments to improve the flow of information
- Due to the continuous development of ERP systems, SAP ERP is facing some major competitors like Microsoft Dynamics which is leading the ERP vendors market, therefore SONATRACH should consider adapting other ERP systems in the future that helps them achieve their goals
- Many users of SAP ERP system within SONATRACH faced problems setting up the system. therefore, it is recommended to adapt the system to make the parametrization process less difficult.

In this chapter we have presented the company where we did our case study, SONATRACH with it's different departments in the first section

Then we have seen a general presentation of SAP ERP and the SAP Project within SONATRACH as well as it's organizational structure.

In the third section we attempted to detect the usefulness of SAP ERP implementation and its contribution to the improvement of the company's performance through the analysis of the results of the questionnaire intended for users of SAP ERP within SONATRACH.

Finally, this analysis led us to the conclusion that ERP deployment has become essential for every firm in order to assure better management, increase performance, and, ultimately, make the right decisions on time.

GENERAL CONCLUSION

General conclusion

The world of information and communication is largely favored by the expansion of information technologies, the spectacular growth of applications on the Internet and the exponential increase in network connections. As a result, this universe resembles an immaterial, unstable, and more fluid environment that no longer responds to the mechanical approach that has mainly inspired the organization.

Companies must consequently understand how to equip themselves with technology resources and construct and operate information systems (IS) to boost internal operations and reinforce competitive positions, ultimately enhancing performance.

This work was created in this context to demonstrate the impact of ERP on the company's performance in ALGERIA. In the first chapter, we have given definitions for information systems as well as ERP system and the process of implementing it.

In the second chapter we presented the concept of firm performance, then showed the link between ERP and company performance, and finally how the performance of a company is measured using different KPIs.

We have discovered that the presence of an information system is necessary in any organization, and that the requirement for coordination and the availability, dependability, and relevance of information in real time has become a critical component for any company's success. In this regard, we have confirmed the significant contribution of the integrated Enterprise Resource Planning to the company's performance.

We used bibliographic materials to theoretically define our study topic, which needed a thorough understanding of the principles and concepts of information systems, ERP, and their relevance to company management.

After showcasing the contribution of ERP in developing companies and making them more flexible, it was required to discuss the aspects of business performance, how it is measured, and to establish the link between improving it and ERP integration. This connection was then portrayed using a conceptual model.

In the empirical section, a case study was undertaken, which served as the foundation for data collecting for a subsequent analysis. The goal of this study is to validate the hypotheses established in the conceptual model.

At the end of this research work at SONATRACH, we discovered that SAP ERP supports the firm's operations, gives less disadvantages than the management software used before it, aims to increase operational effectiveness, organizational and human performance, and gives various benefits to the company: it automates company data, organizes the flow of information, and finally contributes to decision-making.

Based on the research, we can affirm the following three hypotheses:

- **The first hypothesis** states that ERP is an integrated management software that gives fewer disadvantages and better advantages compared to the old management software.
- **The second hypothesis**, which says that Economic indicators (ROI, ROE...) are the most critical KPIs in measurement of firm's performance.
- **The third hypothesis** which states that ERP with all its dimensions have an impact on all the aspects of company's performance (economic, organizational, and human performance).

Certainly, the implementation of the ERP in SONATRACH was a good choice because its database contains all the information necessary for the different functions of the company, the results gained from our research confirmed that SAP ERP increases the performance of SONATRACH. This study, however, has some theoretical and methodological limitations.

Although the study's findings have important implications for the successful use of ERP systems, it also has several limitations. The sample size was the study's principal limitation. This was due to scheduling constraints of SONATRACH employees.

In addition, numerous ERPs are available in the market, but our study focused on SAP ERP as it is the ERP used within SONATRACH. Therefore, future studies could focus on the modern and more developed ERP systems like MICROSOFT DYNAMICS due to the fact that it is the leader in the ERP market in the last two years.

One of the theoretical limits is the selection of only three categories of performance: economic performance, organizational performance, and human performance. Indeed, because performance

is a nebulous and imprecise concept, it cannot be reduced to these three dimensions. However, the abundance of literature on the association between ERP and various characteristics of performance has compelled the selection of these aspects.

Another methodological limitation is related to the research questionnaire. Indeed, although open-ended questions are supposed to provide richer and more exploitable answers for this work, we only had one open question in our survey.

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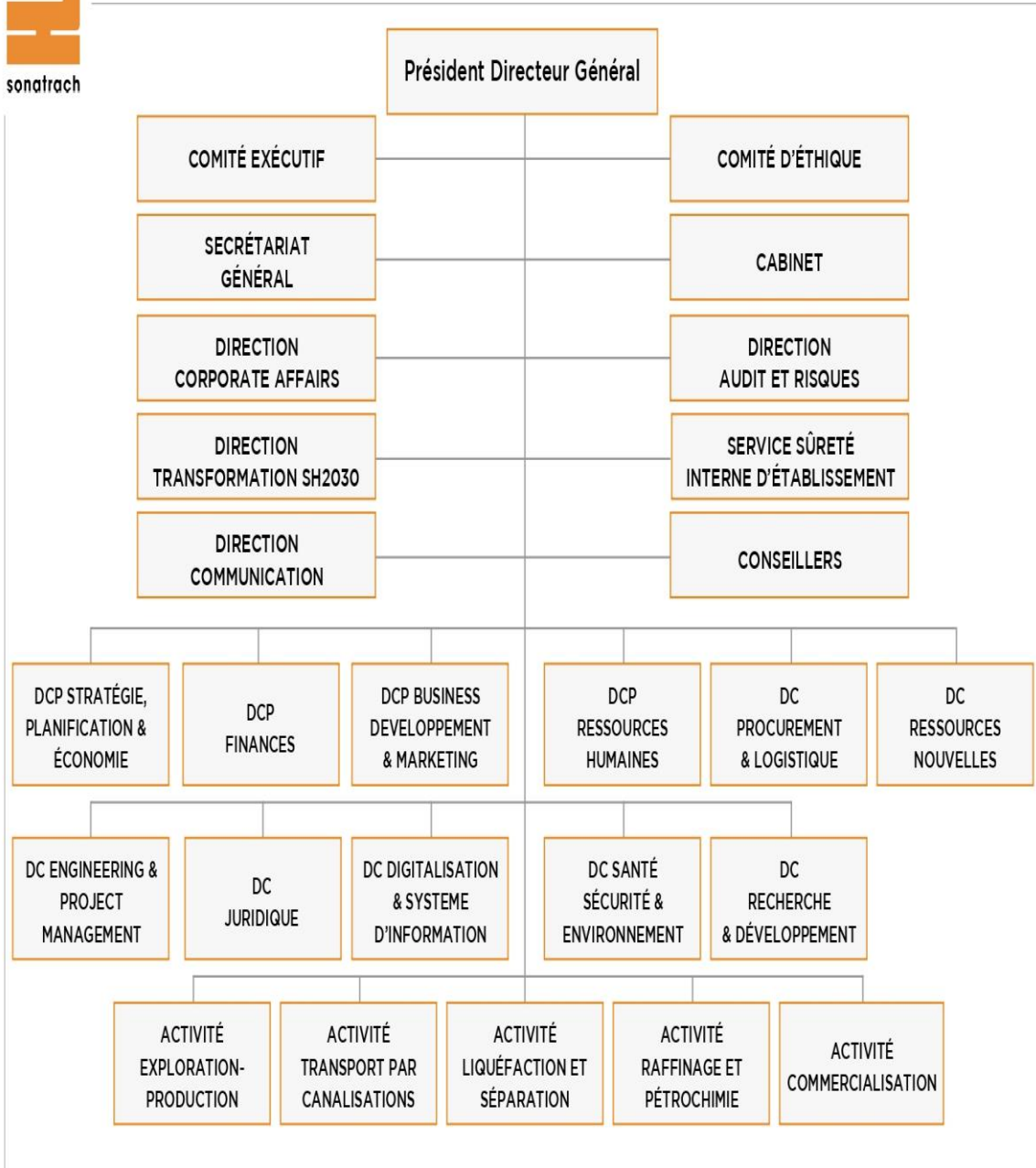
APPENDIXES

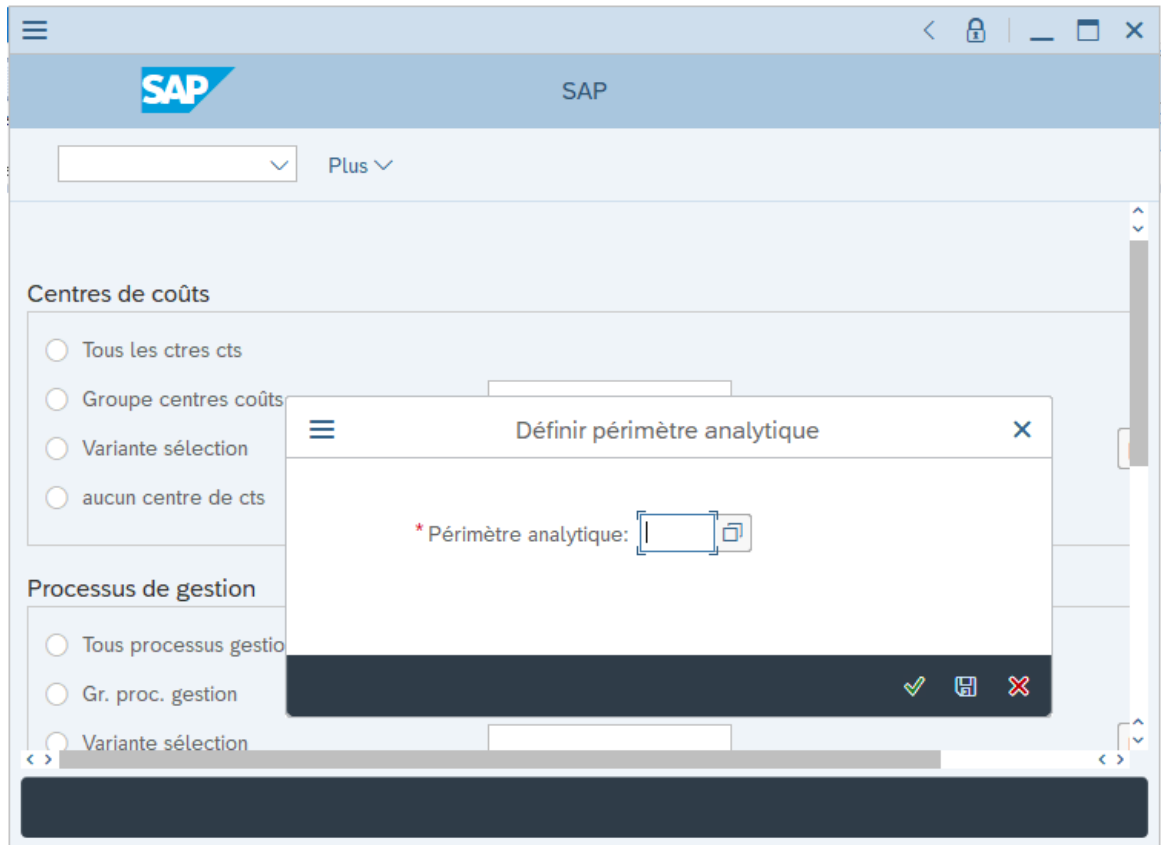
Appendixes

Appendix A



ORGANIGRAMME DE LA MACROSTRUCTURE DE SONATRACH





This screenshot shows the SAP 'Afficher pièce : Écran initial' (Display Part: Initial Screen) interface. At the top, there is a navigation bar with the SAP logo and the title. Below it, a search bar is followed by buttons for 'Liste de pièces', 'Premier poste', and 'Plus'. A 'terminer' button is located in the top right corner. The main area is titled 'Clé de la vue de saisie' (Key of the view) and contains three input fields: 'N° pièce:' (Part Number), 'Société:' (Company), and 'Exercice comptable:' (Fiscal Year). A 'Suite' button is visible in the bottom right corner.

This screenshot shows the SAP 'Afficher données de base personnel' (Display Basic Personnel Data) interface. The top navigation bar includes the SAP logo and the title. Below it, there is a search bar and buttons for '68', a search icon, a refresh icon, and 'Plus'. A 'terminer' button is in the top right. On the left side, there is a search panel titled 'Recherche de' (Search for) with a dropdown menu set to 'Personne' (Person). Below this, there are three search options: 'Aide à la recherche groupée', 'Critère de recherche', and 'Recherche libre'. The main area features a 'Matricule:' (Employee ID) input field. Below the input field, there are two tabs: 'Données de base personnelles' (Basic Personnel Data) and 'Données sup' (Additional Data). Under the 'Données de base personnelles' tab, there is a list of data categories: 'Infotypentext', 'Mesures' (Measurements), 'Affectation' (Assignment), and 'Données individuelles' (Individual Data). A 'Suite' button is located in the bottom right corner.

This screenshot shows the initial screen for creating an order in SAP. The title bar includes the SAP logo and the text 'Créer Ordre : écran initial'. Below the title bar, there is a navigation area with a dropdown menu, the text 'Données d'en-tête', a refresh icon, 'Plus', and a 'terminer' button. The main content area contains several input fields: '* Type ordre:' (with a search icon), 'Priorité:' (dropdown), 'Pos. techn.:', 'Équipement:', 'Sous-ens.:', and 'Div. plan.:' (text boxes). At the bottom, there is a 'Modèle' section with two options: 'Créer ordre suivant' (unchecked) and 'Opérations' (checked).

This screenshot shows the initial screen for creating a production order in SAP. The title bar includes the SAP logo and the text 'Créer ordre de fabrication : écran initial'. Below the title bar, there is a navigation area with a dropdown menu, the text 'Plus', and a 'terminer' button. The main content area contains several input fields: 'Article:' (with a search icon), 'Division production:', 'Division planif.:', 'Type d'ordre:', and 'Ordre:' (text boxes). At the bottom, there is a 'Référence' section with an 'Ordre:' text box and a search icon. A 'Suite' button is located in the bottom right corner.

Project Builder : options utilisateur

☰
×

Généralités

Ouvrir projet avec:

Mode de traitement:

Niveaux hiérar.:

Aperçu dernier projet

Afficher objets supprimés

Objets traitables

Simulation

Définition de projet

Élément d'OTP

Réseau

Activité de réseau

Sous-activité

Composant article

Jalon

Liaison

Texte PS

Document

Modèles

Objets individuels

Projets

Modèles standard

Simulations

Historique

Nombre projets:

Créer document de vente

☰
←
🔒
—
📄
×

←
Créer document de vente

🖼️ IS-Oil
Plus ▾
terminer

* Type commande client:

Données d'organisation

Organis. commerciale:

Canal distribution:

Secteur d'activité:

Agence commerciale:

Groupe de vendeurs:

Suite
Créer avec référence

Appendix B

impact of ERP on entreprise performance

*Obligatoire

1. 1- are you ? *

Une seule réponse possible.

male

Female

2. 2- what is your age range ? *

Une seule réponse possible.

20 to 30

31 to 40

41 to 50

over 51

3. 3- for how long have you been in your current occupation with SONATRACH ?

Une seule réponse possible.

less than 5 years

between 5 and 10 years

10 and 20 years

more than 20 years

4. 4- The socio-professional category

Une seule réponse possible.

- Executive (cadre)
- Supervisor (Agent Maitrise)
- Executor (Exécutant)
- Polyvalent agent

5. 5- do you use an ERP system ?

Une seule réponse possible.

- yes
- no
- in progress of implementation (en cours)

6. 6- if your answer is no, Why?

7. 7- did you use another information system -software- before ERP ?

Une seule réponse possible.

- yes
- no

8. 8- do you agree that ERP is easier to use compared to the old software?

Une seule réponse possible.

	1	2	3	4	5	
strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree

9. 9- What is/was the motivation for implementing ERP ?

Plusieurs réponses possibles.

- strategic (stratégique)
- functional (Fonctionnel)
- Imposed by management (Imposé par la direction)
- Improvement of internal communication (Amélioration de la communication interne)
- Harmonising information flows(Harmonisation des flux d'information)
- Trend (Tendance)
- Autre : _____

10. 10- inconvenients encountered while using these information systems

Plusieurs réponses possibles.

	old software (Logiciel ancien)	SAP ERP
bug	<input type="checkbox"/>	<input type="checkbox"/>
setting up	<input type="checkbox"/>	<input type="checkbox"/>
slow	<input type="checkbox"/>	<input type="checkbox"/>
lack of flow of information between different departments	<input type="checkbox"/>	<input type="checkbox"/>

11. 11- what are the advantages of ERP (quels sont les avantages de l'ERP)

12. 12- what impact do you think the erp has on the company's performance

Plusieurs réponses possibles.

	operational/managerial effectiveness	competitive advantages/strategic benefits	financial performance
User information satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
post implementation review	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ERP integration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extented ERP (SCM, CRM, BI, Web)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. 13- what Key Performance Indicators -KPI- are used to measure the performance of the enterprise ?

Plusieurs réponses possibles.

- ROI (return on investment)
- ROE (return on equity) (rendement des capitaux propres)
- EVA (economic value added) (valeur économique ajoutée)
- (compétitivité des prix/la compétitivité hors prix)
- Benchmarking
- QFD (Quality Function Deployment) (Déploiement de la fonction qualité)
- THE 5s (Sort, Set in Order, Shine, Standarize, Sustain) (éliminer, ranger, nettoyer, standardiser, suivre)
- Autre :

Impact of ERP on Economic Performance

	not at all (pas du tout)	somewhat (un peu)	moderately (moyennement)	a lot (beaucoup)	considerably (Considérablement)
The use of FRP has resulted in a reduction in processing time for tasks that can be automated. (L'utilisation de l'ERP a engendré une économie de temps de traitement sur des tâches automatisables.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The use of ERP has resulted in a reduction in operational cycle time (L'utilisation de l'ERP a permis une réduction du temps du cycle opérationnel)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ERP has led to an increase in turnover (L'ERP a favorisé une hausse du chiffre d'affaire)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ERP has led to an improvement in the company's results. (L'ERP a conduit à l'amélioration du	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
résultat de l'entreprise.)					

15. 15- The degree of influence of ERP on the quality of your company's services is :
(Le degré d'influence de l'ERP sur la qualité des services de votre entreprise est)

Une seule réponse possible par ligne.

	Very low (Très faible)	Low (faible)	Medium (moyenne)	High (élevée)	Very high (Très élevée)
Ligne 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. 16- ERP helped retain existing clients and manage to attract new ones (L'ERP a permis de conserver les clients existants et de réussir à en attirer de nouveaux.)

Une seule réponse possible.

	1	2	3	4	5	
strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree

Impact of ERP on Organizational Performance

17. 17- ERP has improved access to information in a way (L' ERP a amélioré l'accès à l'information d'une manière)

Une seule réponse possible par ligne.

	Very low (Très faible)	Low (faible)	Medium (moyenne)	High (élevée)	Very high (Très élevée)
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. 18-

Une seule réponse possible par ligne.

	not at all (pas du tout)	somewhat (un peu)	moderately (moyennement)	a lot (beaucoup)	considerably (Considérablement)
<p>ERP has improved the reliability of information communicated between different departments (L'ERP a amélioré la fiabilité des informations communiquées entre les différents services)</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Through the integration it offers, ERP has made control tasks easier (Grâce à l'intégration qu'il offre, l'ERP a facilité les tâches de contrôle)</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Can you say that ERP has contributed to the decentralisation of decisions? (Pouvez vous affirmer que l'ERP a contribué à la décentralisation</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

des décisions
?)

19. 19- Do you agree that ERP has improved coordination within your company?
(Êtes-vous d'accord que l'ERP a amélioré la coordination au sein de votre entreprise ?)

Une seule réponse possible.

	1	2	3	4	5	
strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree

20. 20- Following the introduction of ERP, the organisation has become more flexible
(Suite à l'introduction de l'ERP, l'organisation est devenue plus flexible)

Une seule réponse possible.

	1	2	3	4	5	
strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree

Impact of ERP on Human Performance

21. 21- Do you agree that the choice of the ERP implementation was decisive for the follow-up of the objectives set by the company? (Êtes-vous d'accord que le choix de l'implantation de l'ERP a été déterminant pour le suivi des objectifs fixés par l'entreprise)

Une seule réponse possible.

	1	2	3	4	5	
strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree

22. 22-

Une seule réponse possible par ligne.

	not at all (pas du tout)	somewhat (un peu)	moderately (moyennement)	a lot (beaucoup)	considerably (Considérablement)
<p>ERP has helped to improve the quality of managers' decisions (L'ERP a contribué à améliorer la qualité des décisions des responsables)</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Does the ERP contain some functionality to suggest useful proposals for decision making? (L'ERP contient il certaines fonctionnalités permettant de suggérer des propositions utiles à la prise de décisions?)</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>ERP has led to an improvement in staff knowledge (L'ERP a conduit à une amélioration des</p>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

connaissances
du personnel)

ERP has led to
an
improvement
in staff
satisfaction
with their work
(L'ERP a
conduit à une
amélioration
de la
satisfaction du
personnel lors
l'exécution de
leur travail)



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