الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

Mohamed KHIDHER University - Biskra Economic & Commercials & Management Sciences Faculty

Management Sciences Department

جامعة محمد خيضر – بسكرة
كلية العلوم الاقتصادية والتجارية وعلوم التسيير
قسم علوم التسيير

Corporate Foresight practices in an Algerian ecosystem context: insights from a cement sector case study

A Dissertation Submitted to the Department of Management in Partial Fulfilment of the Requirements for the Master's Degree in: Strategic Management of Enterprises

Submitted by:

DJIDJEKH Badie

Supervised by:

BOURICHE Nacereddine

Board of Examiners

1	ROUINA Abdessami	Professor	President	Biskra University
2	IZZRECH Kamilia	M.A.A	Examiner	Biskra University
3	BOURICHE Nacereddine	M.C.B	Supervisor	Biskra University

2020 / 2021

الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

Mohamed KHIDHER University - Biskra Economic & Commercials & Management Sciences Faculty

Management Sciences Department

جامعة محمد خيضر– بسكرة
كلية العلوم الاقتصادية والتجارية وعلوم التسيير
قسم علوم التسيير

Corporate Foresight practices in an Algerian ecosystem context: insights from a cement sector case study

A Dissertation Submitted to the Department of Management in Partial Fulfilment of the Requirements for the Master's Degree in: Strategic Management of Enterprises

Submitted by:

DJIDJEKH Badie

Supervised by:

BOURICHE Nacereddine

Board of Examiners

1	ROUINA Abdessami	Professor	President	Biskra University
2	IZZRECH Kamilia	M.A.A	Examiner	Biskra University
3	BOURICHE Nacereddine	M.C.B	Supervisor	Biskra University

2020 / 2021

I. Acknowledgments

First and foremost, praises and thanks to ALLAH, the Almighty, for his sprays of blessings throughout my research work to complete it successfully.

I would like to express my deepest and most sincere gratitude to my research supervisor, Dr. Nacereddine BOURICHE, professor of finance in Mohamed KHIDHER University, who gave me the opportunity to do my research granting immeasurable assistance and guidance through the whole process, who was indulgent and work flow and patient with my tiring schedule, who gave me a life-changing quote “without deadlines, there would be no results”. And I would like to take the chance to thank professor Dr. Azzeddine BOUTI who provided me with multiple resources, advices and who introduced me to Dr, BOURICHE so that he become my supervisor.

I would like to thank the new friends at LafargeHolcim CILAS who were extremely kind, thoughtful and helping with my research at their factory, and for providing me with the necessary data, information and advices that helped me during my research time. Especially sir Yacine AZZAZ and the quality team members, sir Taha Hussein GHAMRI and sir Chawki CHABAANI, lady Lamia SIDHOUM, sir Abdelhak OUNIS, sir Noureddine from the commercial sector, and sir Taher BOUZID.

Last but not least, I would like to thank my dear parents first and my family second, who were extremely facilitating, loving, caring, sacrificing, patient and understanding about my work on the research and my non-availability for a long period of time that had plenty of heavy-weight events.

II. Abstract

This research aims to study the corporate foresight practices in a non-digital ecosystem (represented by the Algerian Business Ecosystem), how to digitalise a company's system and create a new ecosystem or recreate one, with the intent to extract insights from the cement factory LafargeHolcim.

The qualitative method was the one chosen for the topic, where we used archival research, actual contact and semi-structured interviews. The CILAS branch was considered as research sample as a whole representing the mother company LafargeHolcim, localised in Biskra, Algeria, study took place in April - May 2021. Its main results are that corporate foresight can be objectively measured internally using different indexes, and that foresight can be practiced without the need for massive investments, it can be practiced with the classical methods.

Results from this research are limited to companies in the same ecosystem and the same company size, for the reason that although CILAS does not have the full foresight process digitalised, it is part of a larger group called LafargeHolcim that is responsible for the bigger and major strategic implementations and directions of the company.

Key words: Foresight, Corporate Foresight, Digitalisation, Business Ecosystem, Algerian cement factory.

ملخص:

يهدف هذا الدراسة إلى دراسة ممارسات الاستشراف المؤسسي في نظام بيئي غير رقمي (يمثله نظام الأعمال الجزائري)، وكيفية تحويل نظام الشركة إلى نظام رقمي، وإنشاء نظام بيئي جديد أو إعادة إنشاء واحد، بهدف استخلاص رؤى من مصنع الأسمنت. لافارج هولسيم.

كانت الطريقة النوعية هي الطريقة المختارة للموضوع، حيث استخدمنا البحث الأرشيفي والاتصال الفعلي والمقابلات شبه المنظمة. تم اعتبار فرع CILAS كعينة بحث ككل تمثل الشركة الأم LafargeHolcim، المتموضعة في بسكرة، الجزائر، وقد أجريت الدراسة في أبريل - مايو 2021. وكانت نتائجها الرئيسية أنه يمكن قياس تبصر الشركات بشكل موضوعي داخليًا باستخدام مؤشرات مختلفة، وذلك يمكن ممارسة البصيرة دون الحاجة إلى استثمارات ضخمة، ويمكن ممارستها بالطرق التقليدية.

تقتصر نتائج هذا البحث على الشركات في نفس النظام البيئي ونفس حجم الشركة، لأنه على الرغم من أن CILAS ليس لديها عملية الاستشراف الكامل الرقمية، إلا أنها جزء من مجموعة أكبر تسمى LafargeHolcim المسؤولة عن أكبر التطبيقات الاستراتيجية وتوجهات الشركة.

كلمات مفتاحية: اليقظة، اليقظة المؤسسية، الرقمنة، منظومة الأعمال، مصنع الأسمنت الجزائري.

III. Tables, Figures and Charts

Figures:

Tables:

Charts:

IV. Introduction

In a dynamic environment, unstable economy, and a fast and increasing globalization, information is a crucial success factor in the competition arena. Information plays a significant role in a company's success if extracted fast and adequately used. It can also be a tool to destroy the institution if it is not used correctly.

A "look ahead" in time is what companies nowadays need, a "sneak" in the future ahead from the current state of the other companies, that is what guarantees to be on the wave not under it and trying more challenging to follow it is one of the major concerns of companies today. this "look ahead" and "sneak" has much semantics, some call it "watch", "forecast", "intelligence", "foresight" and many other vocabulary synonyms that some are the same, and others are very close in definition, in this study we're using the term "foresight". (Bergman, K. & Dahlgren, C. ,2020)

To clarify the term, "foresight" is not so much about predicting the future, as it is the ability to recognize changing events and accurately plan for possible future outcomes. Meaning a big part of the foresight process deals with the change in the environment, constant change, new information, and sorts of new plans, i.e., foresight depends on the constant update of secure information to make precise plans. (Schreiber, D. A., & Berge, Z. L. 2019, p 3)

V. Problematic

In a digitised world, in an era of fast and continuous changes, organisations around the globe tend to use foresight as their primary guide through most of the situations, whether it was an internal or external potential issue, organisational foresight was always the solution provider.

In a non-digitised environment, as the case in the Algerian context. Algerian Organisations tend to have problems for unstable and unknown future situations; whether it was an internal or external potential issue, organisational foresight was never the solution provider.

Due to the technological achievements of the developed countries, foresight is at least a part of the success formula. However, due to the lack of an essential component for a fruitful foresight that is digitization, a question could be asked 'whether corporate foresight valid in a non-digitized environment?' as implications to this question other sub-questions could be posed:

- What does an organization need to implement corporate foresight?
- How can the organization face a non-digital environment?
- How can the organization benefit from such a system?

VI. Previous studies:

literature review showed that no single research compromised the two variables studied in our research; this leads to probe each variable separately.

Studies related to corporate foresight

1. ***Making Your R&D Future Proof: The Roles of Corporate Foresight in Innovation Management by:***

René Rohrbeck and Hans Georg Gemünden, Conference Paper, European Center for Information and Communication Technology (EICT), and Technische Universität Berlin, Chair for Innovation and Technology Management, Berlin, Germany, august 2009.

Objectives:

· Achieving a new understanding of how companies identify, assess and react to irregular change and how it is used for innovation management.

- Explore the role of corporate Foresight for innovation management success.

Methodology:

The research adopted multiple case studies approach using a qualitative research strategy base. Each case was selected for a particular purpose. The research uses companies dissimilar in industry, position in the value chain, and their primary business driver. Data collecting techniques such as interviews, questionnaires, observation and secondary sources alongside archival research have been used.

Results: were divided into three roles, the initiator role, the strategist, the opponent role and each was given its impacts on the innovation management

- Impact of Strategist role: Assessing and repositioning of innovation portfolios, providing strategic guidance, identifying new business models, consolidating ideas, Vision creation.
- The impact of the Opponent role: Challenging basic assumptions, scanning for disruptions that might endanger current and future innovations, challenging the state-of-the-art of current R&D projects.

2. ***Strategic Thinking, Organisational Foresight, and Strategic Planning in High-tech SMEs in the UK by:***

Masoud Hassanabadi, doctoral thesis, 237 pages, Bangor business school, Bangor University, Wales, United Kingdom, November 2019.

Objectives: had multiple objectives, parts are related to our research, and other is not:

- Examine the correlation between strategic thinking and firm performance
- The association between organisational Foresight and firm performance
-

examines the mediating effect of strategic planning on the connection between strategic thinking and firm performance.

Explore the mediating weight of strategic planning on the relationship between Foresight and firm performance.

Study the influence of strategic planning on firm performance.

Methodology: the study applied a quantitative methodology and a survey method for data collection. A sample targeted the SMEs in the UK.

Results: The results related to our research are that applying strategic thinking by managers can improve SMEs' performance. Moreover, strategic planning can be used in the strategy-making procedures to intercede the impact of strategic thinking on firms' performance.

Studies related to business ecosystem and digitalisation

1. ***transform to succeed: an empirical analysis of Digital Transformation by:***

Sarah E. Steed, Anne Theresa Eidhoff, Markus Voeth, International Journal of Economics and Management Engineering, World Academy of Science, Engineering and Technology, Vol: 10, No: 6, 2016.

Objectives:

To provide a holistic overview of the concept of digital transformation in business practice and to provide essential insights into the organisation by answering a couple of questions:

What encompasses the understanding of digital transformation in firms?

What is the current status of digital transformation in firms?

How is the digital transformation organised?

What are the significant opportunities and challenges of digital transformation?

Methodology: the qualitative explorative research design was the one chosen, alongside in-depth interviews.

Results:

The results show that the main drivers for transforming business activities are competition, customers, inherent motivation, technical innovation, and firms' strategic consideration.

All the experts interviewed agree that top management support is obligatory for transformation projects to succeed; they should assess their digital readiness for technical capabilities, human resources and knowledge. Also, relevant projects should be strategically selected.

All experts evaluate digital transformation as a requirement that has a significant optimisation potential. The challenges of the significant challenges for firms are how to change traditional business and corporate culture fundamentally. Moreover, inadequate ability to identify auspicious starting points, insufficient knowledge about the application of digital technologies are all significant factors within the sample.

VII. Hypothesis

The central hypothesis that answers our main question would be:

No corporate Foresight is valid in a non-digital environment.

VIII. Epistemology and methodology

Positivism has been adopted. The qualitative method has been conducted, where actual contact, archival research and semi-structured interview have been employed as data collection techniques.

IX. Study’s structure

The objective of the study: descriptive and analytical.

Type of the study: relational

Researcher involvement: minimum effect to analyse the study as it is

Planning: unplanned

Case study: organisational

Time period: successive study

X. Significance of the Study

The significance of this study can be extracted from its central objective, which is providing a real-life case study of an Algerian firm that is implementing the corporate foresight principles in a non-digitalised environment. Furthermore, this case study can constitute a model for other Algerian companies that are not applying these new strategies.

Finally, it reveals how an organisation can implement the CF in a non-digitalised environment.

XI. Primary plan:

Chapter One: What is corporate Foresight

Sub-chapter 1: Corporate foresight concept

Sub-chapter 2: Corporate Foresight implementation

Sub-chapter 3: Corporate foresight value, perspectives and new technologies' effects.

Chapter One: What is corporate foresight

In this chapter, definitions of corporate foresight (C.F) are introduced by defining the foresight part solely first, then some corporate foresight's semantics are presented and compared. Lastly, the objectives and importance of the terms are clarified.

Sub-chapter 1: corporate foresight concept

1. Definition and the historical development of the term

The related literature showed no agreed definition of the ‘‘corporate foresight’’ term; it has been misperceived due to its vague definitions. Therefore, it is suitable to display various definitions from different researchers to derive an in-depth understanding of the term.

First. Defining foresight and corporate foresight

A. foresight

In 1932, the visionary H. G. Wells used the term “Foresight” for the first time in a BBC broadcast, while (hind)sight is about understanding the past, (In)sight is about understanding the present, (fore)sight is about understanding the future, systematically. (Tuomo Kuosa, 2011, p. 09)

Amsteus clarified the term as it is “viewed and analysed with a concentration on the phenomenon of foresight itself, foresight antecedent features and foresight consequences or considering the concept as a tool or series of steps when there needs to be a deeper clarification of the nature of foresight”. (Masoud Hassan Abadi, 2018, p. 46)

Major et al. discussed the ambiguity about the foresight subject, whether it is being a human attribute process or a competency or a countrywide program, while also pointing those debates were unsuccessful in revealing its meaning. (Masoud Hassan Abadi, 2018, p. 5)

Tsoukas and Shepherd believed that foresight procedures can change future situations and asserted that: “foresight indicates the capacity of having a perspective over the complex situation to understand the future trends whilst the trends are still developing, recognizing patterns before they are completely seen, and understand associated features of social streams that can influence future conditions”

Battistella addressed it as “the capability of having a correct judgment about future events and to be able to have an action plan according to such knowledge”. (Masoud Hassan Abadi, 2018, p. 45)

Krayser and Blind asserted that “foresight is a foreseeing ability, looking at forward action, forward viewing and prudent care”.

Richard Slaughter defined it as “the process that attempts to broaden the boundaries of perception in four ways:

- By assessing the implications of present actions and decisions (consequent assessment).
- By detecting and avoiding problems before they occur (early warning and guidance).

- By considering the present implications of possible future events (pro-active strategy formulation).
- By envisioning aspects of desired futures (preparing scenarios).”

The abovementioned definition indicates that the definition of the term is not a simple task. Nevertheless, it is considered an acceptable definition due to its delicate features that indicate foresight's processes and features.

FOREN (Foresight for Regional Development Network) “the Practical Guide to Regional Foresight” which is considered by many foresight practitioners as the “official” European Union’s definition on foresight, defines foresight as:

“Foresight is a systematic, participatory, future-intelligence-gathering and medium-to-long-term vision-building process aimed at enabling present-day decisions and mobilising joint actions. It can be envisaged as a triangle combining “Thinking the Future”, “Debating the Future” and “Shaping the Future”. Foresight is neither prophecy nor prediction. It does not aim to predict the future – to unveil it as if it were predetermined – but to help us build it. It invites us to consider the future as something that we can create or shape, rather than as something already decided.” (Gavigan, J et al., 2001)

To further explain the above quotation, some terms are addressed as follows.

- Action-oriented: Foresight is not only about analysing or contemplating future developments but supporting actors to actively shape the future.
- Open to alternative futures: Foresight assumes that the future is not pre-determined, which means that there is a certain degree of freedom to choose among the alternatives, feasible futures.
- Participatory: Foresight is not small group of expert’s jobs, but a different group of actors that seek feedback to achieve the best possible results.
- Multidisciplinary: Foresight provides an approach that captures realities in their totality with all the variables influencing them, regardless of the type (quantitative and qualitative).

This study has adopted the FOREN definition since a reliable and official group has provided it. The FOREN definition will constitute the primary defining key to our study to understand the term.

B. Corporate foresight

To find the accurate definition for “corporate foresight”, we will approach some of the most known researchers’ definitions that may include other labels, such as ‘organizational foresight’, and ‘strategic foresight’ which are terms for the same field but with minor distinguishing differences that we will address in a later sub-chapter.

According to Slaughter, (C.F) is “a firm’s ability to create and maintain a high quality, coherent and functional forward view, and to use the insights arising in organisationally useful ways”. (Sara Polier, p7)

For Rohrbeck, he defines it as “the capability which comprises environmental scanning, strategic selection and integrating capabilities to enhance companies to distinguish irregular change at the initial stage and understand its outcomes for the organization”. (Masoud Hassanabadi, 2018, p. 57)

It is worth noting that Rohrbeck has built his studies as a successor to Slaughter’s, so one might find his work as a polished version of that of Slaughters.

As the “foresight” general term was identified as an ability, a process, a practice or a capability, “corporate foresight” is also treated as the same way, as Rohrbeck consider it as a capability and a responsibility that is entrusted to employees to involve in forward-looking practices via conventional procedures.

There is a slight conflict between researchers for the labelling part of whether they would use the term, for instance, corporate foresight, strategic foresight and organizational foresight. Rohrbeck argued “(C.F) is a concept derived from strategic foresight”, and we find that Slaughter gave the exact definition about (C.F) to strategic foresight. However, most of the researchers use (C.F) as the term for “foresight” in “organization”.

For our study we will depend on Rohrbeck’s definition that “foresight activities in the corporate context are usually cross-functional with links to multiple functions including corporate development, Research and Development (R&D) and innovation management, strategic management, and controlling. Foresight provides inputs to these functions by creating future insights that help to shape strategic directions, identify future risks, and explore future opportunities related to new products, services, or entire markets”. (Sara Polier, 2019, p. 14)

Second. History of corporate foresight

Historically speaking and as we know most of the strategic techniques and methods are based on military and war techniques, foresight is no different as it starts as early from the fifth century BC, with Greeks playing “Pettia” to learn war strategies.

Moving forward to 1811 when the Chinese and Russian army participated in brainstorming based on theoretical study to create possible future scenarios. In the twentieth century Herman Kahn introduced scenario thinking and became one of the first to use systems analysis to identify mechanism, patterns and structures that may lead to a future event.

After World War Two the presence of scenario thinking increased in modern organizations, and a variety of multiple methodologies emerged, like the Delphi method in the 1950s, road-mapping in the 1970s, and formalized technology forecasting throughout the 1980s and 1990s. and lately in the twenty first century there’s the search for predictive analytics. (Deborah A. Schreiber & Zane L. Berge, p8)

In the next figure we will display the historical trend of (C.F) in the view of Rohrbeck and al, which goes back to only the previous century.

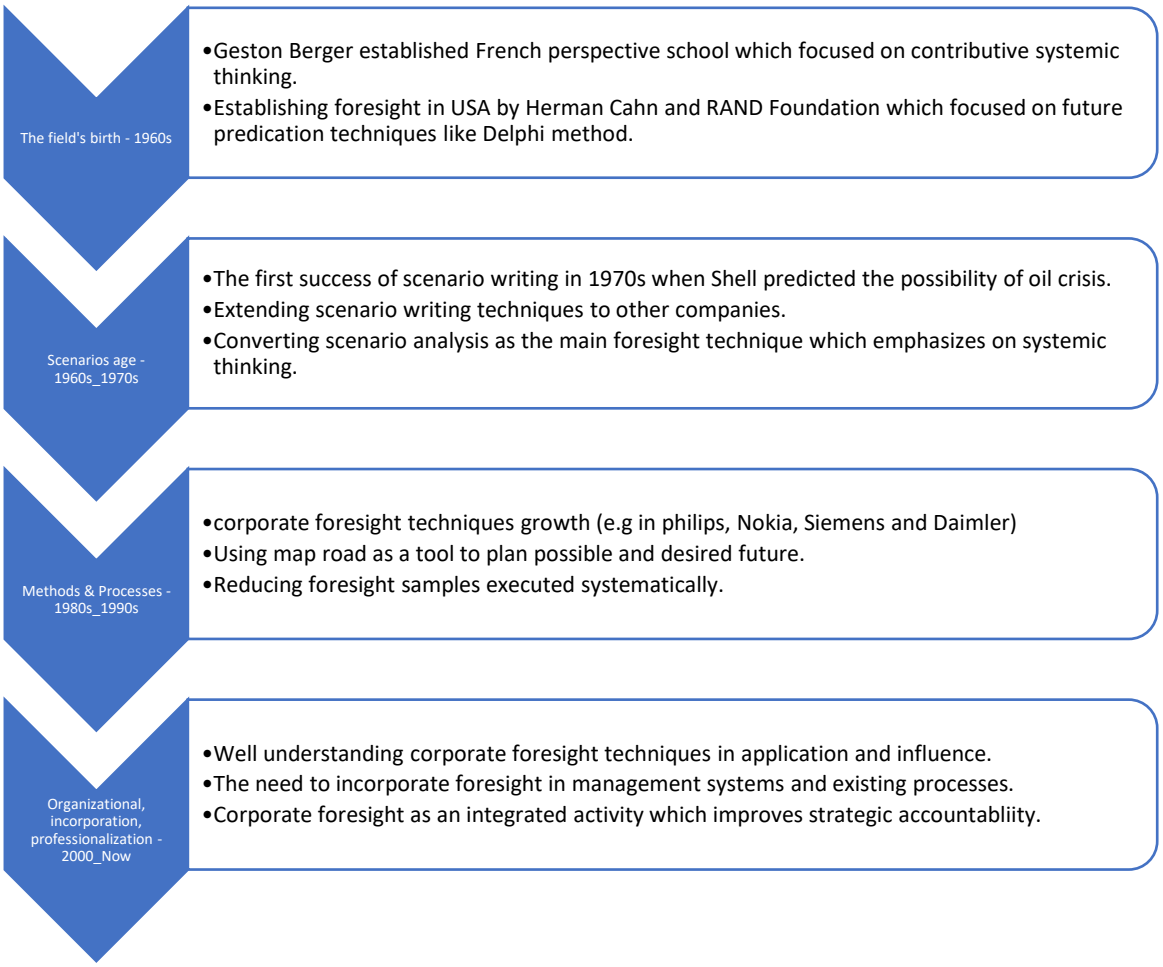


Figure 1: The historical trend of (C.F) in the view of Rohrbeck et al as in Sohail Dadkhah et al., 2018, p. 3

RAND: (Research and Development—a mutual project of U.S. Army Air Corps and Douglas Aircraft Company) in 1940s and 1950s

2. why we do foresight?

After introducing the term, and knowing its overall history and discovering the "what?" part, in this subchapter we will discuss the "why?" part of this thesis, and that's by looking at its benefits, objectives and its outcomes.

First. Benefits

By going back to the previous definitions provided we can extract the core benefits from applying foresight in an organization, such as:

Foresight improves the quality of decision making, and that comes from providing guidance for strategic actions being taken –what, how and when to do-; It allows strategic policy decisions to be based on a wider societal debate; gives a variety of knowledge sources to base our decisions on.

Foresight improves the impact of decision-making by creating commitment for sited actors to support future oriented vision and that's by leading them to reinforce policy measures directed towards the vision by their own activities; and helps joining forces between stakeholders instead going after each other.

Foresight improves capability of an innovation system by creating an increased awareness of possible risks, and hence a basis for more effective contingency planning, and the design and development of appropriate forms of resilience; and it enhances the capacity to design and manage non-routine events.

Second. Objectives

Foresight practices have some widely known typical objectives that almost every organization seek to accomplish, either some of them or all objectives if it was ambitious and seriously well implemented, those objectives are:

Informe policy makers to be aware of longer-term developments, by gathering intelligence and providing alerts on major future risks and opportunities which would give a wider decision significance.

Building networks that bring together people from different sectors and institutions involved with shaping the future, so that they become self-assessing in the future.

Develop a foresight culture through developing capabilities of multiple people with different backgrounds in the organization to create their own foresight networks.

And many other objectives that organizations would try to accomplish which is not surprising because of the many outcomes it promises, and because of the wide list of objectives a foresight practice could have it is fairly hard for a corporate to achieve all of them at the same time and to the same extent, that's why the objective selection process should have some structure and points to follow, such as being realistic - for the available time and money resources - ; choosing wisely and not just listing everything for only to cancel them later; involving key players; clear and easily understandable; suggesting actions.

Sub-chapter 2: How we do corporate Foresight

As we cleared it earlier that (C.F) is a process work, that has a number of steps the company should follow in order to get the job done, but to note that this process sure has common obvious phases, meanwhile we can still find companies adding more steps, fusing or avoiding some, and that's up to what the company sees best fit to her situation, this leads to the statement that "there's no 'one single' best foresight practice, or a bad and a good one", later we will discuss the different types of methodologies proposed for the corporate foresight, what's best use case for some examples, and how to implement them in a proper manner.

The processes of (C.F) designed by different authors are called 'models', although those models get adopted by different researchers, they have common main Phases which are: Inputs; Analysis; Interpretation; Prospection; Outputs, and with each phase there are multiple methods to choose from, use and adopt and the next figure is an introduction to the most known methods that suits each phase in the (C.F) process.

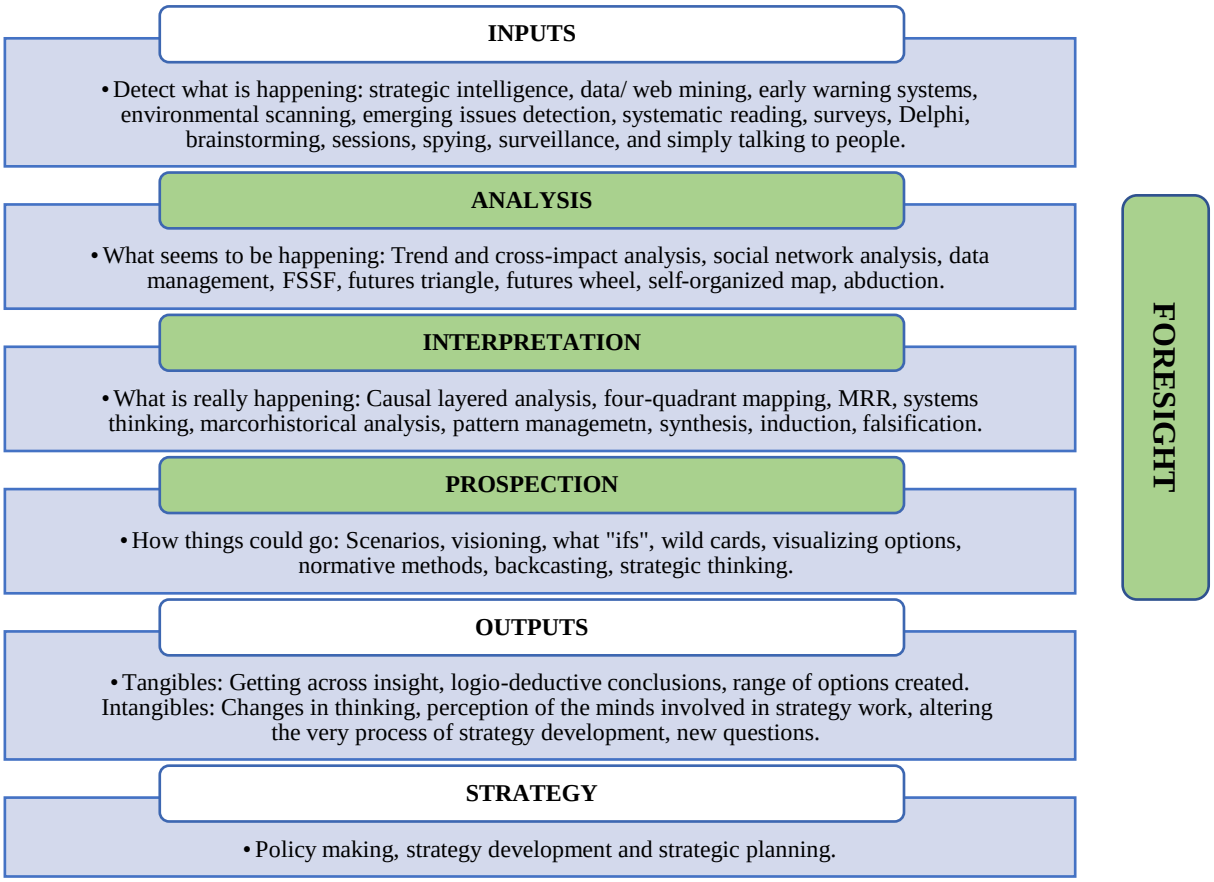


Figure 2: Corporate foresight process. (Tuomo Kuosa, 2011, p. 22)

As the figure shows the process mentioned earlier adding to it a last part "strategy" which is not a phase on itself, but some kind of benefit or a gain from the whole operation that helps in policy making or strategy development and strategic planning.

1. The Foresight control system (FCS)

(FCS) is a foresight process model proposed by *D. Güemes-Castorena and J. L. Amezcua-Martínez (2013)* based on the logic of the control systems, as described by Goodwin (2005) that "it aims to achieve a desired level of performance in the face of uncertainty". (FCS) is a foresight model constructed from many methods and tools that work as the basic structure of the process, it has four main stages: (1) definition of goals, (2) delimitation/acknowledgement of resources, (3) immediate action or target definition, and (4) environmental evaluation *(Güemes and Amezcua, 2013)*, as shown in Figure 3.

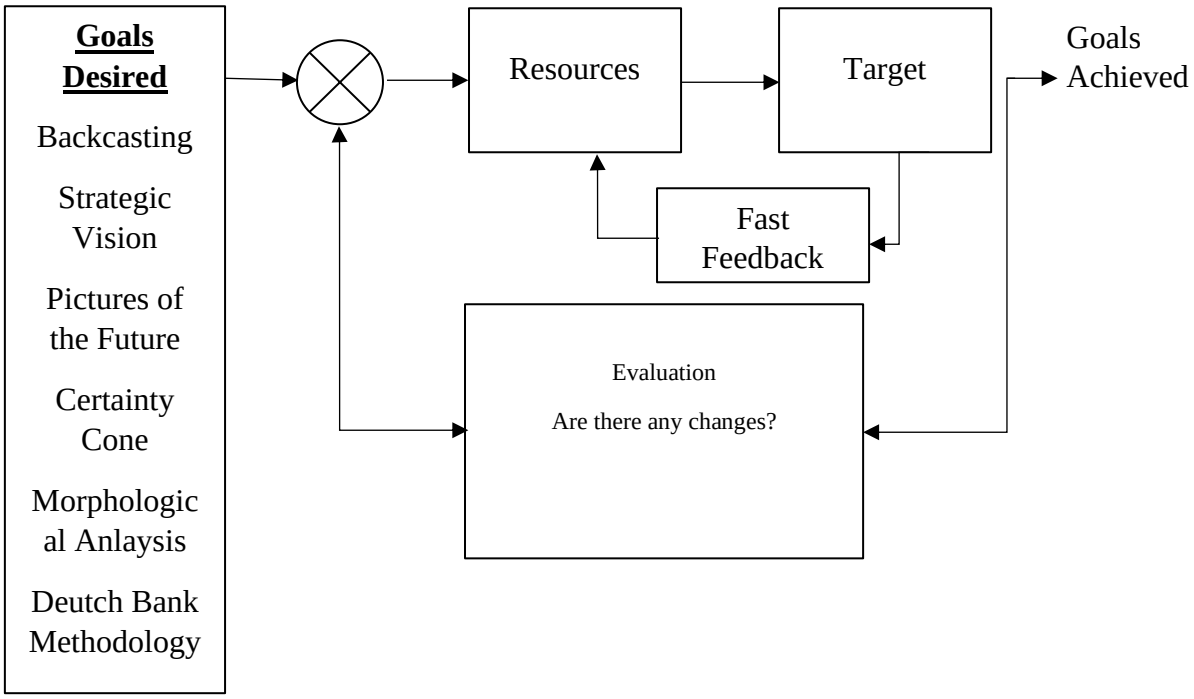


Figure 3: Recommended methods for stage 1

Stage 1: Definition of Goals and Vision

Defining corporate's goals and vision is a priority in the process, so in this stage a mix of multiple methods is used to set the main points and outline the company's main objectives and the plan to achieve them. Although the goals are set once, but they may change with the availability of new information and new trends appear, nonetheless it is very unfrequently to happen, so the possibility will be ignored in this study. We will establish a couple of the main methods this model proposes.

Backcasting is a method to develop normative scenarios and explore their feasibility and implications. Important in the sustainability arena, it is as a tool with which to connect desirable long term future scenarios to the present situation by means of a participatory process, and that's by presenting a future scenario and connecting it to the present situation by an analysis of how it can be possible to create the future scenario. (EFP, *Backcasting, 2010)*

Morphological Analysis is used to organise information in a useful way to help in problem solving, such as new product development and also in constructing scenarios. It involves mapping a discipline to obtain a wide perspective of existing solutions and future possibilities, and that's by following five basic steps: (EFP, *Morphological Analysis, 2010)*

1. Formulation and definition of a problem.

2. Identification and characterisation of all parameters toward a solution.

3. Construction of a multidimensional matrix (morphological box) whose combinations will contain all possible solutions (a morphological box can be constructed that lists parameter along a single axis. The second axis is determined by the nature of the problem).

4. Evaluation of the outcome based on feasibility and achievement of desired goals.

5. In-depth analysis of the best options considering available resources.

Stage 2: Resources (Science and Technology)

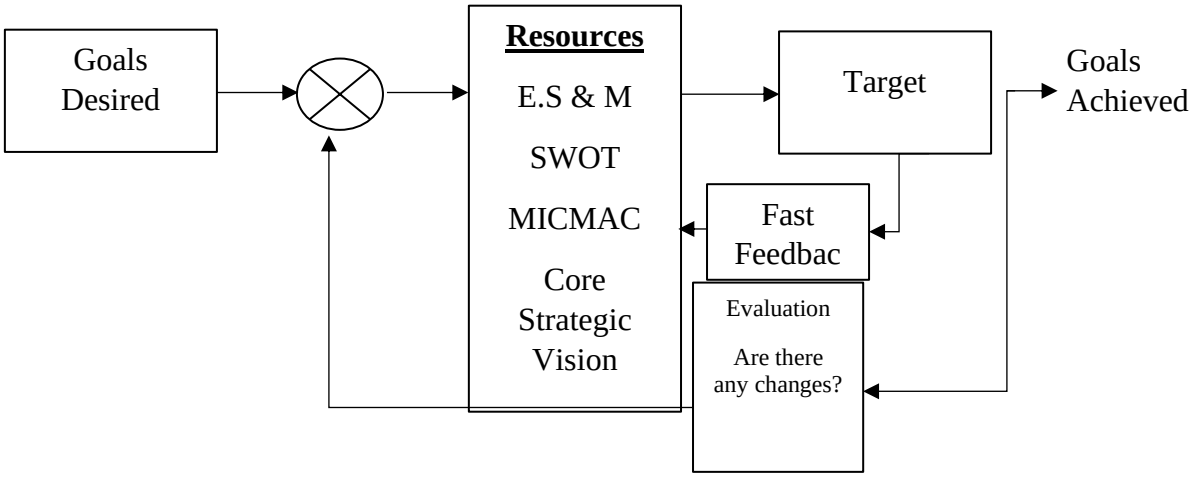


Figure 4: Recommended methods for stage 2

After defining the goals of the operation, stage 2 focuses on the organization's capabilities by defining the necessary resources and available skills that allows the analysis of how feasible the goals defined are, this stage is best known with the Creative Methods for it can generate new ideas and proposals *(Güemes and Amezcua, 2013)*.

Environmental Scanning & Monitoring (ES&M) the scanning aims to detect 'weak signals' in order to provide early warning about important future changes, and that happens by informing the management process, enabling it to consider issues at an early stage rather than reacting to them when they become critical. While the Monitoring depends mainly on the feedback as a control mechanism, and this is why the monitoring part is ignored in this stage. (EFP, Environmental Scanning, 2010)

Core Strategic Vision is a mechanism that leads to define six-element scheme that represents six strategic issues the company must consider both externally (Market Trends/Competitive Strategy, Product Strategy, Technology Trends/Strategy) and internally (Core Competencies, Financial Plan, Business Charter) *(Güemes and Amezcua, 2013, P 58).*

SWOT is one of the most known and used methods in this stage, which defines key competencies and that's by allowing the company to focus on its strengths, minimize weaknesses, and gain the greatest advantage of the opportunities available. *(Güemes and Amezcua, 2013, P 58).*

All foresight analyses must take into account not only new information but also the one that has been generated over time, and that is called the historical data which is considered at this stage and with every foresight control cycle is completed, more historical data get fed back to this section, and since this is an information-gathering stage, the number of variables may grow, making the foresight exercise a very complex problem, that's why there's the need to weigh the relevant variables for the system.

MICMAC is a method that is especially made for complex problems that involve a lot of variables, it can be used when a problem is so complex that it is important to ensure no key variables (internal variables, external variables or major actors) are overlooked or to create a common culture and to reach a consensus on the variables driving the problem under study. It ensures a certain level of quality in the results stemming from the matrix once it has been processed. (EFP, Structural Analysis, 2010) For each variable it gives:

• an **influence index**, which measures the intensity with which a variable act upon the system
• a **dependency index**, which measures the intensity with which each variable is affected by the system.

Stage 3: Target Direction Definition

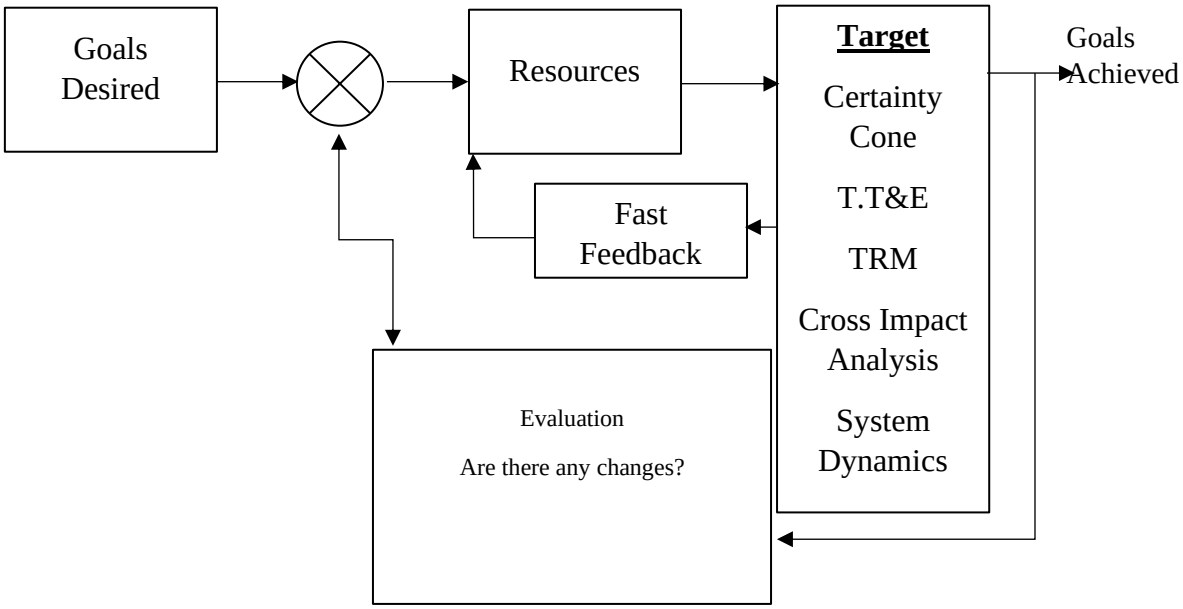


Figure 5: Recommended methods for stage 3

This stage is responsible for the analysis and synthesis of all information obtained previously to define the results of the foresight operation; thus, it is the most critical stage of the process, we can apply a wide set of methodologies in this stage such as Certainty Cone, T.I&E, TRM, Cross Impact Analysis and System Dynamics.

T.I&E (Trend Intra- & Extrapolation): This method has the function of measuring changes in the different sectors to define the trajectory of the trend (extrapolating), and also to match with the objectives and goals defined earlier (interpolating). *(Güemes and Amezcua, 2013, P 60).*

(Technology Roadmapping): as defined in EFP, Technology Roadmap (2010) Usually, Roadmapping is a normative tool, like *relevance trees* and *morphological analysis*, i.e., the desired future state (or possibly states) is pre-determined. The term 'Technology Roadmapping' refers to various kinds of forecast or Foresight studies including visions and detailed projections of future possible technological developments, products or environments. The construction of the roadmap consists of collecting, synthesising and validating the information, and representing the trends within graphical displays associated with support documents, and that

strengthens the connection between objectives and resources, together with the Backcasting *(Güemes and Amezcua, 2013, P 60).*

Pre-Stage 4: Fast Feedback

The importance of the feedback is mainly to provide new and opportune information, for this stage, the ES&M methodology is proposed, focusing mainly on ‘‘monitoring’’ the current conditions of the variables that were selected at the scanning process in stage 2.

Stage 4: Feedback Evaluation

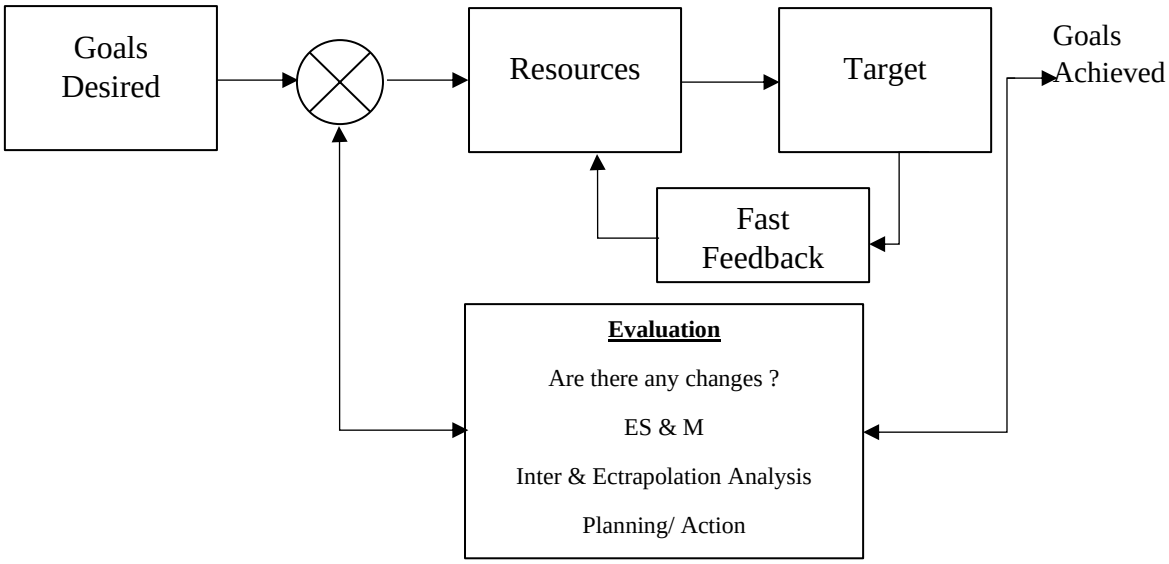


Figure 6: Recommended methods for the evaluation stage

This is the control stage at the strategic level, it uses the same methods but with a stronger focus on the monitoring aspect of it, it is important to verify that the goals are still feasible because the time spans are wider. This stage is targeting to Verify through interpolation; To review whether the goals have changed according to market conditions; or whether it is feasible to achieve the goals; or alternatively, the need to modify them.

From the previous gathered information and monitored variables, we can start the extrapolation process, from the present to the future (point A to point C) and the interpolation, from a longer-term future to the present (point D to point C). And based on a previous defined foresight time frame, point C will be traveling the S-curve from the initial point A, to the end point in D.

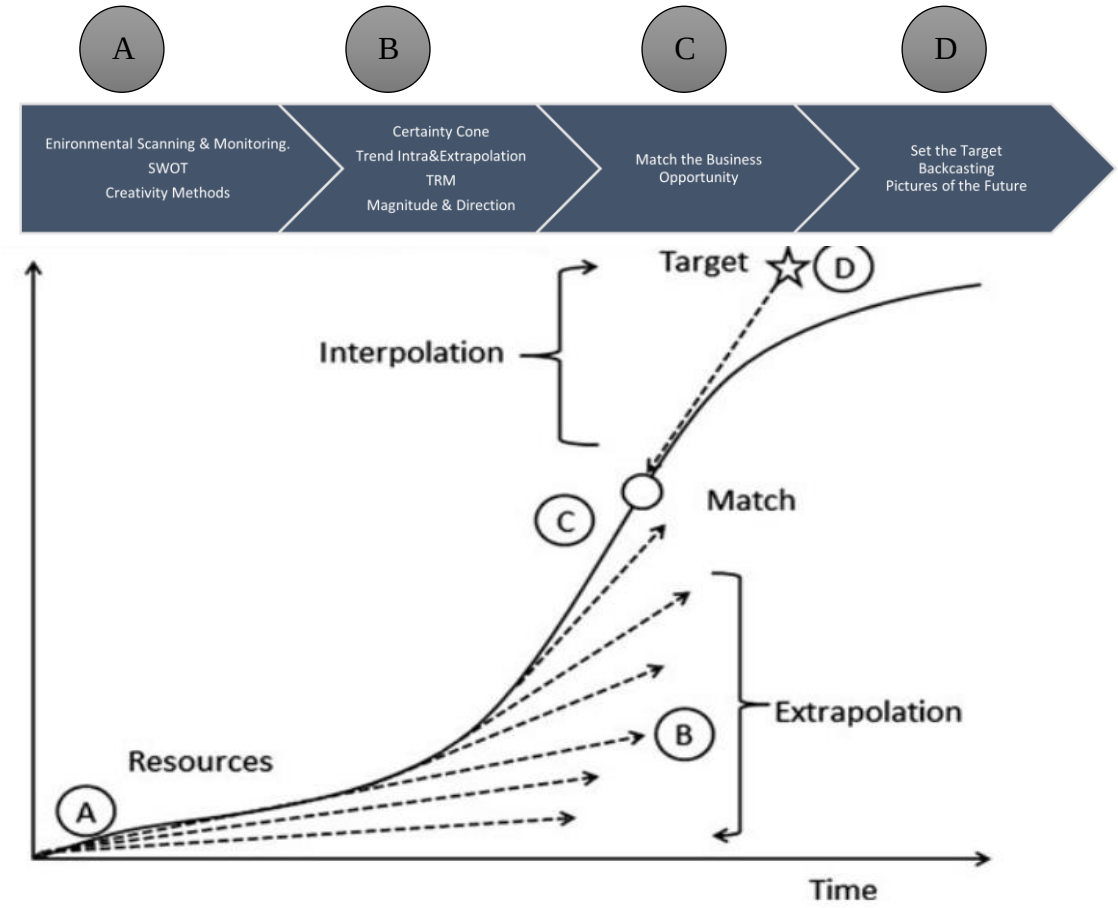


Figure 7: The foresight methodology in contrast with the S-curve

2. Fundamental attributes and different approaches of foresight methods

This section provides different approaches to foresight methods, the Exploratory & Normative methods, Top-Down & Bottom-Up, and recognizing the fundamental attributes, nature and capabilities.

First. Exploratory & Normative

Exploratory methods start from the present and move forward to the future "Outward bound" and that is by asking "What if?" questions about possible developments outside the familiar trends, or on basis of extrapolating past trends or else by causal dynamics. The majority of foresight methods are exploratory such as Trend, Impact, Cross-impact, Conventional Delphi and others. (James P et al., 2001)

Normative methods start with a preliminary view of a possible or desirable future and then work backwards "Inward bound" and study the available constraints. The methods used here have commonalities such as techniques developed, planning and related activities such methods are Relevance Trees, Morphological Analysis, Goals Delphi, Success Scenarios and Aspirational Scenario Workshops.

Second. Top-Down & Bottom-Up

Top-Down according to Cuhls et al. (2015) gets conducted when the top management requires an overview of particular issues for strategic motives, or when requesting an investigation of

predefined objectives with core questions. Such practices improve the reputation and authenticity of foresight (Battistella, 2014; Darkow, 2015; Martin, 1995; Rohrbeck & Gemünden, 2008).

Bottom-Up based on Backer (2002) research, is a more common approach when precise topics were analysed in further detail and thus based on opinions of external experts or lower levels within the organization. (Katarina Bergman & Charlotte Dahlgren, 2020, P. 51)

Third. Nature of Foresight methods

Based on nature, methods can be categorised as qualitative, quantitative or semi-quantitative, (Rafael Popper, (2008), pp. 64 – 65)

Qualitative methods generally provide meaning to events and insights. Such explanations tend to be subjective and lean towards creativity that is rather tough to corroborate, e.g., judgements, beliefs, attitudes, etc. such methods are (15 method): backcasting, brainstorming, citizens' panels, environmental scanning, essays, expert panels, futures workshops, gaming, interviews, literature review (LR), morphological analysis, questionnaires/surveys, relevance trees, scenarios, and SWOT analysis.

Quantitative methods generally measure variables and use statistical analyses, creating reliable and valid data, for instance socio-economic indicators. Methods of that kind (3 methods): bibliometrics, modelling/simulation, and trend extrapolation/megatrends.

Semi-quantitative methods are principally those that apply mathematical regulations to quantify subjectivity, rational judgements and viewpoints of experts and commentators, such as, weighting opinions and probabilities. The category includes: cross-impact/structural analysis, Delphi, key technologies, multi-criteria analysis, stakeholder mapping and (technology) road-mapping.

Fourth. Capabilities of Foresight methods

Refers to the ability to process information using the following characteristics. (Rafael Popper, (2008), P. 65)

Creativity is the blend between original and imaginative thinking that depends profoundly on the creativity of immensely skilled individuals such as artists, technology mentors, science fiction writers or a group brainstorming session. (Ansoff, 1975; Cassingena Harper and Pace, 2004)

Expertise refers to set of skills and knowledge of entities used to aid top-down decisions, giving advices and recommendations, due to the accumulation of experiences and observations of several years in a certain domain. (Kuusi, 1999; Scapolo and Miles, 2006)

Interaction identifies the need to bring different expertise together and practice them legitimately in a democratic society through bottom-up and participatory processes. (Andersen and Jæger, 1999; Cuhls, 2003; Brummer et al., 2007).

Evidence recognises the necessity of explaining and/or forecasting a given phenomenon using proper documentation and tools of analysis, for instance, measurement indicators and statistics, to better understand the current state. (Porter et al., 1980; Armstrong, 2006).

These attributes -Nature and Capabilities- combine together to shape the *Foresight Diamond* created by Popper (2008).

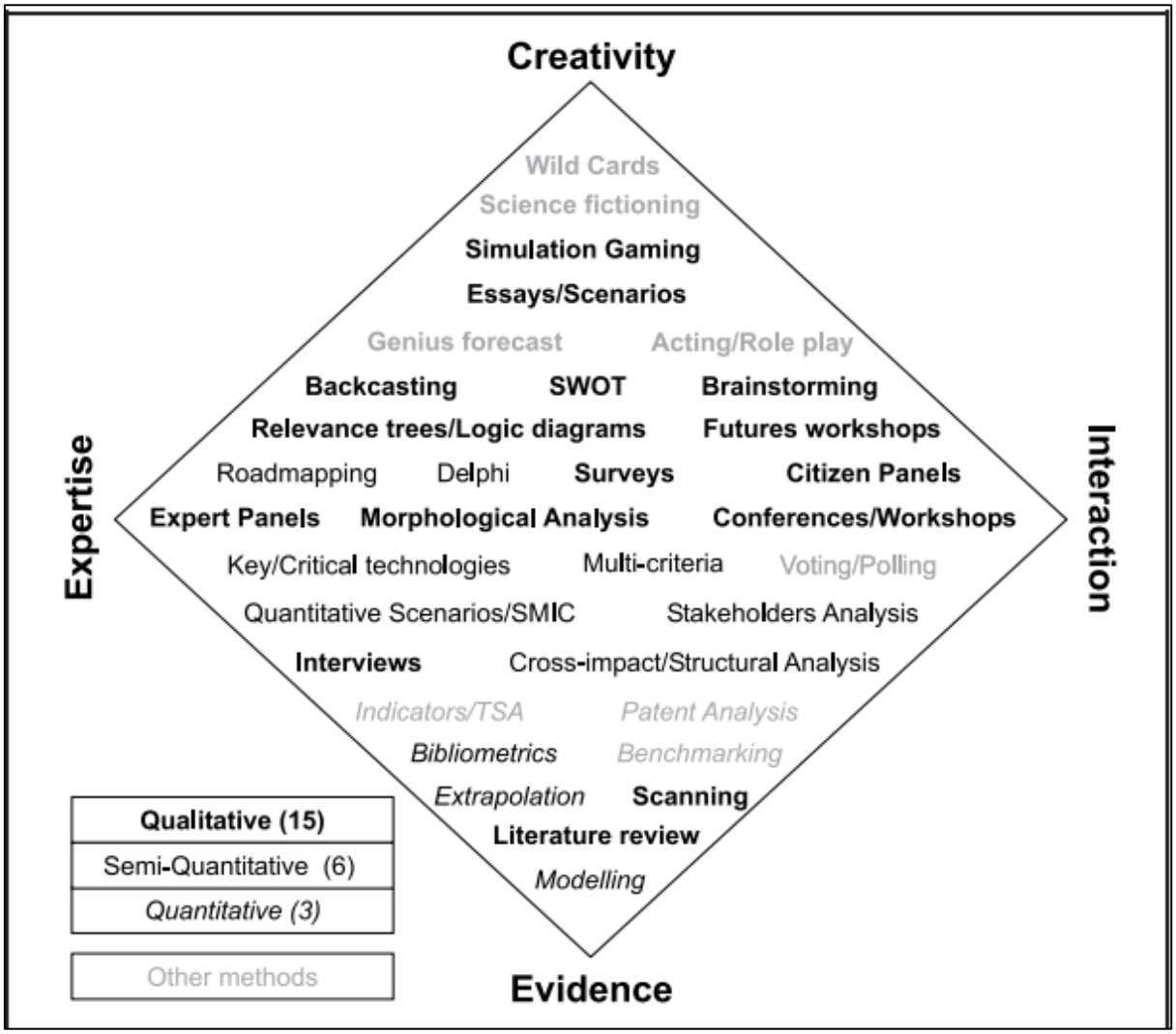


Figure 8: The Foresight Diamond. (Rafael Popper, (2008), P. 66)

Sub-chapter 3: corporate foresight value, perspectives and effects of new technologies on the process

1. The Value behind Corporate Foresight

Value generation and creation is a necessity for the whole adoption operation, and to do so, having a value chain of information and knowledge and understanding them is obligatory. More so it is hugely recommended for the corporate to apply their own foresight process and not recruit an outside party that can only support temporarily. (Horton, 1999, p. 9)

A proper value creation should consider many areas of return of investment, such as: knowledge creating and absorbing, decision support, new products generating, strategic planning enrichment and obtaining necessary strategic resources. The process of Dynamic Capabilities offers a suitable means to define the value creation of corporate foresight, that is necessary in a high uncertainty market for the strategic management viewpoint. (Rohrbeck, 2012, p. 440)

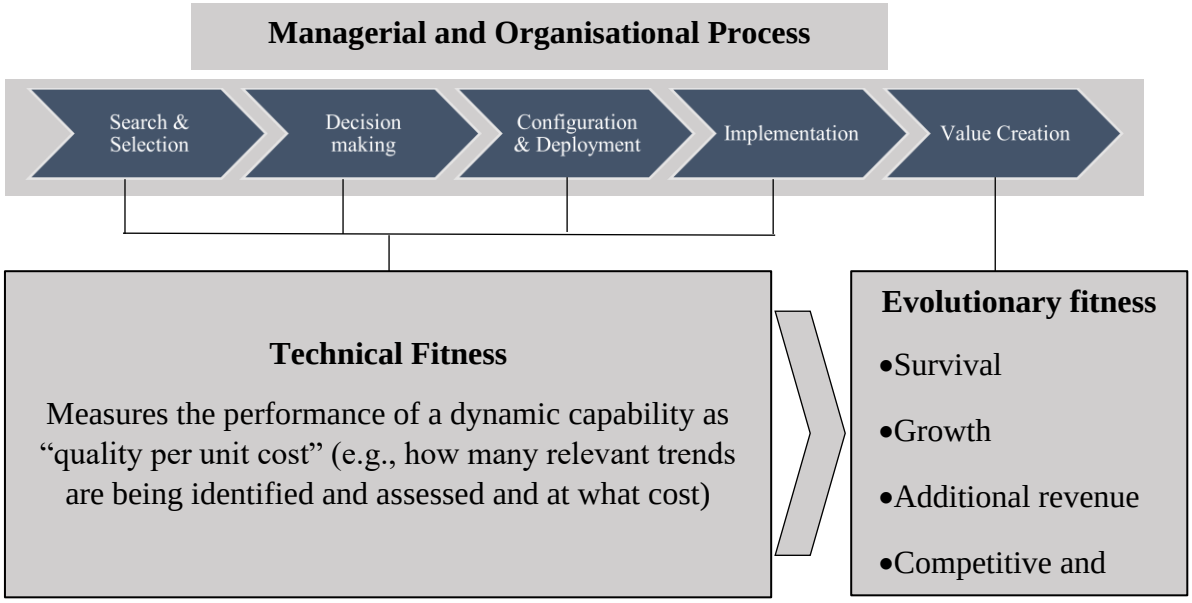


Figure 9: Process model of Dynamic Capabilities (Helfat, 2008, as in Mag. Christian Eckert, 2019)

From the Dynamic Capabilities model, three potential value creation points can be recognised:

Firstly, (C.F) assures threats' detection and help it aim for the opportunities, by detecting related external change, start based on that innovation ingenuities and challenge the whole innovation development, and that is to create value for the corporate.

Secondly, (C.F) affect the strategic discussions by guiding them to compel the stakeholders to join the process of a corporate change on the strategic level

Finally, value creation is not limited to searching for the resources, but to develop them internally or acquire them externally by identifying essential resources to produce a competitive advantage in a troubling environment. (Rohrbeck, 2012, p.442)

2. Corporate foresight perspectives

(C.F) can get adopted and practiced in different ways, some companies choose to create a new independent cell or department responsible for the foresight process, but many companies tend to divide foresighting responsibilities on the already available departments, such as marketing, corporate developments, R&D and controlling department, by adding their standpoints and fusing foresight methods with theirs to generate a functional high-quality forward view. (Slaughter, 1998, p.382)

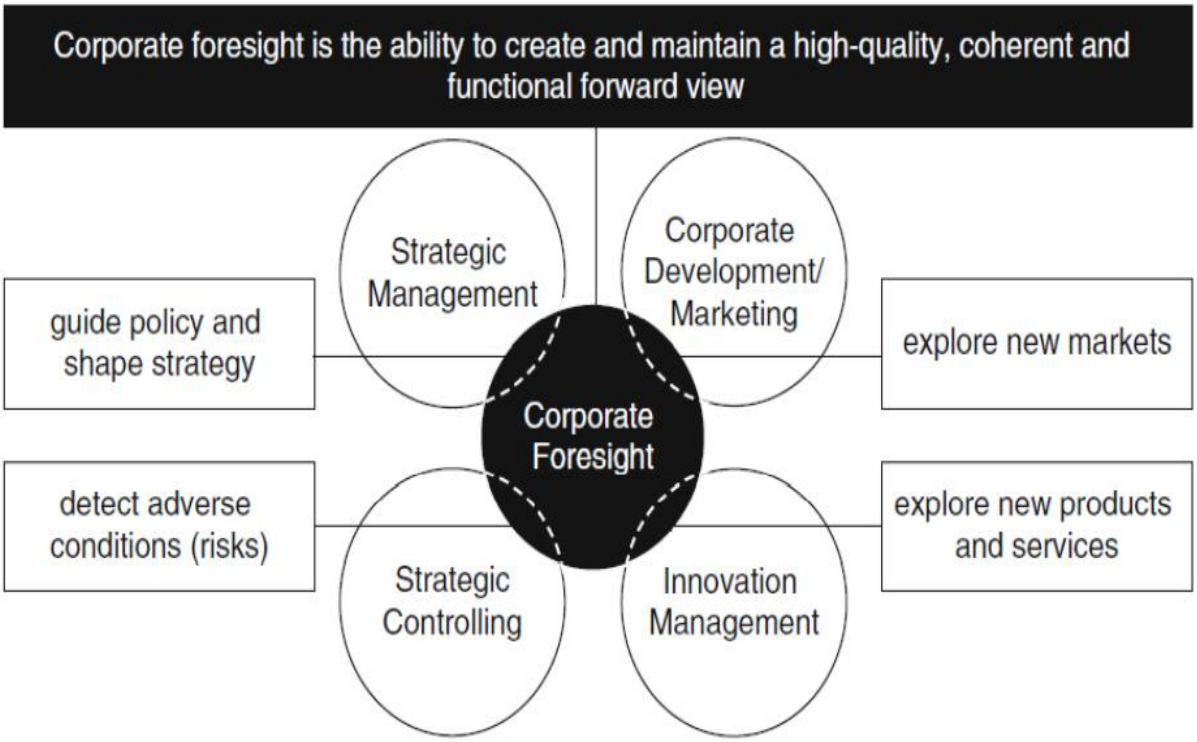


Figure 10: Multiple perspectives of Corporate Foresight (Rohrbeck, 2010, p. 12, as in Mag. Christian Eckert, 2019

Strategic Management can apply scenario building techniques to offer different strategies in different conditions by near-future environment insights. (Slaughter, 1998, p. 383)

Strategic Controlling has the ability to find future risks with precision from adverse situations. (Rohrbeck, 2010, p. 12)

Corporate Development/ Marketing can categorise new clients and improve the understanding of customer needs, and also explore new markets and learn how the current ones works. (Rohrbeck/ Schwarz, 2013, p. 15)

Innovation Management can inspect new products and services by classifying breaks along with threats facing the company's products and technology portfolio. (Rohrbeck/ Schwarz, 2013, p. 15)

3. The effects of new technology and new foresight support systems on the process:

The utility that technology has for the foresight process is nothing new, like for the Delphi method that has used the advantages of the internet (Gordon/Pease, 2006, p. 321), and the data mining method is just a branch for the big data obtaining and analysis (Chan/Franklin, 2011, p. 190). The Information and Communication Technology (ICT)- based application are immensely beneficial for the foresight capabilities and will gain more reputation by the coming years. (Rohrbeck, 2011).

First. Foresight support systems and the changes they cause

Von der Gracht et al. (2015) define the Foresight Support Systems (FSS) as computer-based systems, which support on the one hand communication in general, as well as the analysis of statistical and qualitative data and on the other hand decision modelling and the rules of the order in the whole (C.F) process. Companies seek from the (FSS) to provide platform for information creation, exchange, analysis, collaboration and assessment to support a solution-oriented foresight process.

To further explain what (FSS) is, a basic definition for the essentials of (ICT) is needed.

ICT, describes any sort of product or service that stores, retrieves, manipulates, processes, transmits or receives information electronically in a digital from, that includes Artificial Intelligence (AI), Internet of Things (IoT), Big Data analytics and Block Chain – that are used to link unrelated pieces of data- are key emerging technologies. (Birudavolu, 2019, p. 3)

Web 2.0 tools embodies an evolutionary phase concerning the use of the World Wide Web, in which the focus is no longer the mere broadcasting of information or product sales by website operators, but the contribution of users on the Web and the generation of supplementary profits. (Christian Eckert, 2019)

The next table will showcase the starting point of a possible classification of the (FSS)

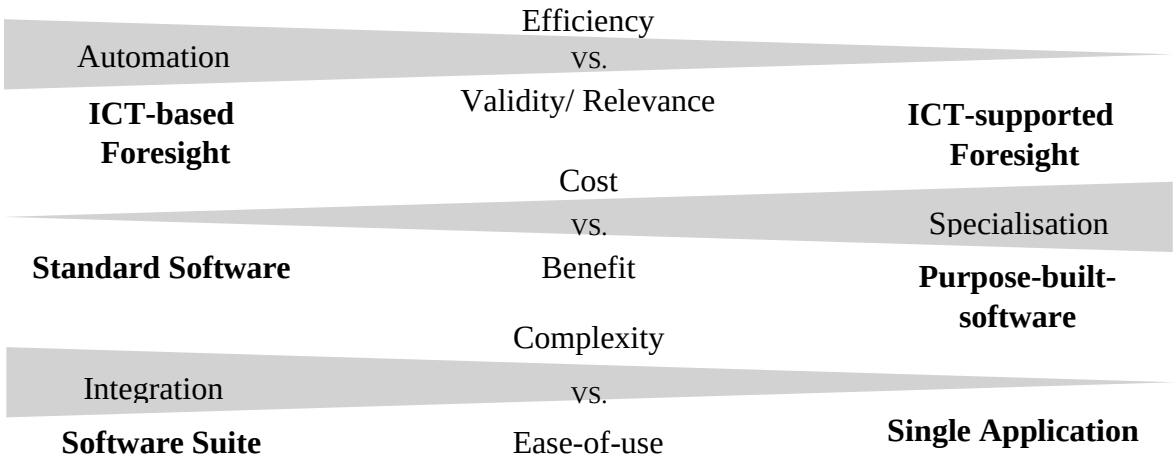


Figure 11: Classification criteria of Foresight Support System. (Von der Gracht, et al, 2015, p. 2, as in Mag. Christian Eckert, 2019)

The many changes a (FSS) causes can be seen in the following examples of ICT's and foresight methods:

Big data and Web 2.0: in case of fusing qualitative and quantitative data, the fast-growing IT department shows the new possibilities for forecasting analysts. Moreover Web 2.0 tools indorse cross-disciplinary learning by matching both techniques. (Von der Gracht et al, 2015, p. 1)

Combination of Delphi with prediction market: (FSS) can provide new market forecasting and delivers a whole forecast distribution. (Von der Gracht, et al., 2015, p. 47)

Data mining: web and data-mining techniques gets used to analyse Web forums data from users with common interests to help objective decision making. (Von der Gracht, et al, 2015, p. 3)

Weak signals and innovation: the (FSS) can support in the scanning process of weak signals to accumulate new market ideas for conceivable innovations and adopt them. (Rohrbeck, 2015, p. 115)

Internet as a collaboration platform: knowledgeable people on the internet with the same aim can provide beneficial collaboration, like what the Delphi or Scenario methods offers as collaboration methods. (Linstone, 2011, p. 1718)

Second. Foresight 2.0

Foresight was primarily expert-based closed-system process, but with the (FSS) new approaches to the corporate foresight process gets introduced by emerging the quantitative and qualitative process, and making it accessible on large-scale infrastructures, furthermore offers new co-operating and interacting methods and gives new possibilities for innovation processes, that is the *Foresight 2.0*. (Schatzmann et al. 2013, p. 1.4)

By dint of the improved communication, experts and external stakeholders can avoid the too homogenous future images, and prearranged goals can be flexible. And thanks to the Web 2.0 platforms, big internet companies can bring about massive quantitative data to create conjecturing analysis for short, medium and long future developments. All along with more advantages as mentioned: the growing diversity of views and perspectives; reducing complexity and identifying relevant factors; transparency and traceability; and the ability of real-time data collection. Likewise, there must be some disadvantages for the Foresight 2.0, such as: secrecy of online correspondence lessens socialising aspects of classical foresight processes; lacking of essential academic base due its initial stages. (Schatzmann et al. 2013, p. 4.5.6)

Integrating different fields' developments like (AI), text and data mining, simulation, pattern recognition and decision support technologies, would enhance systems developments and arrange World Wide accessible knowledge, which could give high expectancy for Future research. The next list exhibits the most propitious foresight 2.0 applications:

- Databases & Wikis, that ease the forecast and predictions.
- Social rating systems, discards the irrelevant data and provides possibility of an ideal scalability of the number of participants.
- Collaborative Scenarios, which lessens complexity by impelling assumptions.
- Prediction markets with precision of forecasting events on short perspective

(Schatzmann et al. 2013, p. 13)

Chapter Two: Business Ecosystem and Digitalisation

This chapter's end point goal is to set key principles and proposed foundational elements to overcome a defining necessity for the corporate foresight, that is the digitisation, by defining what makes an environment digital, what is a digital transformation, what are its characteristics, drivers, key impacts and the targeted areas.

Sub-Chapter 1: What is a digital ecosystem?

1. Defining Digital ecosystem

Before getting to the main term, the "*Digital*" part must have a proper definition to avoid misinterpreting the aimed meaning in this research. Dorner and Edelman (2015) interpret that McKinsey stated "digital" is about how companies run their business, and gave some points about it, saying that it creates value at the limits of business world, it optimises the process that impacts the customer experience, and it forms key capabilities that sustains the business.

Ecosystem is a term generally used for biology and the evolution theory, but got metaphorically adopted to different fields, as described by Francesco Nachira et.al, (2002), a European group that brought the full Digital Business Ecosystem concept to use, referring to Moore's (1996) take on it as a biological metaphor that underlines the interdependence of all parties in the business environment who coevolve their capabilities and roles.

Business ecosystem is a concept proposed by James F. Moore (1993), he defined it as "An economic community supported by a foundation of interacting organizations and individuals—the 'organisms of the business world'. This economic community produces goods and services of value to customers, who themselves are members of the ecosystem", afterward Francesco Nachira et.al, (2007) stated that a rich ecosystem is the one with equilibrium between cooperation and competition in a dynamic free market.

gave a more precise definition than the precedent one by defining it as:

A digital ecosystem (DE) is a multidisciplinary concept proposed as new method to observe the increasingly compound and interdependent systems being shaped, and defining it necessitates delving into many disciplines (e.g., ecology, economic, and technology). (Fiorina, C .2000)

From an ecological perspective, Fu, H (2006) defined it as "a digital environment populated by digital species or digital components which can be software components, applications, services, knowledge, business processes and models, training modules, contractual frameworks, law, etc.", those digital components can be any valuable idea that is well expressed in formal or natural language, digitalised and conveyed within the ecosystem to make it processable by humans and machines. Nachira et.al, (2007)

From an economical perspective, presented by P Dini et.al. (2000) as "a useful metaphor for understanding the dynamics of business networks at the regional and sectoral levels and their interaction with and through ICTs". Also addressed by the "Open Philosophies for Associative Autopoietic Digital Ecosystems" (OPAALS) that (DE) is appearing as an innovative method enabled by peer-to-peer operation in a global public environment by Small and Medium-sized Enterprises (SME) for a sustainable regional development.

From a technological perspective, viewed by Gerard Briscoe (2009) as in Li, W et al. (2012) the digital complements of biological ecosystems, which are believed to be sturdy, self-arranging and flexible architectures that can automatically resolve composite and dynamic problems.

However, since it is perceived as a multidisciplinary concept, a compatible definition is a must, we find Razavi A et.al. (2009) proposed that "A digital ecosystem is a self-organizing digital infrastructure aimed at creating a digital environment for networked organizations that supports the cooperation, the knowledge sharing, the development of open and adaptive technologies and evolutionary business models.". Even though Razavi gave a proper comprehensive definition for the digital ecosystem as a whole, some defining attributes that were missing will be mentioned later.

2. Characteristics

Digital Ecosystem is a dynamic, complex, self-organising, scalable and sustainable system that runs on the necks of multiple dynamic, high-dimensional and non-linear systems. The following will detail the before mentioned characteristics. Li, W et al. (2012)

Heylighen, F, (2008) offered the self-*organisation* characteristic for the spontaneous appearance of global structure out of local exchanges, the evolving population of the organisation, and the dependency towards a system context.

scalability is the ability of a system or process to handle increasing quantities of labour in an elegant manner or its ability to be expanded to accommodate that growth.

The *sustainability* of a Digital Ecosystem can be observed as the reconciliation of digital resources, knowledge, and people, to locate the ability to a remarkable job, continuing the change of internal and external environments, and recovering from the system's errors and damages.

Lastly the *dynamism* is broadly implemented in complex systems to define the time need of a point's state variables in a system. And it is defined as the character of a digital entity that gets modified as time passes, that profile offers a description of its values, connections and collaborations with outsider entities.

3. Categories

From the multiple definitions studied, various types of DE that offers different approaches were presented and studied, these categories could be seen the same as the DE disciplines, but they are interpreted differently as main categories of the Digital Ecosystem.

The *Digital Business Ecosystem* (DBE), considered as the main application of DE, originated in Europe in 2002, coupling the two concepts Digital Ecosystem and Business Ecosystem (proposed by Moore and renovated by Nachira et.al (2007), it is made up of the peer-to-peer infrastructural software technology to transfer, discover, and link services and information over the Internet, and to enable transactions of all digital units using the network infrastructure. (Francesco N., et al, 2007)

The *Knowledge Ecosystem* emerged as a solution to the constant evolution nature of knowledge exchanges between bodies to advance decision-making and innovation through evolutionary networks of alliances. Chatterjee, J. and Prabhakar in (2008) introduced the Digital Knowledge

Ecosystem as response for the need of easier information exchange, storage and retrieval, as knowledge flow mechanisms.

The *Digital Service Ecosystem*, is a value-generating ecosystem, includes the mechanism of self-organization and co-evolution of service systems to assemble a capability infrastructure that unceasingly synergizes and increases organizations' collective intelligence to adapt to new business vision and chances. (Sawatani, Y. 2007). Dorloff, F in 2010 presented service descriptions in Digital Ecosystems by concentrating on standardization and conversion as significant features to improve interoperability among services.

The *Human Digital Ecosystem* is the social perspective of the DE, which may include social networks that can be affected by social behavioural data patterns, it can be helpful in understanding human situations, behavioural patterns and social ecology. (Nimmagadda, S.L et, al. 2010)

4. Components and requirements

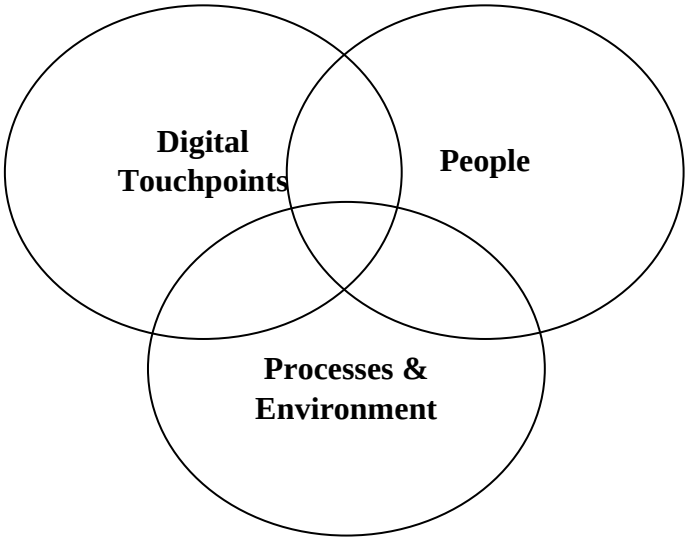


Figure 12: Classification criteria of Foresight Support System. (Von der Gracht et al, 2015, p. 2, as in Mag. Christian Eckert, 2019)

This figure represents the general components a framework needs to function as a digital ecosystem, these components can be split into five main structural elements that will be examined, but without forgetting the interdependent relation between these components.

Table 1: Structural components of the digital ecosystem (Matt Schaffnit, 2020, p 57)

Element	Description
Device (Hardware)	The *Device (Hardware)* is the most tangible component of the ecosystem and consists of the computer, tablet, smart phone and the like. This is the place where the user physically interacts

Network	Because a Device is limited to their stand-alone functions, the *Network* is essential in order to connect a user through a given Device to the digital world (aka the Digital Ecosystem). Network connectivity comes in a variety of forms such as broadband and WIFI as well as sensor and private networks all of which can be local or cover huge distances
Content	*Content* is simply the data users want to access or deliver. It could be simple text, audio, still or moving images, or any combination of those and can be either live and responsive or static
Application (Software)	An *Application (Software)* is the system, program or software that runs on the Device and allows you or your users to access the Network and utilize your Content. It could be something custom for your business, it could be the system that delivers dedicated services to an individual or a community, or it could be something as ubiquitous as a social media outlet or a site on the web
Services	Commensurate with its evolutions, *Services* have emerged to cater to the digital ecosystem as a whole and represent diversified commercial and professional services, *IT* consulting, support and infrastructure services

As mentioned earlier, the table is a representation of the general components of a Digital Ecosystem in a company level, the 'Digital Touchpoints' is represented with "Devises and applications" that enable users to access specific content. 'Processes & Environment' represented by "Devices and Applications" which create the foundational connection between 'Digital Touchpoints' and "People" with the help of networks.

Sub-Chapter 2: Implication of a Digital Ecosystem

According to both Iansiti and Levien (2004) a business ecosystem is formed from a set of elements or species: *Keystones, Dominators, Hub landlords and Niche players*. These species are found in all ecosystems with approximately the same ratio while the Keystones always being the small portion of the total network. (Karhiniemi. M, 2009)

Keystones are essential for the survival of the ecosystem, they continuously enhance the overall health of the business ecosystem, they depend on the constant execution of the firms in the composite network for their own survival and benefits, and their loss can have direct or indirect damaging effects for the entire ecosystem, their roles vary from eliminating species that would decrease productivity, providing foundations for other species, sustaining stability of the ecosystem and generating variety for the ecosystem. (Karhiniemi. M, 2009)

Dominators can be differentiated from the *keystones* by two characteristics, they tend to be bigger in size than keystones and they deject diversity by gaining-control the functions of the elements, they also abolish species and most of value capture and value creation are their

responsibility to keep for themselves, thus giving little opportunity for the appearance of a flexible ecosystem. (Karhiniemi. M, 2009)

Hub landlords have a mere value-adding to the ecosystem, while also extracting the most possible value from the network without the direct controlling of it. (Karhiniemi. M, 2009)

Niche players comprise the scale of the ecosystem in mass and variety, and does not have a broad-reaching effect on other species in the ecosystem individually. While Keystones outlines *what an ecosystem does*, Niche players outlines *what the ecosystem is*. Whilst they occupy a fraction of the network, they develop unique capabilities to differentiate themselves from other species in the ecosystem. (Karhiniemi. M, 2009)

After defining what the main species are, it is important to recall that the ecosystem is ever-developing process, which indicates that even the main species can face change, can take roles, eliminate each other, have a strategic move for another role, all except for the keystones and the system as a whole. Even after defining each of the species, Iansiti and Levien did not provide any examples for what those elements could be, but according to Moore (1996) who stated that a business ecosystem is constructed from customers, market, intermediaries, companies selling complementary products, suppliers, and the company itself, which according to Marko Karhiniemi (2009) can be thought as the primary species mentioned earlier. Moore (1996) depicted what a typical Business Ecosystem assemble of without elaborating on each-of the ecosystem's structure, roles, and networking in details, he considers the Business Ecosystem as business initiatives or vast collections of enterprises, where the borders can be ambiguous.

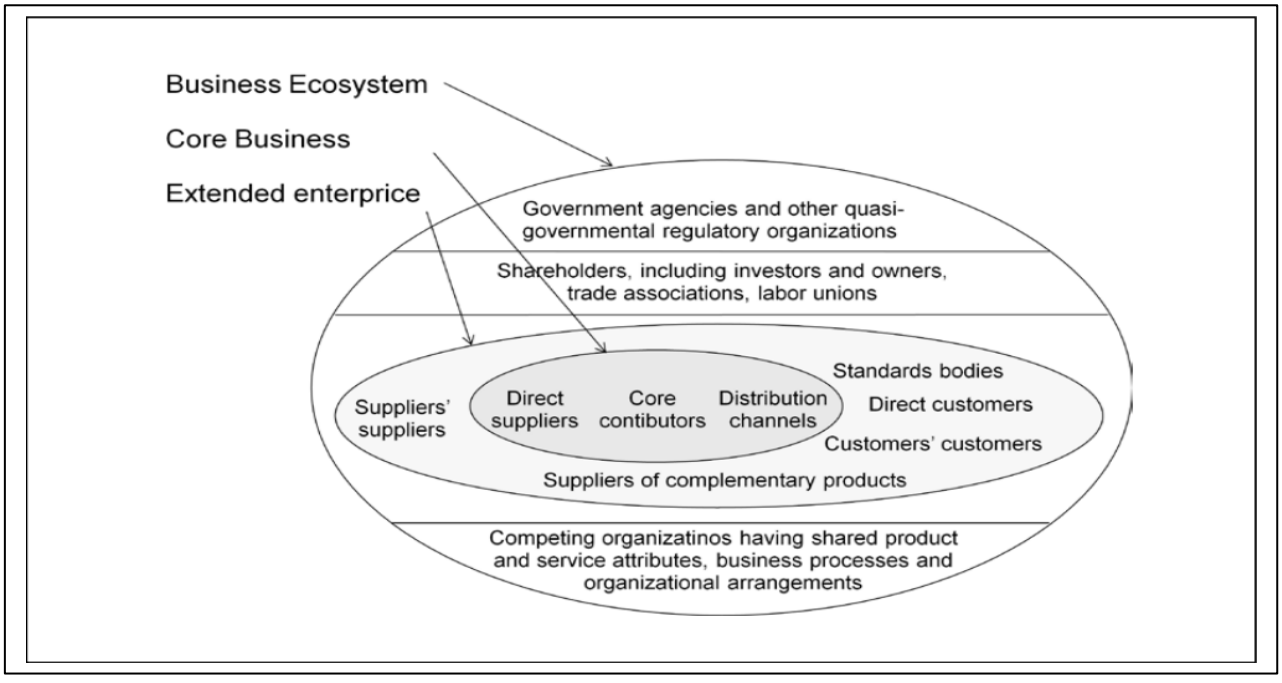


Figure 13: Business Ecosystem (Moore, 1996)

Ecosystems can co-evolve in a structural level in addition to species, roles and functions, Nachira et.al. (2007) illustrated a DBE structure by coupling both Business Ecosystem and Digital Ecosystem forming a dynamic innovation ecosystem, which as mentioned earlier, is a continuation for Moore's structure of the Business Ecosystem.

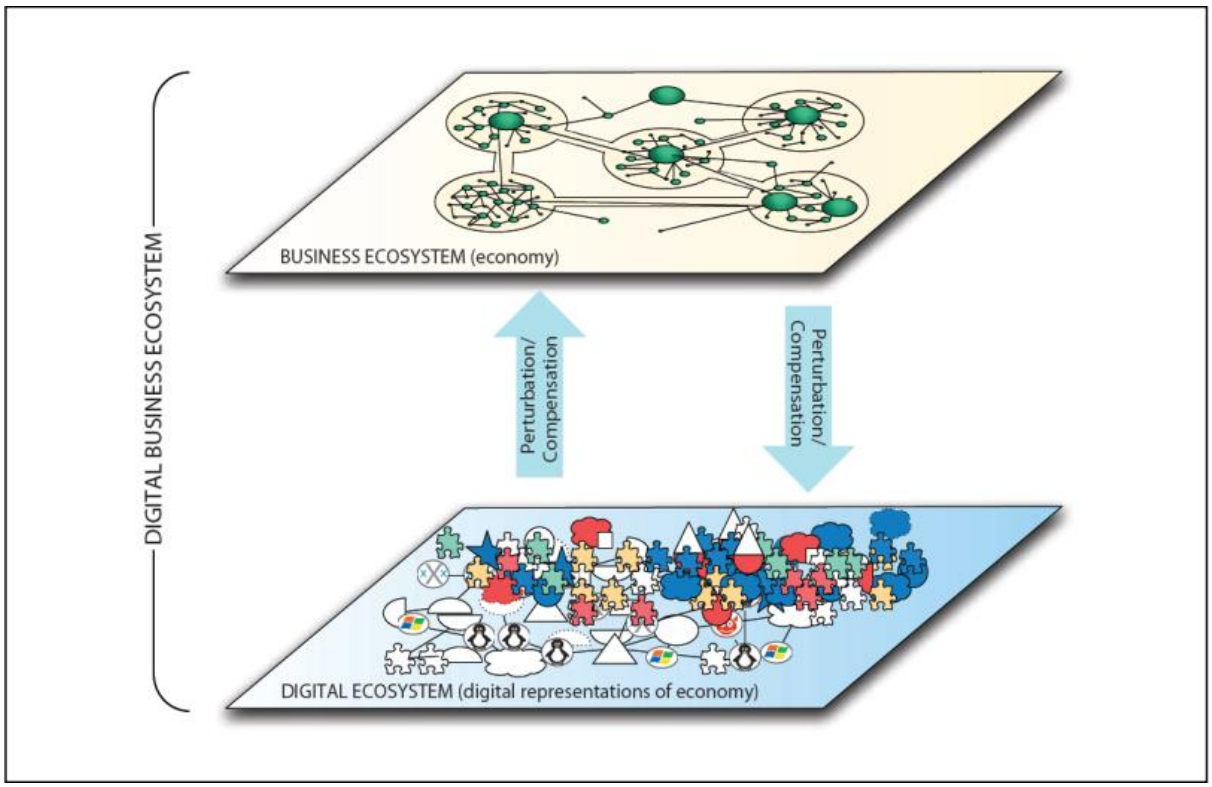


Figure 14: Digital Business Ecosystem (Nachira et.al, 2007)

1. Creating a Business Ecosystem

Business Ecosystem creation can be in two different cases, the first one being the creation of whole new Business Ecosystem (through a new industry or market, by value creation), and the second is recreating the existing business ecosystem process based on a proposed and already-existing business environment.

First. A new Business Ecosystem

To create a business ecosystem, generally there are two fundamental components, the value creation and the value sharing, the first one is responsible for attracting new members to the ecosystem for its growth's sake (innovation is also a value creation), the later one is a self-explaining component which means to share value within the ecosystem.

A. Value Creation

Iansiti and Levien (2004) called value creation as "operating leverage" in ecosystems, which can be defined as innovation that gets obtained by the development of physical, intellectual and financial assets.

There are multiple value creation theories in literature, a couple of the most known ones will be presented.

The disruptive innovation theory by Christensen et al. (2004) introduced a two-ways method that a disruptive innovation can occur in. The first disruption opportunity (the low-end disruption) is in reforming the market by presenting a comparative straightforward product when the market's products are "too-good" and are overpriced compared to their value for the consumer. The second disruption opportunity occurs when a product is inconvenient for the user due to its centralised settings, deep expertise needed to use or great wealth. The disruptive

product targets the characteristics the markets products lack the most, such as ease of use as the main value proposed. (Christensen et al., 2004)

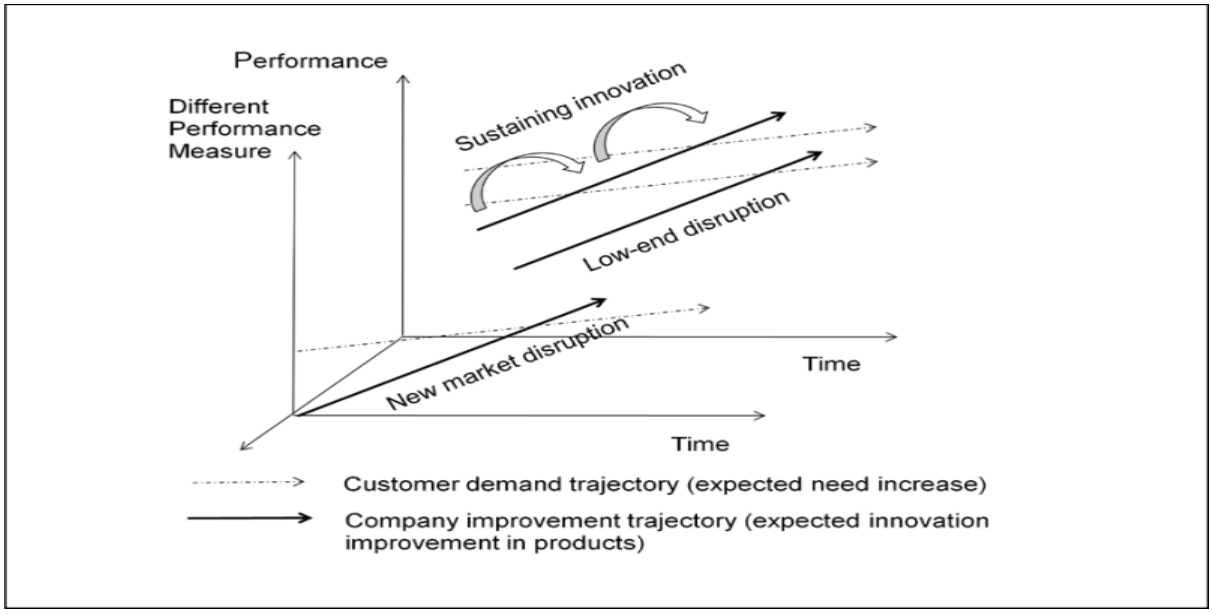


Figure 15: Disruptive Innovation Theory by Christensen et al. (2004)

The solid lines demonstrate company upgrading trajectories in products and services which are the anticipated incremental innovations executed to products. The dashed lines (customer demand trajectories) demonstrate how customer demand and needs escalates over time, determined in performance and feature requirements.

The Black Swan theory, which is not a management or business-exclusive theory is a well-known theory amongst multiple disciplines, its premise is that, "just because most of the swans are white, does not negate the existence of a black swan", from a value creation standpoint the theory proclaims that since the world is tremendously complex, we systematically ignore occasions, and get derived by widely held assumptions and beliefs, but this does not negate the existence of a value creation opportunity. This theory did not get adopted by a particular researcher, rather than the concept was discussed by many such as Bayon (2008) to induce people challenging laws to create new ecosystems. (Marko Karhiniemi, 2009)

B. Establishing the Ecosystem

Moore (1996) suggests a targeted learning cycle to foresight what is involved and emerge in an evolving new business ecosystem. The directed learning cycle is an accelerated method to test with the creation of economic value that involve: new ideas, action and experimentation, grasping value for customers and investors, and finally, exposing what has been created

According to Gawer and Gusumano (2008), it is suggested to establish a set of strategic options from business and technology perspectives. The technology actions should consider solving essential "system" problem, easing exterior companies' provision of adjuncts, keeping intellectual property closed on the entrails of the technology, upholding strong interdependencies between platform and complements. For the business actions, generating and conserving complementors' stimulus to contribute and innovate, defending main sources of income and profit and preserving high switching costs to competing platforms.

The establishment of Business Ecosystem requires strategic paths with certain actions, these strategic options get divided into 3 main categories with each one is specific for a particular reason, the core strategic options (gets chosen in the establishment phase); strategic options for the "promise" of the ecosystem (serves the purpose of sharing value in the ecosystem); and strategic options for the management of the ecosystem (used to manage the ecosystem). (Marko Karhiniemi, 2009)

Iansiti and Levien (2004) commented on the core strategic options, saying that it depends on figuring-out about the foundation of: an architecture (which is the boundaries between organisations, products and technologies); the integration (how collaborations across the boundaries are done); and market management (how organisations complete transactions across boundaries in the complex market dynamics).

The set of strategic selections can vary based in the vision and intent defined for the ecosystem, a strategic option set could be: number of chosen species and denoting their roles, co-evolution of other ecosystems (knowledge ecosystem, service ecosystem, etc), a level of permissible member diversity, a level of opportunity discovering versus leveraging clear resources, a level of favoured ecosystem evolution rate and openness versus closed in the ecosystem and towards another ecosystem. (Marko Karhiniemi, 2009)

C. Value Sharing

Value sharing is core principle in the business ecosystem, a responsibility taken by the Keystones as discussed earlier, it is not a question of should the species share value with each other, or how much of the value to share, it is a substantial operating challenge through a massive network of business partners with the aim of decreasing the cost of value sharing simultaneously with the growth of network's size.

To share value within the ecosystem there must be methods to follow. keystones, using such methods, focus on refining the global health of the ecosystem (performance, robustness, niche creation), the effective value sharing ways generally involve of robust platforms, easy-to-use APIs (Application Programming Interfaces), intellectual property licensing, shared operations, enabling software tools, and the likes. (Iansiti and Levien, 2004). As mentioned previously that business ecosystem strategy was divided into three sets of choices, the value sharing in an ecosystem is a fundamental part of the second set, the "promise" of the ecosystem set. The promise of the ecosystem is based on three major theories: openness versus closed by Shapiro and Varian (1999), network externalities (Bell laboratories in the 70s, Rohlfs 1974, Asvanund et al. 2004), and innovation diffusion by Rogers (2003).

The first theory, *openness versus closed* by Shapiro and Varian, is essential in networked markets in the information economy. In the compromise premise of this theory, the "open" part proposes higher compatibility over variety of products, quicker launch for products, lighter lock-in, availability of specifications, open APIs and the like. In the other hand, "close" choices provide compatible products of the same family, based on branded interfaces and standards, necessitates market power, investments, leaning towards supplementary resolutions and high value proposal over other solutions. Nonetheless, the later one can be easily managed because of its centralisation, though each solution has its benefits and drawbacks, the next figure present the relation between the two solutions.

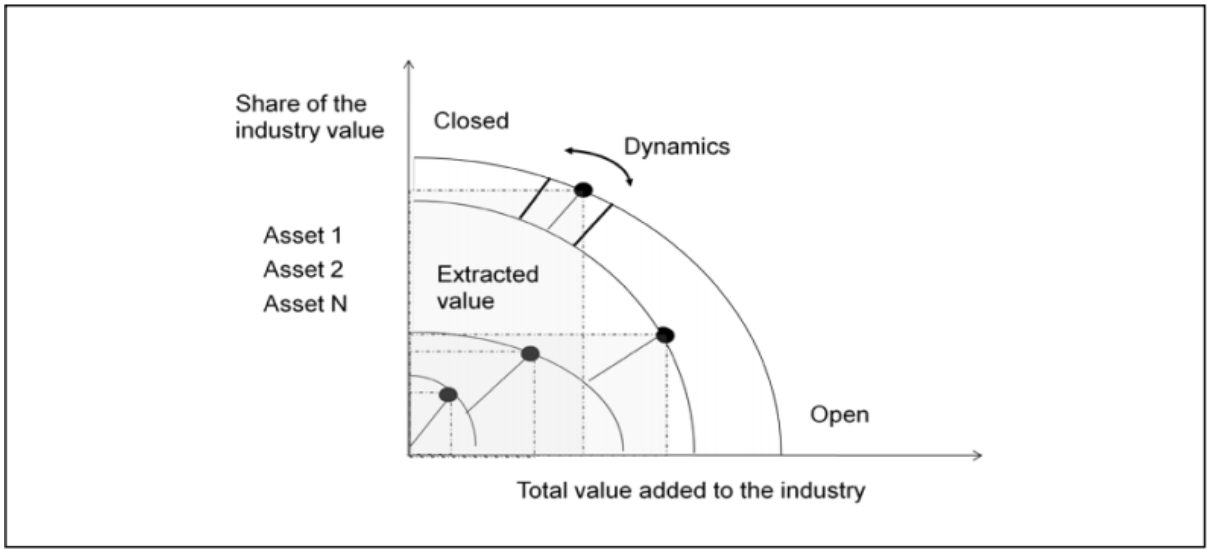


Figure 16: Openness versus Closed, Assets and Dynamics (Marko Karhiniemi, 2009)

The figure presents for each asset, which generally is related technology (API, development tool, interfaces in hardware or software), an appropriate strategy is chosen whether it was openness or closed strategy that is decided according to the desired lock-in, industry collaboration or compatibility between systems. However, choosing a certain strategy does not discard the ability to change it later from closed to open interface (that has three categories: member type interfaces, technical interfaces, and interfaces in a business case level) or vice versa, and that is demonstrated with the dynamics in the ecosystem. (Marko Karhiniemi, 2009)

A paper by Eisenmann et al. (2008), discussed the openness in the member type division at multiple levels, to search whether the participation is restricted at the demand side user; the supply side user: platform provider or at the platform sponsor level. The results are shown in the next table.

Table 2: Openness in Platforms at Member Type Level (Eisenmann et al. 2008)

	Linux	**Windows**	**Macintosh**	**iPhone**
Demand-Side-User (End User)	Open	Open	Open	Open
Supply-Side-User (Application Developer)	Open	Open	Open	Closed
Platform Provider (Hardware/OS Bundle)	Open	Open	Closed	Closed
Platform Sponsor (Design & IP Rights Owner	Open	Closed	Closed	Closed

Likewise, in the business case it is defined whether certain members are allowed to share information, subject to exclusivity, co-operating in research, joint-venture, regardless if certain general guidelines, suggestions, practices or values are to be followed. (Marko Karhiniemi, 2009)

The second theory, the network externalities theory, as each of Shapiro and Varian (1999) and Iansiti and Levien (2004) discussed, that it is deeply existent in business ecosystem, especially

in the information economy with each of the demand and supply sides. The theory discusses the idea of how the use of a product has an outcome on other user's value of the same product in the economy (as it also can have a negative effect on other's product value). This can be explained by the example of a telephone network where an increasing number of users grow each user's product value due to a wider reach of the telephones in the network. (Rohlfs, 1974)

In this ecosystem "promise" phase, the most noteworthy parts of creating network externalities lever are outlined. For example, it can be in an area of: end-users, who produce shareable content across network (ecosystem); developers who offer top-tier innovation to shareholders; innovative supply chain/delivery mechanism delivering greater economies of scale; or premium platform offering different ways to merge and connect assets for further leveraging (local network effects). (Marko Karhiniemi, 2009)

The third theory, innovation diffusion, starting from Roger's (2003) definition of innovation as an idea, practice or object that is perceived as new by the individuals. No innovation is equivalent to another, each has its own characteristics, those attributes are: relative advantage, compatibility, complexity, trialability and observability.

According to Rogers (2003), the Relative advantage is a subjective attribute that gives degree to which an innovation is considered as better than the idea it replaces and can be calculated in economic terms. Though, social factors, convenience and satisfaction are important determinants as well.

Compatibility is the degree an innovation is regarded as being consistent with the present values, past experiences and needs of the probable adopters. An incompatible idea with the present values and standards of a societal system will not be accepted as rapidly as a congruent one, since incompatible adoption regularly necessitates the prior adoption of a new value system, which is a slow procedure.

Complexity refers to the degree an innovation is regarded as complicated to comprehend and use. Some innovations can be easier to grasp by individuals which makes them easier and faster to embrace, while the concepts that necessitate new abilities and intellect are slower to adopt.

Trialability is the degree to which an innovation can be investigated-with on a restricted basis. The concepts that can be tested on current instalment mostly gets adopted quicker because of learning by doing, easier division, and lowering ambiguity about the idea.

Observability is the degree the results of an innovation are visible to others. The more visible it is, the more probable and simply innovations get implemented since visibility motivates peer discussion and innovation evaluation.

Beside the discussed theories, Iansiti and Levien (2004) proposed some efficient value sharing methods such as: robust platforms, easy-to-use APIs intellectual property licensing, shared operations, and enabling software tools. And in Marko Karhiniemi's (2009) view, he proposes in his thesis that in the ecosystem formation phase, the value should be shared by guiding and escorting information to the appropriate stakeholders and members fast, and that should be facilitated for the addressed persons in the business ecosystem structure, and can be slowed down in unwanted areas if necessary.

Delivering the information faster facilitates the distribution by decreasing uncertainty towards innovation, this facilitation necessitates profound analysis of the innovation and its suitability to members' intentions and plans, and requires also adopting some attributes, including awareness, principles of the innovation, attitude to innovation, information asymmetries, innovation diffusing culture, formal and informal networking, individual dissention (conflicting messages after decision), discontinuance (promote current innovation where new innovations in the same area emerge), and using appropriate communication channels to target multitude audience, groups or individuals.

Second. Recreating Existing Business Ecosystem

Before getting inro how recreating an existing Business Ecosystem happens, and what are its main phases, first, the reason why a recreation act is even considered should be addressed. One reason that is likely to occur is that the ecosystem promise known as its leveraged value creation proposal, has gotten mature, therefore the growth reducing down and logically needs to be invested in and renewed. Or change in the economic/ regulatory environment or customer preferences and behaviour, which requires a regeneration, with many other reasons that would cause internal or external disturbance, such as strong value proposals (technology, experience, and other assets), ecosystem instability (due to external or internal disturbances), or wild species, that would cause the ecosystem to become too inflexible.

For the recreation process, a lot of action is required, the analysis of the existing Business Ecosystem, creating new value from the existing activities, attracting new members from different other ecosystems, birth of new species and others cease to exist, even the ecosystem's structure is subject to change, however it does not vanish. This ecosystem recreation is applied through five phases (*find a new value proposal; adapt to the environment; adapt to the existing ecosystem; adapt towards competing ecosystems; and adapt to future insight*) in which, the first phase resemble value creation in contrast to phases in Creating New Business Ecosystems. While second phases fit with establishing ecosystems (core strategic options), furthermore third, fourth and fifth phases are similar to value sharing (ecosystem promise). (Marko Karhiniemi, 2009)

A. Finding New Value Proposal

Finding new value does not have a single right way, more so to recreate a business ecosystem and adapt it to the existing market, substantial number of similarities to the existing ecosystem's value proposal is needed, or else, creating a new Business Ecosystem is what should be considered.

Kim et al. (2005) discusses the fields that new value factors can be found in, and they are six: across alternative industries (not only direct alternates), across strategic groups (strategies of groups outside competitive clusters within the same industry), across chain of buyers (acquire new insight from former ignored consumers), across complementary products and offerings (release complementary products' and services' value), functional and emotional appeal to buyers, and across time perspective (look for insights in observable trends today).

Kim et al. (2005) and Christensen et al. (2004), proposed typical value proposal factors for the ecosystem that are based on available solutions, evolving technologies or other innovations to be pursued which can generate an uncontested market as Kim et al. (2005) called it, Blue Ocean.

And since the “rules of the game” are not set yet and the value is gradually created rather than clashed over, competition is not relevant.

B. Adaptation to the Environment

This phase deals with the core strategic options, they get framed, evaluated and picked. The core strategic options define how the decisions among choices (that are made in regional, regulative, political, ecosystems’ governance model perspective) affect future evolution and ecosystems’ living chances. The options are made in regional, regulative, political, ecosystems’ governance model perspective, and are examined regarding dynamics, co-evolution between ecosystems, the possibility for species variety in the ecosystem, highlight certain domains or build/tear down restrictions between technologies. (Marko Karhiniemi, 2009)

C. Ecosystem Promise Adaptation

The past two phases constitute the base as inputs for the rest phases: *adaptation to the existing ecosystem, adaptation towards competing ecosystem and adaptation to the future insights*, these three, form the promise of the ecosystem. So as to generate a new ecosystem promise and adapt it, the existing promise should be identified and analysed, and for analysing, Competitive Intelligence (CI) is an essential part for the process (likewise responsible for analysing in an upcoming part “Analysing Ecosystems”).

The new value proposal and core selections are product of analysing elements of key ecosystem parameters, key competitive assets, current roles and strategies, and future insight. After investing and comparing, Marko Karhiniemi (2009) asks several questions: what are the key competitive assets that can be used in the new value proposal, which are to be changed, substituted or totally removed? Are the species, roles and structures appropriate for the new value proposal? What can the parameters expose from existing ecosystems strengths and weaknesses? How open should the ecosystem be towards different members? How to ensure great customer access for ecosystem members? And many other questions, to express how vague and unclear the ecosystem domain still is.

D. Adaptation to the Future Insights

For the sake of attracting upcoming members to the ecosystem, a relation between the previous ecosystem and the new and attractive new value proposal is needed, and that is what the future insight adaptation all about, it focuses on linking between existing, new and possible future promise. Moreover, there should be relations in a business-case level, for instance, with contracts, methods and common tools. Adaptation with the future insights expands on the present state of the ecosystem concerning switching costs and evolution. Those switching costs are developing regarding the evolution of the ecosystem as well the experience of new products, innovation, and other member activities, which can open up new market gaps and occasions for the future. (Marko Karhiniemi, 2009)

After learning about business ecosystem and how to create a new Business ecosystem or recreate one, the next step is digitalising that ecosystem. Next sub-chapter will discuss digitalisation and how to implement it.

Sub-Chapter 3: Digitalisation

1. What is digitalisation?

Legner et.al. (2017) differentiated between digitisation and digitalisation, he defined digitisation as the technical process of converting analogue signals into a digital form, whereas digitalisation is the process of adopting digital technologies in wider individual, organisational and societal setting. Bharadwaj et.al. (2013) defined it as a formulated and implemented organisational strategy by using digital resources to create added value, this definition touches the strategic part of the organisation to benefit from the digital transformation which indicates that it is a strategic level decision to adopt the system.

Henriette et.al. (2015) indicates that it is: "a business model driven by the changes associated with the application of digital technology in all aspects of human society".

Hess et.al. (2016) explains that it is related to the adjustments to the business model of a company owing to digital technologies, leading to adjusted products, organisational structures or in the automation process.

(Lucas et.al. 2013, as in Morakanyane, R et.al. 2017, p. 434) interprets it as a "fundamentally altering traditional ways of doing business by redefining business capabilities, processes and relationships", the given definition is the one adopted in this research as it includes key components that will get addressed later.

2. What are its Characteristics? And What are its Drivers?

To address digital transformation' (or digitalisation) characteristics, improvisation was the only option due to the lack of clear and explicit information in multiple resources used in this research, from the definitions used in this research, limited characteristics could be extracted such as redefining and transformative, whereas Morakanyane, R et.al. (2017) added some, as radical, disruptive, evolutionary, continuous and complex.

Drivers of digitalisation are attributes that drive the process to happen, Ezeokli et.al. (2016) listed some of the drivers: customer satisfaction, amplified business agility, increased employee productivity and competitive advantage, new revenue growth, etc. While some may find these drivers are all what digitalisation needs, Kane et.al (2015) argues that in addition to digital technologies, other factors are needed such as digital capabilities, strategies, culture and talent development.

3. Digital Transformation Viewpoint Perspectives

Mark Skilton (2016) presented a new perception for what digitisation is and what are its viewpoints, he initiated it by saying that Digitisation changes the physical and virtual locational space dimension and the time, and called it Temporal Dimension. The clarifying example he gave was, "the physical location you are in while reading this page may be connected to other virtual locations through the internet. You can read this in the present, but you could also access past pages or find information not on this page by searching the internet. In this sense the digital experience is different from the physical one in that space and time are a convergence of physical and virtual environments". This represented a new mindset for the emerging impact of

new digital systems architecture, he defined it as the spatial, temporal, and contextual (STC) dimensions of the digital workspace.

Before discussing the STC dimensions, Mark Skilton gave a proper definition for the Digital workspaces: “Digital workspaces are digital platforms that support a multi-layered set of capabilities that are specific to each enterprise”. (Mark Skilton, 2016, p 98)

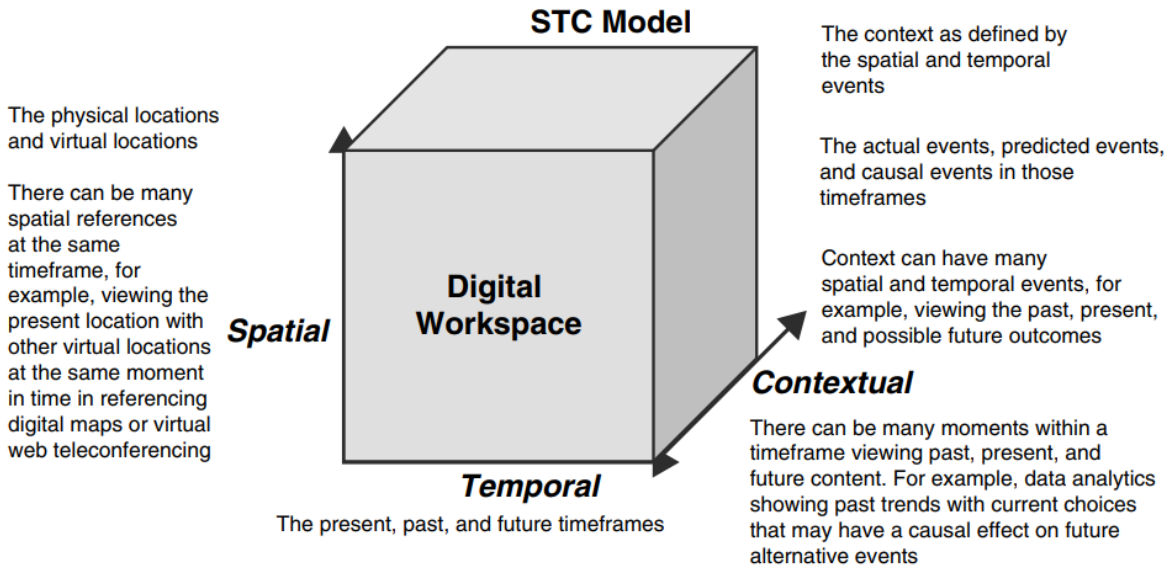


Figure 17: Field of view of an STC – spatial, temporal, contextual – model, (Mark Skilton, 2016, p 82)

First. Spatial Field of Information View

Considered as the simplest concept of digitalisation, brought by the growth of data, connectivity of the devices and the huge scale of the internet infrastructure. Information can get digitally diffused to almost any physical location (called the network effect), means the virtualising of physical locations and their information.

Mark Skilton (2016) presented a special information field of view figure to deliberate the new view for information we can gain, inspired from the satellite navigation and multimedia broadcasting than fuse physical and virtual location data into a mutual perspective with a distinct orientation, this would change the spatial information from first-person viewpoint to the third-person perspective for a wider viewing information field that contains markets, communities, and global events.

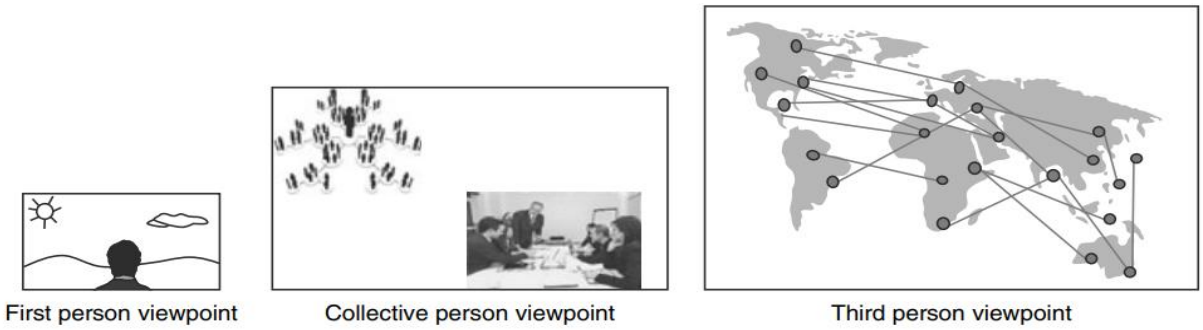


Figure 18: Spatial views of view ((Mark Skilton, 2016, p 83)

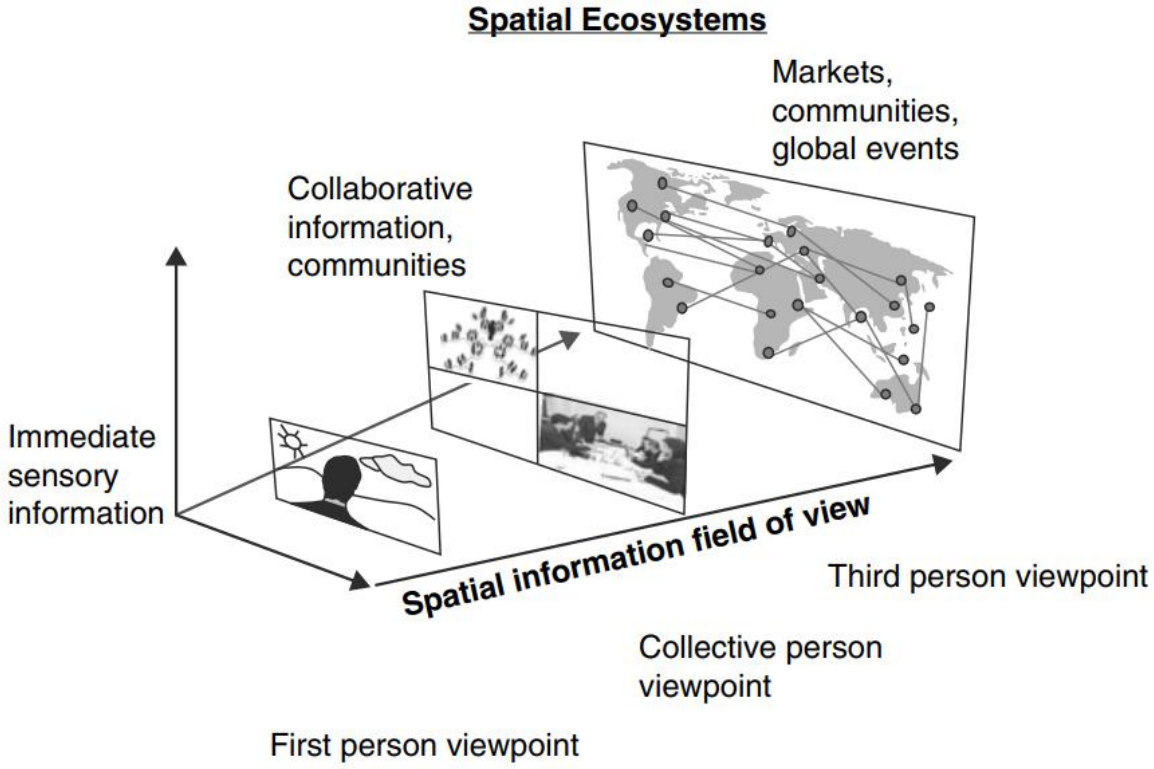


Figure 19: Spatial information field of view (Mark Skilton, 2016, p 84)

Second. Contextual Field of Information View (Semantic)

The semantic information field of view is capable of spreading physical information in a contextual state comprising collective intelligence and amplified or artificial intelligence illustrating new forms of semantic information that are produced in the digital ecosystem. And that is with the help of Spatial Information to see different sets of information and contextualising each set combining different sources of information. Moreover, with digitisation of information from the physical data, new terms emerged, with the "metadata" that describes information about other information, and using sensors and data analytics, new arrangements of metadata concerning assemblies of names and actions of communities gets gathered. Also, the "Hyperdata" term that define larger set of information standpoints, combine data and information from wider sources, locally and globally, to enable large-scale population analysis. (Mark Skilton, 2016)

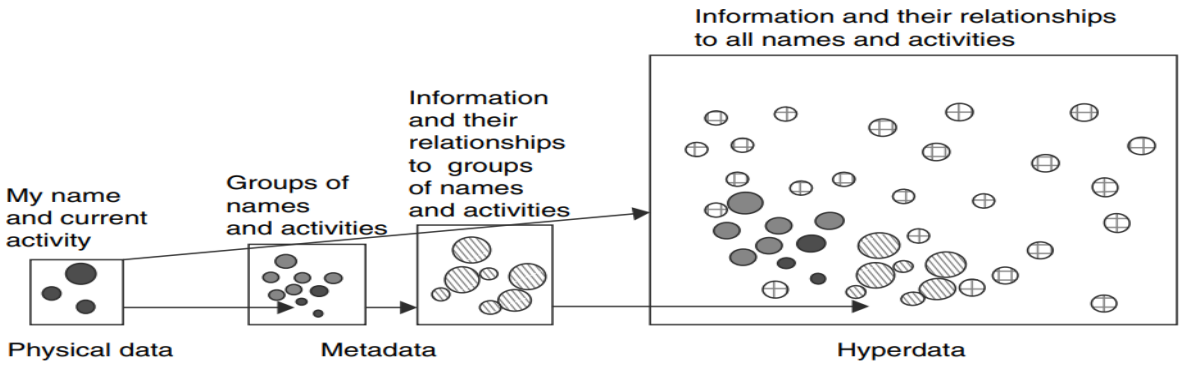


Figure 20: Physical data, metadata, and hyperdata, (Mark Skilton, 2016, p 85)

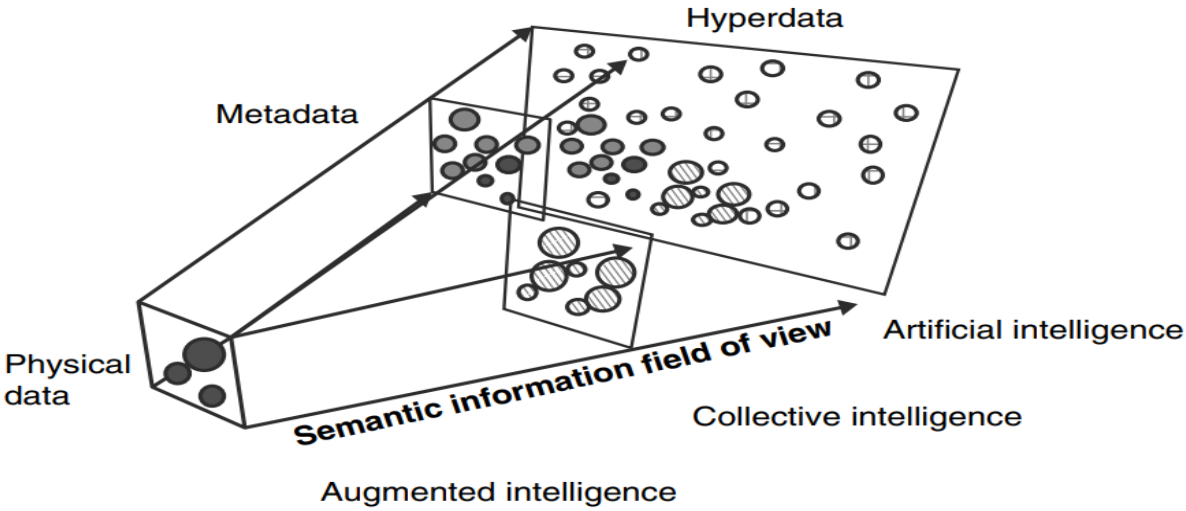


Figure 21: Semantic information field of view, (Mark Skilton, 2016, p 85)

Third. Temporal Information Field of View

Mark Skilton (2016) gave some demonstrating examples to help understand the temporal field view of information, by explaining the relation between the human and time, because even that humans live in the present, they can remember the past, and speculate to some degree the immediate future. And with digitisation of information, past information can be preserved and documented, and forecast or even affect the future. Additionally, contextual content (like videos, discussions and decisions) in the digital content can be created, preserved and taken with you on mobile devices or social network and get back to it like a time loop into the present, which makes it co-existent with its owner, while also having the ability to simulate future conceivable outcomes.

As known, there are always restraints in availability of everything, that necessitates to have a foresight and hindsight ability (as mentioned in the previous chapter) mainly because of digitisation of moments, events, and services.

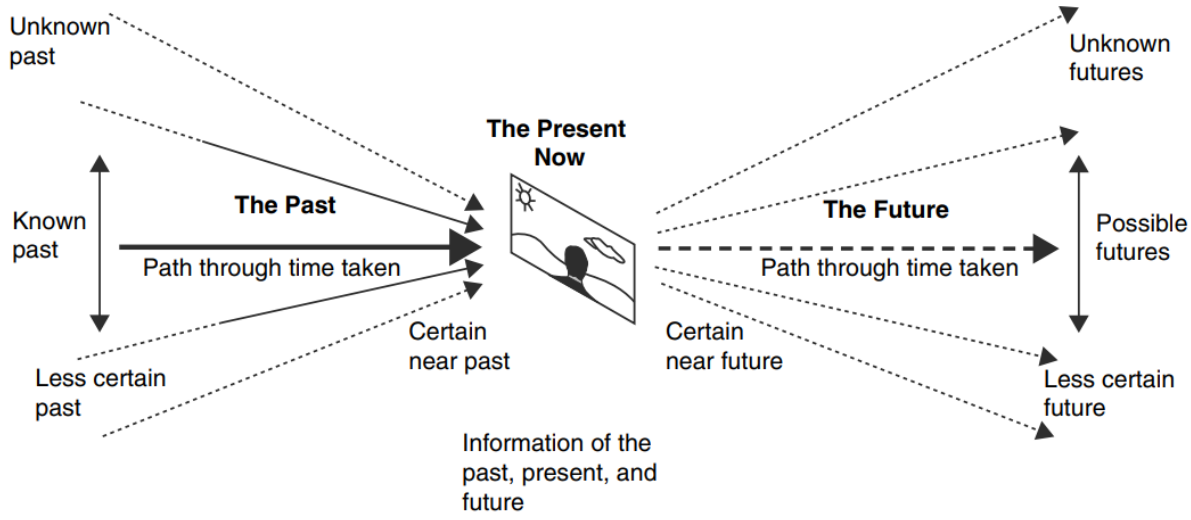


Figure 22: The present now, pasts, and futures, (Mark Skilton, 2016, p 86)

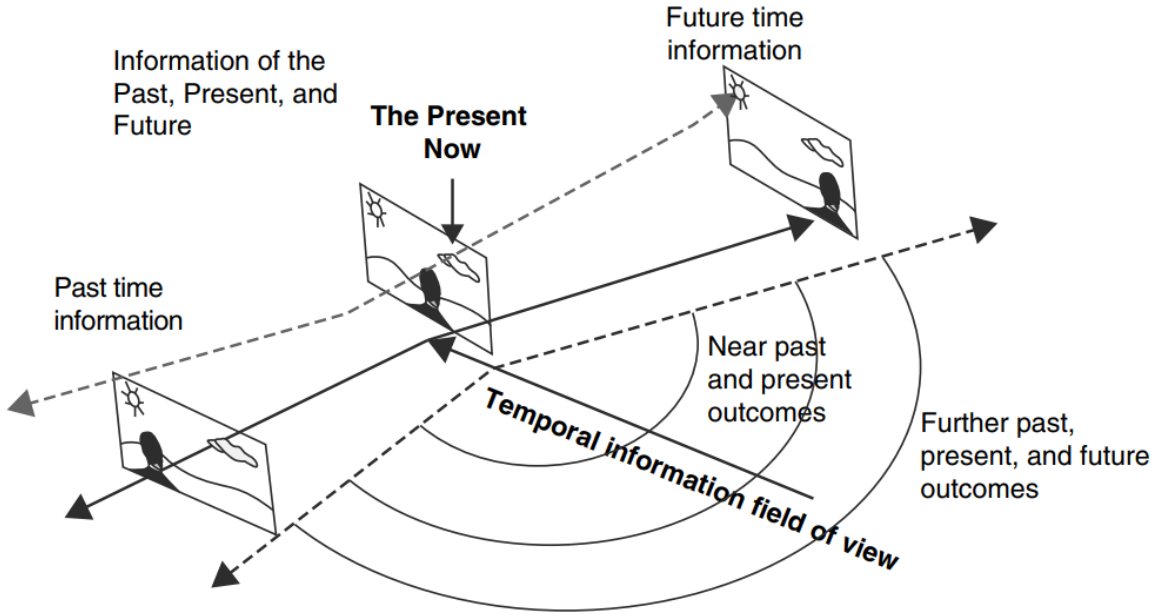


Figure 23: Temporal information field of view, (Mark Skilton, 2016, p 87)

4. Digital Business Transformation process

After learning how to form a new Business Ecosystem in the last sub-chapter, and discovering the different digitisation transformation perspectives in the last part, this part's objective is to digitise the business ecosystem to form it into a Digital Business Ecosystem.

This thesis's perspective is that in order to form a DBE, there has to be a Business Ecosystem, whether it is newly formed or recreated as discussed in the last sub-chapter, then apply the business digitisation process on the different species that form the Business Ecosystem, which then make it a DBE.

Experts in the business world agree that adopting technology is not what digitisation is all about, but rather to properly implement it, a radical strategic and cultural change is needed in the organisation (Von Leipzig et al. 2017), that both levels, individual and organisational levels are required to comprehend the strategic imperative after any digital addition and transformation

attempts (Kaufman & Horton 2015). What Von Leipzig et al. (2017) described, and many other researchers addressed is what a digital transformation process needs, a digital transformation strategy (also known as digitisation strategy).

Singh & Hess (2017) defined digital transformation strategy as an all-embracing and company-wide strategy that guides the organization in its entire digital transformation journey, moreover it touches on the opportunities and dangers related with the enabling digital technologies. Since it is an overarching strategy, it requires various alignment mechanisms, the alignment with the business strategy, and the alignment with other operational strategies to link between various strategy levels within companies (Kaufman & Horton, 2015). Because of the multidimension nature of the digital transformation that include digital activities and modifications to products, services and business models, digital transformation strategy should have a broader design, and should continuously reassessing towards their assumptions. (Matt et al. 2014).

From the fore-mentioned characteristics and the alignment mechanism earlier, the digital transformation is positioned in the business strategy level, that gives it the capability to integrate the numerous opportunities that the digital environment and the available digital technologies present. (Sebastian et al. 2017)

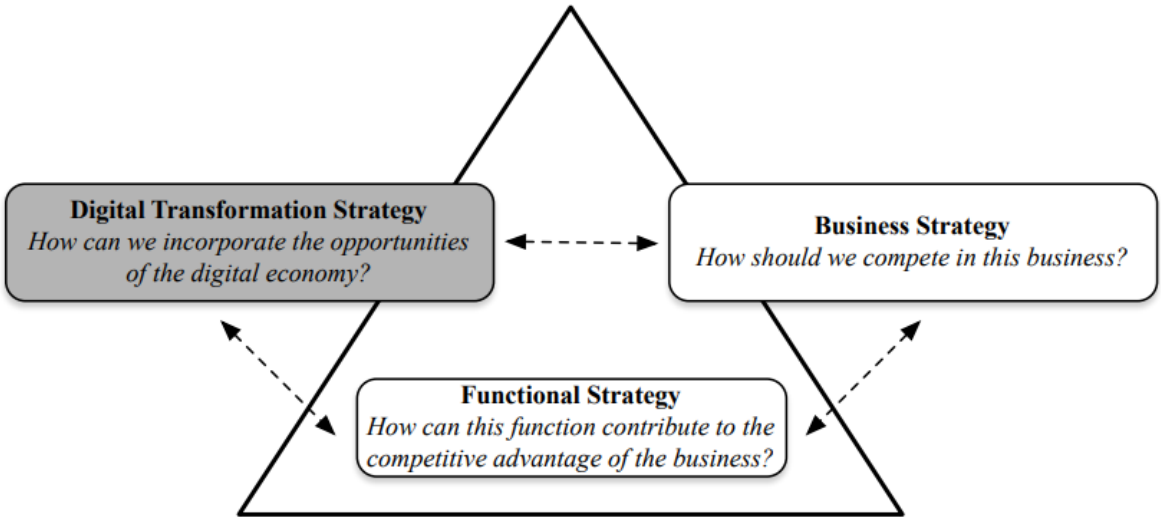


Figure 24: Positioning Digital Transformation Strategy, Mariam H. Ismail et al. (2017) p. 15

First. The relevant decision areas

Mariam H. Ismail et al. (2017) made a list of the relevant decision areas for appropriate strategic decisions in terms of digital transformation strategy, summarised and categorised according to the strategy level that is addressed.

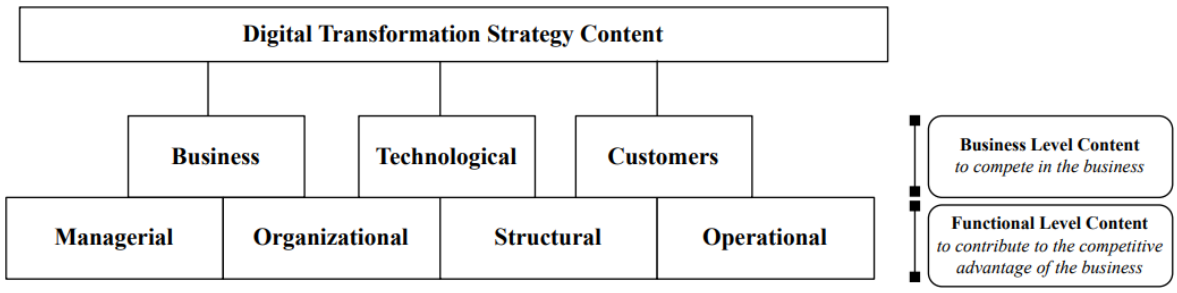


Figure 25: Digital Transformation Strategy Content, Mariam H. Ismail et al. (2017) p. 16

Second. Strategy phases

Table 3: Phases identified in Digital Transformation Frameworks, Mariam H. Ismail et al. (2017) p. 23

Phase	Description
Initiation	Understanding digitalization opportunities, threats and impact
Ideation	Imagining transformation dimensions as options for the business
Assessment	Evaluating digital readiness levels and identifying gaps
Engagement	Communicating the vision and integrating the necessary people
Implementation	Proceeding with the action plan in various domains
sustainability	Validating and optimizing the action plan continuously

Mariam H. Ismail et al. (2017) gave a six distinctive phases transformation strategy that are universal for all frameworks. The framework they gave is simple and self-explanatory, and no further explanation is needed.

Chapter Three: Case Study

Sub-chapter 1: Presenting CILAS LAFARGEHOLCIM

1. ABOUT LAFARGEHOLCIM

The global leader in building materials and solutions serving masons, builders, architects and engineers around the world. The Group produces cement, aggregates and ready-mixed concrete used for constructions as varied as affordable housing, complex infrastructures from a technical and architectural point of view. LafargeHolcim is a leader in all regions of the world, employs around 90,000 people in more than 80 countries and has a balanced geographic presence between developing and mature markets. Small local projects or projects.

First. Activity

With a capacity of 2.7 million tonnes per year, the Biskra cement plant started its activity in July 2016. Located 400 km from Algiers, it meets the needs of the cement market in the South of Algeria. This is the most recent plant built by Lafarge Holcim.

The Biskra cement plant is driven by the CILAS company, 51% owned by the Industrial Souakri brothers' group, an Algerian private industrial group, and 49% by Lafarge Holcim, in accordance with the 51/49 rule applied to foreign investments in Algeria. The investment cost amounts to 35 billion Algerian dinars, intended to supply the cement market in southern Algeria.

Built in 21 months, it shows excellent results in terms of health & safety, with 5 million hours worked without accident.

This cement plant benefits from the most advanced production technologies with a strong focus on customer service and the environmental footprint:

- Grinding operations carried out with the largest vertical crusher in the world.
- Fully automated bagging and palletizing to better serve customers.
- Efficiency energy consumption significantly improved compared to an equivalent plant:
    - -20% gas consumption thanks to the use of a pre-calcination tower
    - -35% electricity consumption thanks to the use of vertical mills
- Reduction of the environmental footprint (water, noise, dust)
- A factory design designed to protect the health and safety of employees

Second. Location

- Cement plant located in Hammam Sidi El Hadj, municipality of Djemorah
- Distance clay quarry (Oued dieb) / Factory 10 km.

Third. Vision

To be the benchmark cement plant for the southern Algerian market. And to be the company at the forefront of the building materials sector.

Fourth. Strategy

Aim for operational excellence across the entire chain of Value:

- Produce 2.7 MT / year Bulk and Bag

- A Customer-centric organization
- Logistics: Bulk delivery and palletized bags to reduce costs and delays for our customers
- Create shared value for all of our stakeholders.

The strategy aims for operational excellence across the entire value chain, by:

- Innovation as the main engine of growth, offering innovative solutions to meet the needs of our customers is a pillar of our growth strategy. the Construction Laboratory "CDL Rouiba" supports our customers every day in the implementation of our unique solutions.
- Continuously improving our performance, working to increase efficiency at all stages of production, this constant optimization of operations aims to always better serve the customers. The world-class “POM 2.0” operational system has enabled production in Algeria to increase by 4 MT / year over the past 7 years with the existing tool, i.e., the equivalent of a new cement plant.
- For transformation, the goal is to raise people to their best level and protect everyone working for the operations. the continuous actions in terms of Health & Safety have made it possible to divide by 6 the number of accidents with lost time in 6 years.
- Investment, more than 2 billion USD of assets in Algeria and more than 74 billion Dinars invested in this day.
- Commitment to sustainable development, the goal is to create value for all of stakeholders while reducing environmental footprint.

Fifth. Activity & Strategy

The construction sector has been growing since year 2000, with significant needs for construction materials and construction solutions. LafargeHolcim Algeria is present throughout the value chain of construction materials "cements, road binders, special cements for hydrocarbon wells, mortars, aggregates, concrete, plasters, bags and distribution" through different business models.

LafargeHolcim is strongly committed to the economic and social development of Algeria employs 2000 country staff.

Sixth. Mission & Objectives

The mission is to help increase national production and to have the best Solutions & Services offer for our customers. Objectives vary to offer an unrivalled Solutions & Services offering that allows to build sustainably faster, more beautiful and less expensive. Organize and promote the transfer of know-how locally. Have a positive societal footprint. Bringing the end consumer closer to the producer by setting up an efficient distribution network: more than 500 distributors cover the entire territory, 30 concrete plants, a BATISTORE building materials supermarket chain with a target of 100 points of sale by 2020.

Seventh. Priorities

- Health & Safety is top priority, ensuring a safe and healthy environment with a target of zero accidents for all of the parts stakeholders.

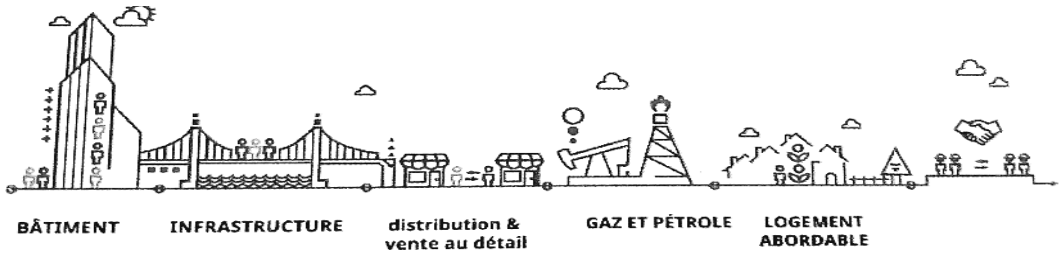
- The employees are the Group's main asset
- Sustainable performance, to be at the forefront of the industry by offering constructive solutions
- Collaborating, efficient Collaborating with communities close to the operations

Eighth. Values

- Client Build an organization and culture focused on markets and clients.
- Result Deliver objectives, within the framework of a rigorous execution.
- Integrity Create a working environment where compliance and respect for the rules guide the daily actions.
- Sustainability Show leadership in environmental management, be exemplary in exercise of responsibilities towards future generations.
- People offer the employees a diverse, inclusive and respectful work environment to promote individual achievement and collective performance

Ninth. Products & Services

The products vary from: cement, mortar, aggregate, concrete, plaster and roads for the customers, these products get used in multiple constructions as demonstrated in the next illustration.



Tenth. The organisations structure

Performance:
Promote the improvement of performance in the factory through the analysis of processes and products Presentation of existing structures.
Customer Support:
Ensure all the actions that accompany the loading of finished products.
Production:
Ensure the production, packaging and loading of finished products in quantity and quality to meet customer needs, on time and in compliance with commitments
Careers: Ensure the supply in quantity and quality of raw materials necessary for the manufacture of cement while guaranteeing long-term exploitation of the deposits.

Management Control:
To be the pilot of the budgetary process in the factory to guarantee the reliability of the data and their production over time.

Maintenance:
Ensure the best availability of equipment in the short, medium and long term.
Quality:
Ensure the implementation of the product quality plan in collaboration with the production manager and ensure product compliance at all stages of manufacturing, from receipt of raw materials to delivery of the finished product to the customer.
Stakeholders:
Define the strategies and action plans of the organization in terms of sustainable local development or in a more sectoral area (environment, education and ...).
Health & Safety:
Ensure short-, medium- and long-term regulatory compliance and excellence in health and safety.
Human Resources:
Ensure that the organization has the necessary staff for its operation and that these staff do their best to improve performance.
Safety:
Preservation of the safety, security of the plant, the safety of expatriates inside and outside the site. establishment infrastructure, customer safety,

Eleventh. The work tools

Client Support:

- SD6 software to manage operations and final product's changes
- PMS software to manage operations and raw materials changes.

Management Control: T-ONE software for management and budget monitoring.

Quality:

- AXIOM software for KPI's quality management.
- PACT software to present KPI's quality results.
- TIS software for quality analysis
- OPTIMIX software to calculate the raw material's raw recipe

Maintenance: MAXIMO software to manage maintenance operations

Production:

- TIS software for conduction and supervise equipment
- HLC software for equipment automatization

Purchase: T-ONE software to manage purchases

Health & security:

- BASE SALAMA software for health and security's audits
- ACARE software for the VPC lifts
- IZI software

Human Resources:

- WORKDAY software to manage the quarry
- KELIO software for pointing
- SAGE X3 software to calculate the payment
- MILLES tool to manage shifting

Quarry:

- QUARRY MASTER software to manage places of limestone change
- PMS software to manage raw materials' changing operations

Sub-chapter 2: Manufacturing process

The process this thesis will be covering is the cement manufacturing process, since it is the main product for CILAS and the one that include most of the chain. The process divided to six steps: Mining; Crushing, stacking and reclaiming raw materials; Raw meal drying, grinding and homogenisation; Clinkerisation; Cement grinding and storage; and lastly Packing.

1. Mining

The cement manufacturing process starts from the mining of raw materials that are used in cement manufacturing, mainly limestone and clays. A limestone quarry is inside the plant area and a clays quarry is as far from the plant area as 25 km. The limestone is excavated from open cast mines after drilling and blasting and loaded onto dumpers which transport the materials and unload into hoppers of limestone crushers. The clays are excavated from open cast mines and loaded onto dumpers which transport the materials and unload into open yard storage. Then it is transported by trucks and unloaded into the hopper of a clay crusher. There are three types of clay used in cement manufacturing, namely silty clay, Zafarana clay, and Kaolin.

Other raw materials are used to control the kiln feed mix design, namely sand, and iron ore. The sand and iron ore are transport from outside the plant (from different suppliers) by trucks and unloaded into open yard piles, called sand and iron ore piles.

2. Crushing, stacking and reclaiming of raw materials

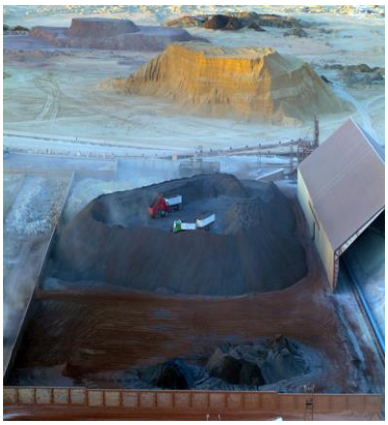
The limestone crushed in the first crusher called a jaw crusher and then fed into the second crusher called an impact crusher with mixing of clays to reduce particle size below 50mm. The discharged raw mix (limestone 70%, clays 30%) is fed onto a belt conveyor and passed across a bulk material analyser. The raw mix is fed into a circular storage unit called a raw mix storage. Then, the mix is extracted transversely from the stockpile by reclaimers and conveyed to a raw mill bin called the raw mix bin for grinding.

The other raw materials that are used in cement manufacturing, called additives, are high purity limestone, sand and iron ore. The high purity limestone is crushed in a lone in jaw crusher and then crushed more in a secondary crusher to reduce the size to completely pass through a 50mm sieve. Then, it is stacked by a limestone stacker into a longitudinal storage unit called the limestone storage stockpile. Finally, the limestone is extracted transversely from the stockpile by reclaimer and conveyed to a raw mill bin, called the limestone bin, for grinding.

3. Raw meal drying, grinding and homogenisation

The raw mix, high grade limestone, sand, and iron ore are fed from their bins to raw mills, called air swept mills, for drying and fine grinding. The raw mill contains two chambers, separated by diaphragm, namely a drying chamber and a grinding chamber. The hot gases coming from a preheater (preheater / kiln system) enter the mill and are used in raw mills for drying. Then the drying materials enter the grinding chamber of raw mills for fine grinding. The grinding chamber contains a certain quantity of ball charge in different sizes ranging from 30mm to 90mm. The hot gas and grinding materials mill outlet feeds to a separator which separates fine and course product. The latter, called reject, is sent to the mill inlet via an air slide for regrinding. The hot gas and fine materials enter a multistage "cyclone" to separate a fine materials and gases. The fine material, called raw meal, is collected from the multi-cyclone and then fed into an air slide for lifting called an Aeropol. The hot gases with very fine materials enter an electrostatic precipitator to separate the fine materials from gases. The very fine materials called preheater dust or electrostatic separator dust is collected from filters and fed into screw conveyors and are then mixed with the fine material in an air slide and transported to an air lift vessel via air slide. In the air lift, the raw meal is lifted to the silo by compressed air to the air slide and then stored and homogenized in a concrete silo. Raw meal extracted from the silo, now called kiln feed, is fed to the top of the preheater via an air lift called the Poldos for pyro-processing.

4. Clinkerisation



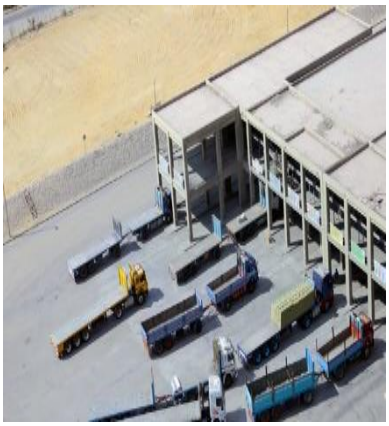
Cement clinker is made by pyro-processing of kiln feed into the preheater-kiln system. The preheater-kiln system consists of a multi-stage cyclone preheater with five stages, combustion chamber, riser duct, rotary kiln, and grate cooler. In the preheater, the kiln feed is preheated by hot gas coming from the combustion chamber and rotary kiln. Then the preheated kiln feed is partially calcined (made powdery) in a combustion chamber and riser duct and then completely calcined in a rotary kiln as well as heated to approximately 1400 C to form clinker components C3A, C4AF, C2S, and C3S. The main source of heat is natural gas. Natural gas is fired as a main fuel (100 %) in the main burner rotary kiln and a 95% natural gas and 5.0% heavy oil combination in the combustion chamber. The fuel is used to provide the heat required to convert the kiln feed into clinker. Hot clinker discharge from the kiln drops onto the grate cooler for cooling from approximately 1350-1450 C to approximately 120 C. In the cooler, the quantity of cooling air required for clinker cooling is extracted from the atmosphere by different cooling fans and fed into the cooler chambers and pressurized through the cooler plate and clinker bed. The cooled clinker discharges from the cooler into the pan conveyor and it is transported to the clinker storage. The clinker is taken from the clinker storage to cement ball mill hoppers for cement grinding. Part of the hot air extracted from the cooler is utilized as a secondary and tertiary air for combustion in rotary kiln and combustion chamber, respectively.

5. Cement grinding and storage

Clinker and gypsum for OPC, limestone for limestone cement, and slag for slag cement are all extracted from their respective hoppers and fed to the cement mills. The ball mill grinds the feed to a fine powder in two chambers, namely the first and second chambers. The two chambers have a certain quantity of ball charge of different sizes from 17mm to 90 mm. The mill discharge is fed to a bucket elevator which takes the material to a separator which separates fine and coarse product. The latter is sent to the mill inlet for regrinding and the final product is stored in concrete silos.

6. Packing

Cement extracted from silos is conveyed to the automatic electronic packers where it is packed in 50 kg bags and dispatched in trucks.



Sub-chapter 3: About the company's foresight and digital solutions

As mentioned in the first chapter of the thesis, the corporate foresight is responsible for two sides, the internal foresight, and the external one as detailed in the FSC model by targeting the "resources" stage in the internal and the external of the company.

1. The corporate foresight

For the research part, the definition of the corporate foresight by Rohrbeck was chosen as a guide to measure the foresight activities in the corporate, as Rohrbeck defined it as: "foresight activities in the corporate context are usually cross-functional with links to multiple functions including corporate development, R&D and innovation management, strategic management, and controlling. Foresight provides inputs to these functions by creating future insights that help to shape strategic directions, identify future risks, and explore future opportunities related to new products, services, or entire markets".

The thesis focused only on three functions of the corporate foresight: R&D, Strategic management and controlling, these were chosen because the appropriate information was found in the CILAS branch of Biskra, the other functions are centralised in the main branch of Algeria located in the capital Algiers.

The initial method used to measure the application of the corporate foresight in the company, was by comparing the three chosen functions earlier, between the set objectives of the company, and their realisation.

First. <u>Controlling</u>

As a core function in the company, the controlling function include many different objectives and indexes to measure the realisation. The controlling covers: the operational objectives; Health & Security; Environment; HR and many other sub-objectives.

For the controlling section, the company had multiple goals listed as:

- 0 accident
- 0 environmental incident
- 0 non-conformity quality
- 100% client's satisfaction in quality

- NOEE crusher > 90%
- NOEE Kiln > 85 %
- NOEE VRM > 85 %
- NOEE VCM > 85 %
- NOEE Expeditions > 65 %
- GIGO < 45 min / YIGO < 1h30
- Respect du budget FF

To measure those objectives, although the given realisation statistics are not complete compared to the objectives, the company gave us many of the realisation statistics, the next tables and charts are what the company presented.

A. The (Vertical Raw Mill) VRM Objectives:

- (Production Rate Index) PRI > 95%
- (Net Availability Index) NAI > 90%
- (Net Overall Efficiency Index) Net OEE > 85%
- Specific Raw electric consumption (SEEC) < 19 kWh/t.
- Specific Filler electric consumption (SEEC) < 20 kWh/t.
- (Mean Time Between Failures) MTBF > 125 h

<u>The VRM realisation:</u>

	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Cumul
Volume (kt)	251,0	168,2	258,4	190,7	215,9	102,4	201,7	237,9	173,7	269,7	275,4	127,3	2472,3
PRI	83,0	80,6	86,5	99,8	86,8	90,5	94,3	96,8	96,7	93,6	95,9	99,5	91,4
NAI	81,9	93,2	91,1	94,3	92,3	57,5	86,8	88,4	97,0	96,1	96,2	90,5	88,8
NOEE	68,0	75,0	78,8	94,1	80,1	52,1	81,8	85,6	93,8	90,0	92,2	90,0	81,1
SEEC	22,6	23,0	22,6	19,6	20,7	19,6	19,7	18,5	18,9	19,6	19,2	19,8	20,4
MTBF	14,7	15,4	14,3	15,2	15,8	15,4	15,6	17,5	18,8	19,5	20,1	20,5	202.8

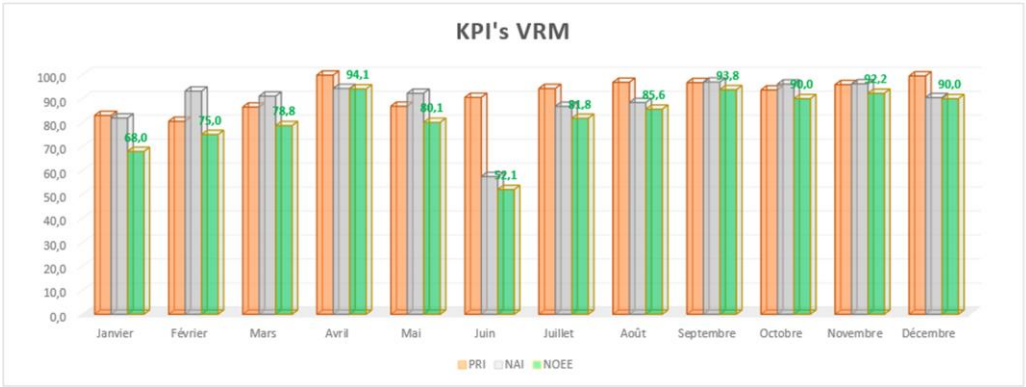


Chart 1: VRM realisation

From the table given, couple of notes can be perceived, as all objectives except the MTBF are not met in realisation, with the MTBF achieved with a massive lead compared to its objective.

The other indexes were not realised in the total year cumulate, however, for the individual count for each month, the first five months were the ones shifted the most from the objectives, with other months having an on-point realisations and others shifted also.

B. The (Vertical Cement Mill) VCM objectives:

- PRI > 95%
- NAI > 90%
- Net OEE > 85%
- SEEC < 39 kWh/t
- MTBF > 125 h

The VCM realisation:

	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Cumul
Volume (kt)	93,4	11,1	0,0	98,0	114,3	110,6	125,9	94,2	116,8	157,1	136,7	112,9	1171,1
PRI (%)	75,6	53,4	0,0	59,5	60,0	95,2	105,4	102,7	108,4	106,4	111,3	123,9	90,3
NAI (%)	59,5	10,3	0,0	65,3	72,2	90,3	86,3	93,0	87,4	90,1	85,4	72,4	68,0
NOEE (%)	45,0	5,5	0,0	38,8	43,3	85,9	91,0	95,4	94,7	95,9	95,0	89,7	61,4
SEEC (Kwh/t)	45,9	55,5	0,0	51,5	55,0	40,4	39,7	39,1	38,5	39,5	38,9	37,3	42,4
MTBF (h)	10,4	10,3	10,0	10,9	10,9	10,5	10,0	11,4	13,0	13,2	12,0	11,7	

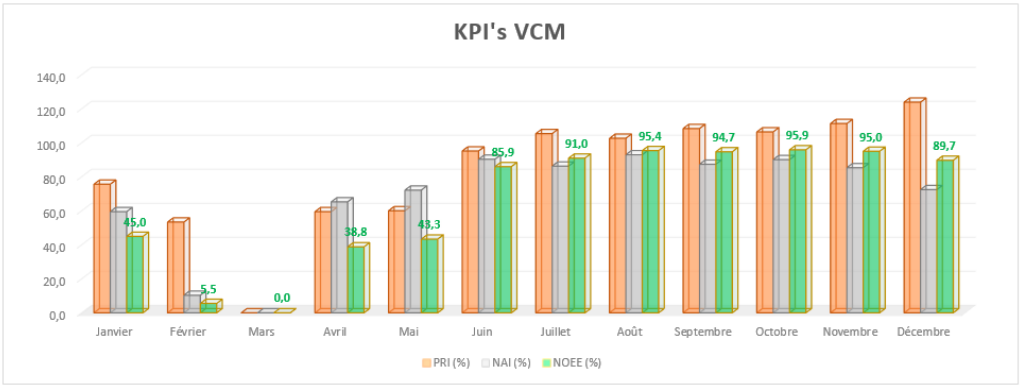


Chart 2: VCM realisation

For the VCM the overall performance is inferior to the objectives for all the indexes, due to some problems occurred in March, although for the other months, the indexes show a relatively good statistics for the marked objectives.

C. The Kiln objectives:

- PRI > 95 %
- NAI > 90 %
- Net OEE > 85 %
- Specific Electric Energy Consumption kiln (SEEC) < 23 KWh/t CK.
- Specific Thermal Energy Consumption kiln (STEC) < 3240 Mj/t CK.
- MTBF > 500 h

The Kiln realisation:

	Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Cumul
Volume (kt)	157,4	100,6	157,8	118,9	130,6	65,3	121,7	149,1	107,3	161,8	166,9	71,4	1508,7
PRI	95,0	89,1	98,2	99,4	88,3	100,0	92,4	95,6	96,9	102,3	104,0	105,4	96,9
NAI	97,2	73,8	98,3	72,5	86,7	40,0	77,3	92,9	98,3	94,0	98,0	89,0	85,0
NOEE	92,3	65,7	96,5	72,0	76,6	40,0	71,4	88,8	95,3	96,1	102,0	93,8	82,4
SEEC	24,4	29,7	23,3	25,5	24,8	25,2	25,0	24,6	25,8	24,6	24,8	27,4	25,2
STEC	3313,0	3598,6	3382,6	3262,3	3428,4	3293,6	3327,1	3180,4	3370,5	3340,7	3359,0	3431,7	3350,3
MTBF	86,0	86,4	92,1	93,1	114,1	133,6	129,1	131,2	156,8	156,7	130,0	123,5	

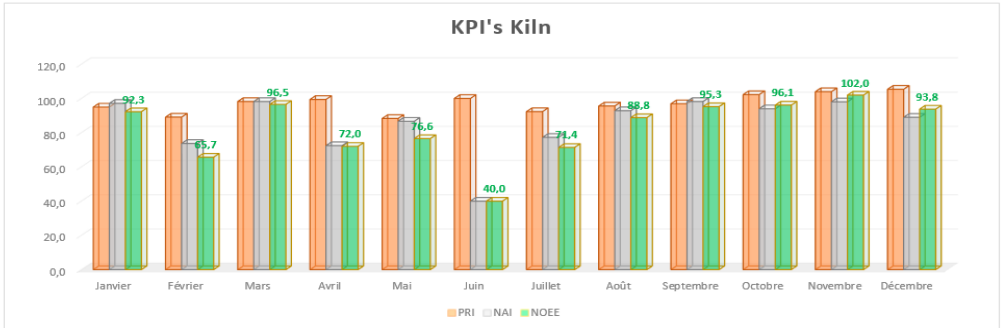


Chart 3: Kiln realisation

For the Kiln realisation, PRI index is the only benchmark achieved by the company, the rest is slightly shifted from the set objective.

D. The crusher objectives:

- PRI > 97%
- NAI > 93%
- Net OEE > 90%
- SEEC < 1 KWh/t

<u>The crusher realisation:</u>

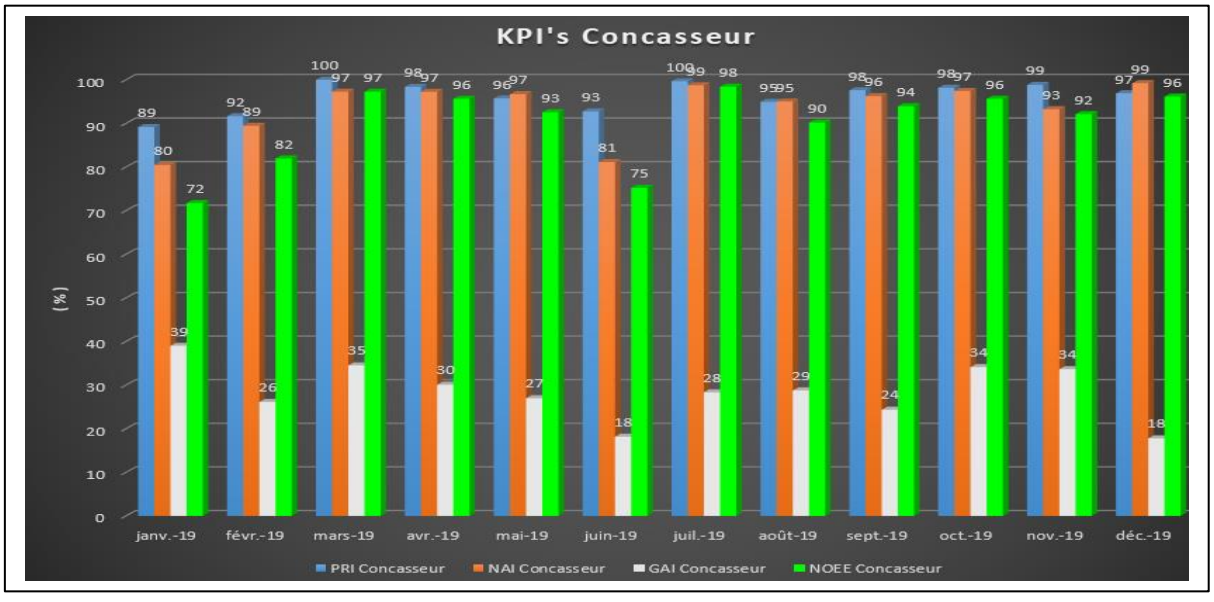


Chart 4: Crusher realisation

For the crusher (or the quarry) only the chart was given, after calculating the cumulation of each one, the next is the results:

PRI = 96.25

NAI = 93.33

NOEE = 90.08

From the results we can confirm that both NAI and NOEE objectives were achieved and surpassed, only the PRI that lacked due to the drop from the first month with 89% PRI only.

And those were the main controlling domain of interest, with the addition of more function such as water consumption, dust and gases emission, and housekeeping index.

Water consumption

Table 4: Water consumption

	Objective	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
pumped water (L/s)	**<10**	8	5.5	7.2	7.7	8.2	7.1	7.8	9.7	10.2	14.21	7.9	5.1	**8.2**
Consumed water (L/t CEM)	**<130**	229	146	122	211	192	171	195	275	234	242	154	121	**188**

Dust emission:

Table 5: Dust emission

	Objective	Jan	Feb	Mar	Apr	May	Jui	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
Kiln & VRM (mg/Nm3)	**<30**	65	123	188	198	2008	37	6.6	3.6	2.8	7.1	23	14	**72**
Cooler & VCM (mg/Nm3)	**<30**	11	17	23	17	18	15	6	1.5	1.8	8.6	11.7	4	**12.5**

Gas emission:

Table 6: Gas emission

	Objective	Jan	Feb	Mar	Apr	May	Jui	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
NOX (mg/Nm3)	**<650**	756	853	690	722	771	738	867	914	911	754	736	729	**794**
SOX (mg/Nm3)	**<45**	1.6	1.5	0.8	15	4.7	95	38	42	3	3	4.5	0.4	**19**
CO (mg/Nm3)	**<80**	59	59	68	72	74	71	63	65	55	59	56	25	**61**

Housekeeping Index:

Table 7: Housekeeping Index

%	**Objective**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
Crasher	**>90**	89	88	90	81	85	92	89	86	85	85	90	88	**87**
VRM	**>90**	92	95	93	97	95	96	95	91	93	93	96	90	**92**
Kiln	**>90**	96	95	95	92	90	92	96	94	96	96	92	95	**95**
VCM	**>90**	87	91	90	92	90	94	90	91	87	89	90	87	**89**
Expedition	**>90**	92	97	94	96	96	96	94	93	93	94	96	94	**95**

Second. Research & Development

For the Research & Development function, the CILAS branch has its specific laboratory, the main R&D lab is also centralised in the main branch in Algiers (Rouiba). Instead, because this thesis focuses on the CILAS branch, only few information was available.

As presented earlier to measure the company's performance in each sector or function, indexes are needed to compare the objective performance and the real one, in other words they are a benchmarking tool for the performance of the company, those indexes are called KPI's (Key Performance Indexes). The laboratory focuses on many aspects of the cement, quality is one very important task the laboratory is responsible of, each benchmark of the quality measuring has a specific KPI, that will be introduced next.

Compliance to product specification KPI:

The chart demonstrates the jump in performance in the case of product specification compliance in 2019 compared the previous year, with 95% as the set objective and 99.13% as the realisation.

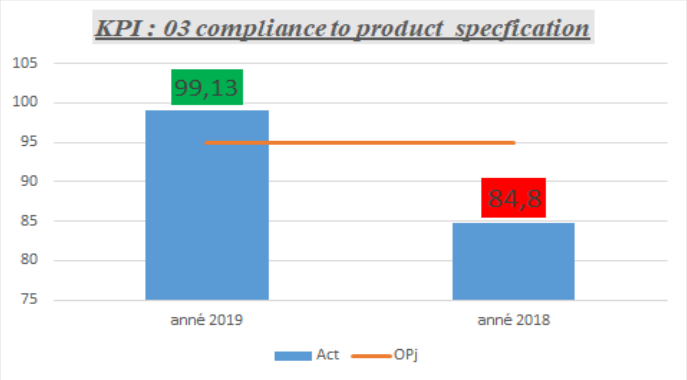


Chart 5: KPI 03 between 2018 & 2019

And the progress kept stable in 2020 too, as showed in the next chart:

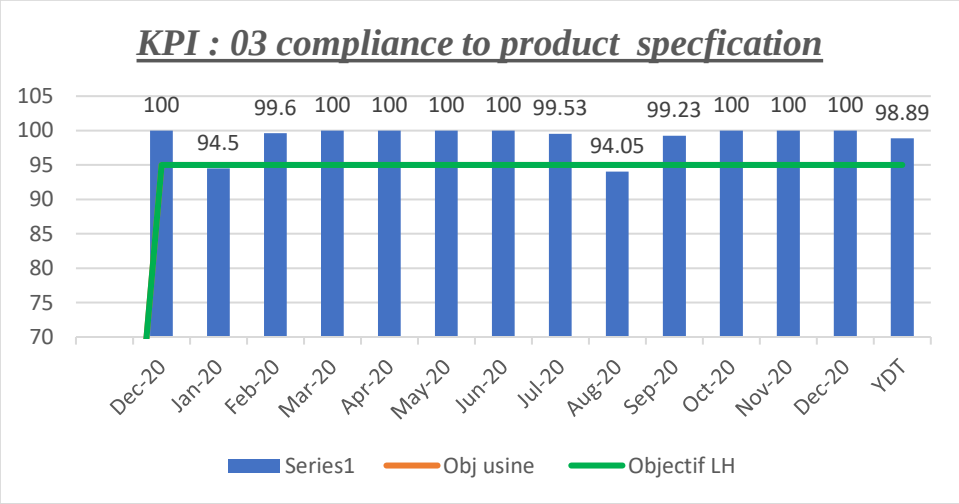


Chart 6: KPI 03 in 2020

Product Uniformity KPI:

For the product uniformity, both years KPI did not reach the set objective of 2.5, while also decreasing in 2019 to result 1.7.

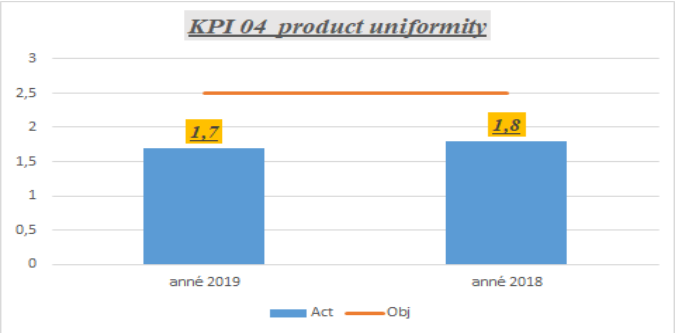


Chart 7: KPI 04 between 2018 & 2019

2020 also was not different, where the KPI for all products offered by CILAS did not meet the set objective.

Table 8: KPI 04 in 2020

	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	YTD / Total
Chamil	0.83	2.44	2.82	2.01	1.91	3.04	1.58	1.56	2.69	1.12	1.47	2.53	1.13	1.17
Matine	1.04	0.94	1.61	1.33	1.09	1.15	0.92	0.83	1.06	0.63	0.77	0.7	1	
Sarie	1.3	0.95	2.12	0.95	1.49	1.04	1.27	0.86	0.69	0.55	0.55	0.76	0.21	
Obj CILAS	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Objectif LH	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

Clinker Compliance KPI:

As easily observed, the clinker compliance got augmented from 2018 with 74.9 to 87.91 in 2019, even though, that was not the set objective which was 90.

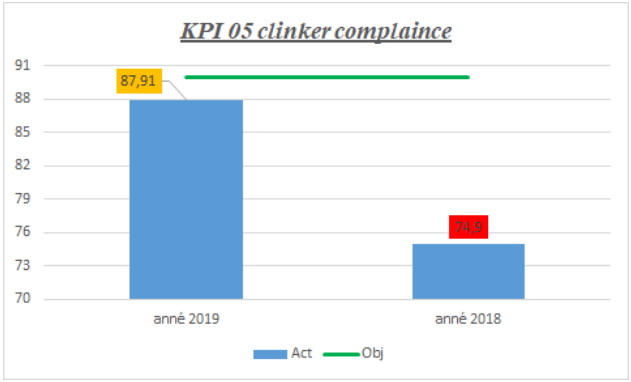


Chart 8: KPI 05 between 2018 & 2019

In 2020, the Clinker compliance augmented even more to 92.66, surpassing both the CILAS and LH objectives.

Table 9: KPI 05 in 2020

	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	YDT
clinker	80.39	80.44	89.82	92.42	98.52	97.15	96.96	95.06	94.96	92.95	96.91	97.16	92.66
Obj CILAS	85	85	85	85	85	85	85	85	85	85	85	85	85

Obj LH	90	90	90	90	90	90	90	90	90	90	90	90	90
Production	177722	98754.8	152610.8	88725	154169.6	166233.7	1624401.25	1095499.518	1340802.586	1585502.18	386100.29	159662.7923	1599000
Incuit	13446	8300	3587	488	554	0	920	1728	5014	6440	1000	1000	38800
%	7.57	8.40	2.35	0.55	0.36	0.00	0.57	1.58	3.74	4.06	2.59	0.63	2.43

Clinker Factor /Bulger KPI:

Although there was an increasing in the realised Clinker factor compared to the previous year 2018 of 97.8, but it did not reach the specific set objective of 100, almost achieving it with 99.93.

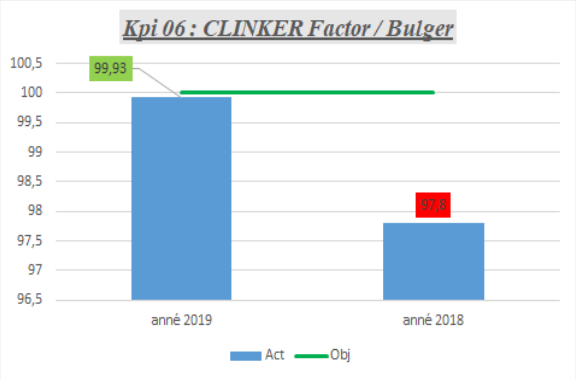


Chart 9: KPI 06 between 2018 & 2019

In 2020, the objective was achieved with 100.13 in the year cumulative.

Table 10: KPI 06 in 2020

	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	YDT
clinker factor / bulget	100.96	98.47	98.67	100.06	100.95	101.31	101.50	99.76	101.27	100.24	98.60	100	100.13
Obj CILAS	100	100	100	100	100	100	100	100	100	100	100	100	
Objectif LH	100	100	100	100	100	100	100	100	100	100	100	100	100

Laboratory accuracy index KPI:

for the given KPI, the objective of 95 was achieved in both 2017 and 2018, and even was surpassed in 2018, improving from 2016 that was at 84.2 only.

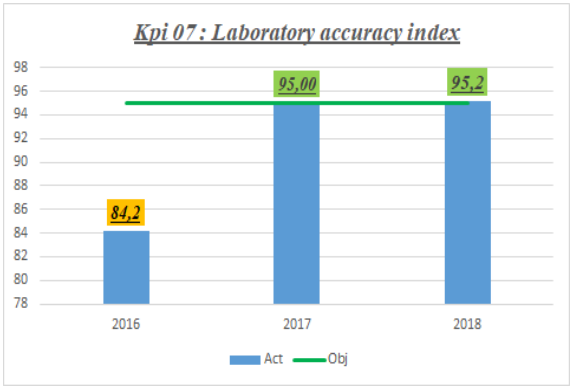


Chart 10: KPI 07 between 2016 & 2018

The next table represented as a full comparison between the former KPI's:

Table 11: comparative of all KPIs between 2018 & 2020

	KPI 03	KPI 04	KPI 05	KPI 06	KPI 07
2018	84.8	1.9	74.9	97.98	95
2019	99.13	1.9	87.91	99.93	95.2
2020	98.89	1.17	92.66	100.13	100

With the orange-coloured columns represent the non-achieved KPI's, and the green ones represents the achieved ones. We can easily from simple observation note that objectives are getting achieved more in all KPI's which means that there is a progress in the performance.

Third. Strategic management

For the foresight in strategic management function, CILAS does not have a dedicated sector responsible for the strategic management, instead it is a centralised function in the main Head Quarter of the company. In order to get proper information, an interview with the General Director of CILAS was made, and few targeted questions were asked. The next answers are what was gathered for the strategic management function part in the company.

- The strategy of CILAS, is it built for the local market or for the international market?

Answer: CILAS is targeted mainly towards the national local market, but whenever there was a business chance, the company would not miss the chance, for instance, if there was a massive production compared to the market needs, and there was a market stagnation, the surplus will get targeted towards the international market. CILAS targets a regional local market, not that it is forbidden from other regions like the west of Algeria or the north, but because there is another Lafarge Holcim's branch located in that region, it is not wise to enter the same region with two or more branches, that would cause conflict. These decisions are not taken locally, but nationally, to harmonise the branches group work.

- How do you predict environmental changes and react to them, and how you put the prediction for like a 2030 vision « rise of the energy cost »?

Answer: from exterior environment changes, economic and politic changes, all predictions and foresight actions are taken from the national level management team, the branches are responsible only for the PDP (plant development plan), which means taking care of the local plant development only. Other major information like, market share, conquerors shares and their tendencies, and other foresight inputs are also from the national level management.

- Do you have Innovation foresight, and do you have information exchange between the branches in Algeria?

Answer: for innovation foresight Lafarge Holcim has its laboratories and research teams for all sorts of innovation prediction and foresighting, but as many other functions, innovation foresight is also centralised. Information exchange is necessary for the company, and that is a benefit for being a part of a big organization group.

- Any relations with the university laboratory or private schools for the research side of the industry?

Answer: the only laboratory that we work with is our main one in Algiers, to get the appropriates normative and specific detailed ingredients, even for the quality of packets, and in the local laboratory, we work to check our products quality to be conforming to the standards given.

- "Plant of tomorrow", how were the proposed solutions made, and why you chose them?

Answer: the solutions were made through the multiple of more than 100 plants of Lafarge Holcim, the best practices in each quarry from different places were picked, for the reason they were efficient. They were chosen to form a development road for all Lafarge Holcim branches.

After that, couple of questions were directed to the commercial manager of CILAS, to ask about their techniques and tools to practice foresight. The interview will be summarised into the coming points.

- The company have multiple sources to collect various data from the market, it benefits from its loyal clients to learn about other competitor's prices and their special sales offers, that happens when their customers buy the competitor's product, then they share the pricing details with CILAS sending photos of the receipt from the competitor with a private group using common communication applications, such as Viber and WhatsApp. Sometimes customers share information without hard proof, CILAS categorises it as a non-evidential information which requires confirmation from a second or a third source to confirm its reliability and to take the appropriate measures. And if the information was not reliable (some customers provide false information such as a better pricing deal from the competitor with the intent to get a better deal from the company), the company puts the informer in the non-reliable source of information list, to filtrate its trust-worthy clients and potential future clients.
- The company uses also social networks and social media apps to gather formal public information from other competitors' websites, pages and in-person -if available- information, like new products and new pricings. Besides dealing with public organisations -like the OPG- that provide statistics and official market information.
- Digitalising the whole foresight operation is not an easy task, especially for the exterior information and how the company attracts it, for the reason that there is not a reliable source of data to provide such information digitally. therefore, the company's orientation is to digitalise how information circulate inside the company and information sharing between different sectors and individuals the fastest and easiest ways, by providing several software and applications to cover the whole process -as mentioned earlier in the chapter-, and other applications for the customers and the in-field reporters such as Smart-Size application for visits reports, and Credit-Api for customers to order, buy with dept, track the progress and location of the order and pay for it, all from his/her smartphone.

2. The corporate's digitalisation

Lafarge Holcim has a global strategic project for all its branches around the word, called "Plant of Tomorrow" (POT), CILAS is also part of the project and it is in the process of realising it, this project aims to digitalise all processes and necessary functions within the company. Before getting to the POT project, some essential tools and projects need to be introduced first.

First. Technical Information System (TIS):

The expression TIS is used for LafargeHolcim's concept of technical data handling based on ABB's Knowledge Manager (KM).

TIS is a strategic tool for:

- Online process data acquisition,
- Long-time data storage,
- Comprehensive process data management,
- Analysis of process performance and optimization

TIS Modules

Core System:

- Data storage with expanded lifetime, data consolidation and interfaces to Process Control

Process Information Management System (PIMS):

- Process Data Analysis (trend curve, SPC) and operation / production Report (DPR (Daily Production report); LHARP energy reports (*Electrical* and Thermal); Maintenance counters report; Pareto report and chart; KPIs Reports for each main equipment, and else more.

Lab Information Management System (LIMS):

- Interfaces to Laboratory equipment and Quality Data Analysis and Quality Reports, and Sample management that include: (sample List, Worklist, Details, Limits).

As displayed in the next figure the TIS project and other complementary modules that were not mentioned.

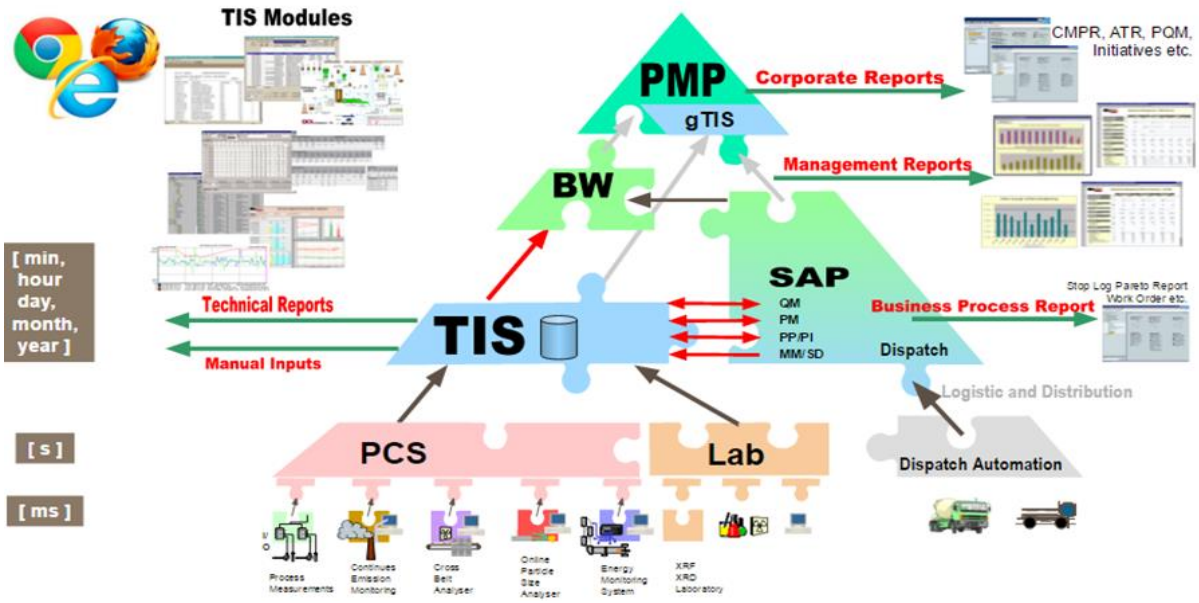


Figure 26: TIS project and other complementary modules illustration

Second. Plants of Tomorrow (POT)

The POT project is a collection of best practices inspired and extracted from the different branches of the company around the world, which means that some solutions can be already implemented in CILAS, but that does not necessitate them to be 100% applied.

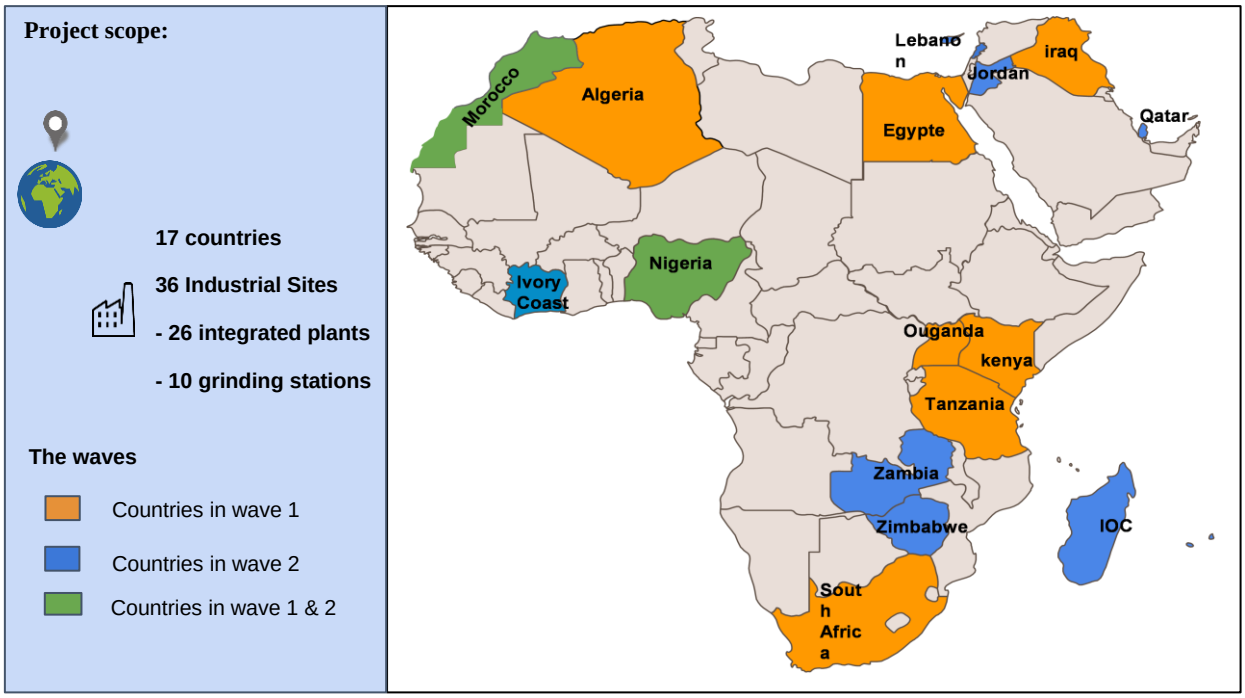


Figure 27: Geographical scope of POT progress in the MEA (Middle east and Africa) project

The next table present the solutions that project POT took into consideration for the company to implement in each branch

Table 12: solutions that need to be scaled in the region

Solution				**Type**	**Priority**
PACT				Proven	Basic need
iCIF				Proven	Basic need
Kiln & Mill Master				Proven	Basic need
Mobile Suite (Walk by Inspection)				Proven	Basic need
Mobile Suite (Inventory Mgt)				Extension of 1level inspection	One
TIS on phones				Extension of PACT	One
Power Management Module				Proven (vs Tarif)	Two
Drones (Inventory, topo & inspec.)				Proven	One
Extended Condition Monitoring				MVP	One
MPredict (VRM...)				MVP	One
eDM (Document Manager)				MVP	One
Statistical Demand Forecasting				MVP	Two

Finesse Prediction				MVP (logistics)	One
CEM-Q (Strength Prediction)				MVP (where high MTBF)	Two
Image recognition (AF, belt, blast…)				MVP (where high St Deviation)	Two
Fuel Mix Management (ML)				MVP	Two
Kiln refractory wear				Development	One

	Improvement in Capacity Utilisation
	Lowering of Operational Costs
	Rapidly Adapting to New Operating Conditions
MVP	Minimal Viable Product

The project is divided into three phases, or as called waves, each wave targets specific need to achieve certain goals, as detailed in the next chart.

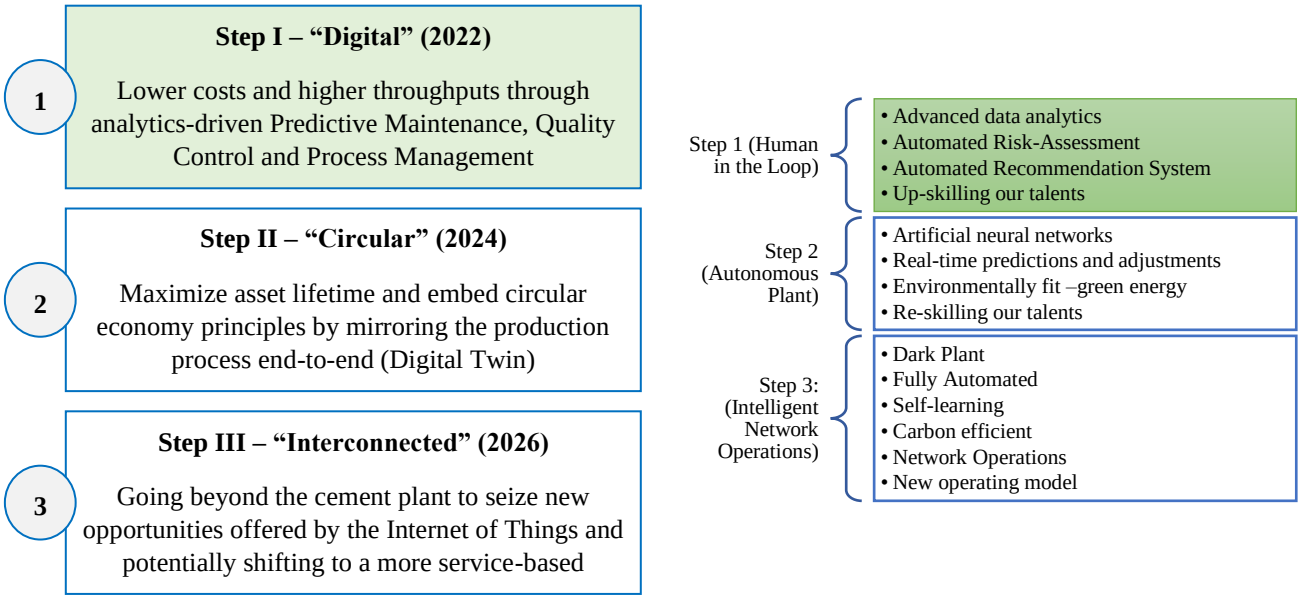


Figure 28: project POT phases

Table 13: project POT Wave 1

			Months																				
SOLUTION	**ACTION**	**STATUS (%)**	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De
Sufficient Network Capacity	Scoping	100																					
PACT	On-Line	30																					
iCIF	Monitoring	85																					
HLC Kiln Master	Execution	0																					
HLC Mill Master	Execution	65																					

	Execution
	Preparation

The company started in the wave 1 and progressed in the process, it has completed the sufficient Network Capacity with 100%, and progressed in Pact (Performance and collaboration tool), iCIF (Intelligent Cement Industry framework), HLC Mill Master (High level control Mill Master), but has yet to start with the HLC Kiln Master. The goal to achieve from the Wave 1 is to get plug & play already existing solutions from the group and set the foundation for analytics driven decision making.

Table 14: project POT Wave 2

			Months																				
SOLUTION	ACTION	STATUS (%)	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De
1st Level of inspection	On-Line	50																					
TIS EEM (Electrical Energy Module)	Monitoring	0																					
Drones (Inventory &	Execution	0																					

Inspections)			
Siemens and Dalog	Execution	75	
Finesse & CEM-Q	Execution	0	
Seec analysis (TIS)	Execution	50	
Kiln refractory wear	Definition	0	
Image recognition	Definition	0	
Pre-heater Cyclone Blockage	Definition	0	
Dual Probe Analyzer	Definition	10	
Free Lime prediction (online analyser)	Definition	0	

For the second wave, CILAS company has not finished any of the solutions yet, but as started in the 1st Level of Inspection, Siemens and Dalog, SEEC Analysis TIS and Free Time Prediction, the rest are still 0% project status. Wave 2 aim to get solutions mapped to the current plant operating model (CIF) main gaps and focused on quickly realizable value pockets.

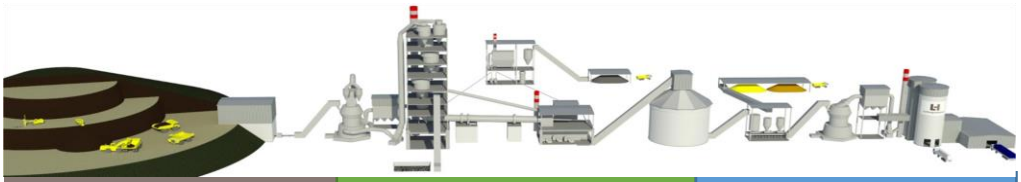
Table 15: project POT Wave 3

			Months																			
SOLUTION	**ACTION**	**STATUS (%)**	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De
Up-skilling and re-skilling	Execution	0																					
eDM App (Phase 1)	Execution	0																					
PCS Changes / New Works	On-Line	0																					
Anywhere plant Operation	Monitoring	0																					

Spare Parts Optimization	Definition	0																					
People where-about (safety access)	Definition	0																					

Wave 3 is not yet in application for CILAS, as it is planned to get done by the year 2023, this phase's goal is to drive management of change through up-skilling, re-skilling and increasing level of automation, and with the Wave 3 is done, the company will be as planned fully automated and foresight ready.

The project POT vision was founded on CIF (Cement Industry framework) that is responsible of the proper work habits and solutions, and enabled by digitalization sustainably to even adopt and compete.



	Raw materials	Production process	Dispatch
Digital Solutions & Process Innovation	• Automated quarry management • Drones for surveillance & mine planning • Smart mine planning & forecasting APP • Online analyser for online blending • Autonomous blockage cleaning and spillage control	• Advanced analytics for burning zone simulation (free time prediction) • Clinker and cement quality prediction modules • Wear parts (liners, refractory, etc.) usage predictions. • upset process conditions predictions (cyclone blockage, kiln ring/ball formation • autonomous blockage cleaning and spillage control • image recognition for materials management	• advanced demand forecasting & capacity planning • self-service loading • fleet management & efficiency predictions • market driven portfolio optimization
Predictive Maintenance	• advanced analytics and predictive maintenance for main & critical equipment (kiln, mils, fans, bucket elevators, motors, reducers, etc.) • digital walk by inspections for patrols, operators and maintenance inspectors • drones for high-risk exposure inspections and measurements (DSCQP, silo, kiln & cyclones inspection, etc.) • remote coaching and interventions		

Figure 29: project POT vision for solutions and innovation

Conclusion

In this study, to answer the question: "What does an organisation require to implement CF? ". A set of well-known foresight models from the literature have been explored . The Foresight control system-FCS" as a combination of sound methods, has been selected. Furthermore, findings revealed that CF could not be implemented solely, i.e., it requires an Ecosystem to be built.

"Building a Business Ecosystem" infers two main questions. The first question: How can an organisation handle a non-digital environment? the answer is by introducing digitalisation for both the company and the environment "ecosystem". The second question: How can the organisation benefit from such a system? the answer is by creating a business ecosystem by creating value sharing between species within the system. i.e., ecosystem. That is how an organisation benefits from Foresight in such a system.

Findings from the case study " Lafarge Holcim company" demonstrated that CF is valid in a non-digitised environment. It follows it as a centralised practice in the head company as well as its subsidiaries. However, being valid for LafargeHolcim does not necessitate it to be the predominant model for all companies. Nevertheless, it can be a good model for companies belonging to the same sector as LafargeHolcim (building materials market). Thus, it is necessary and valid for other companies in the same market, even in a non-digital environment.

The study objectives were to introduce new tools and new skills for top-decision makers attempting to implement the Foresight in their companies. The objectives may not be fully achieved, but it introduced solutions for the foresight process and the digitalisation methods a company should follow to optimise its transformation journey. The study differs from other researches by giving internal solutions " a real-life digitalisation, and foresight requirements example" and external solutions "a real-life business ecosystem building example" regarding the Algerian context.

This study's primary outcomes and results vary between three sides: CF, Ecosystem, and digitalisation. For the former one, CF can be objectively measured using different indicators. Secondly, digitalisation could be hard for the whole corporation, but it can be affordable if it deals with internal information digitalisation. For the ecosystem and digitalisation, the Algerian ecosystem is still not adapted to the significant changes. Although digitalisation is valuable for Foresight as it constitutes a significant feature for its strategy, Foresight can be implemented without massive investments.

For the short and over-charged time, the study did not thoroughly analyse the case company because the company is a multinational one, which means it is too big to investigate it thoroughly.

However, some propositions based on the results of the study can be summarised as follows. Firstly, for the exterior CF, since the company deals only with public organisations, CILAS should have other sources that provide market information, using websites that intelligently provide social media information, send precise alerts, provide analytics for specified key research words, create personal dashboards and even analytical suggestions.

Secondly, the company should help create and develop a Digital Business Ecosystem that would ease the foresight process due to its characteristics and contribute to the rise of the Algerian market to become an international one with the same developed and modern systems as for other multinational markets.

Table of content

Citation Bibliography

1. Research article

- Andersen, I. E., & Jæger, B. (1999). Scenario workshops and consensus conferences: towards more democratic decision-making. Science and public policy, 26(5), 331-340. https://doi.org/10.3152/147154399781782301
- Ansoff, H. I. (1975). Managing strategic surprise by response to weak signals. California management review, 18(2), 21-33.
- Armstrong, J. S. (2006). Findings from evidence-based forecasting: Methods for reducing forecast error. International Journal of Forecasting, 22(3), 583-598. https://doi.org/10.1016/j.ijforecast.2006.04.006
- Asvanund, A., Clay, K., Krishnan, R., & Smith, M. D. (2004). An empirical analysis of network externalities in peer-to-peer music-sharing networks. Information Systems Research, 15(2), 155-174.
- Battistella, C. (2014). The organization of corporate foresight: A multiple case study in the telecommunication industry. Technological Forecasting and Social Change, 87, pp. 60–79. doi: 10.1016/j.techfore.2013.10.022. doi: 10.1016/j.techfore.2013.10.022.pp. 6079. doi: 10.1016/j.techfore.2013.10.022
- Bayon (2008). State of the world 2008 – Innovations for a Sustainable Economy. The World watch Institute, p.123-137
- Bharadwaj, A., El Sawy, O., Pavlou, P., & Venkatraman, N. (2013). Digital Business Strategy: Toward a Next Generation of Insights. MIS Quarterly, 37(2), 471-482. Retrieved June 12, 2021, from http://www.jstor.org/stable/43825919
- Brummer, V., Könnölä, T., & Salo, A. (2008). Foresight within ERA-NETs: experiences from the preparation of an international research program. Technological Forecasting and Social Change, 75(4), 483-495. https://doi.org/10.1016/j.techfore.2008.02.005
- Cassingena Harper, J., & Pace, G. J. (2007). Creative processes in policy making: a case for context in foresight, Proceedings of the Fifth International Conference on Creative Thinking, Malta, pp. 21-2.
- Chan, S. W., & Franklin, J. (2011). A text-based decision support system for financial sequence prediction. Decision Support Systems, 52(1), 189-198. https://doi.org/10.1016/j.dss.2011.07.003
- Cuhls, K. (2003), ‘‘From forecasting to foresight processes – new participative foresight activities in Germany’’, Journal of Forecasting, Vol. 22, Special Issue, pp. 93-111.
- Cuhls, K., Erdmann, L., Warnke, P., Toivanen, H., Toivanen, M., van der Giessen, A. M. & Seiffert, L. (2015). Models of horizon scanning. How to integrate horizon scanning into European research and innovation policies. Brussels: European Commission.
- Dadkhah, S., Bayat, R., Fazli, S., Tork, E. K., & Ebrahimi, A. (2018). Corporate foresight: developing a process model. European Journal of Futures Research, 6(1), 1-10. Martin, B.R. (1995). Foresight in science and technology. Technology analysis & Strategic Management, 7(2), pp. 139–168. doi:10.1080/09537329508524202
- Darkow, I-L. (2015) The involvement of middle management in strategy development – Development and implementation of a foresight-based approach. Technological Forecasting & Social Change, 101, pp. 10–24. doi: 10.1016/j.techfore.2013.12.002

- Dorloff, F. D. (2010, April). Service descriptions in Digital Ecosystems: based on standards and converters. In 4th IEEE International Conference on Digital Ecosystems and Technologies (pp. 75-79). IEEE. https://doi.org/10.1109/DEST.2010.5610671
- Eisenmann, T.R., Parker, G., and Van Alstyne, M.W. (2008). Opening Platforms: How, When and Why? Harvard Business School working paper 09-030.
- Ezeokoli, F. O., Okolie, K. C., Okoye, P. U., & Belonwu, C. C. (2016). Digital transformation in the Nigeria construction industry: The professionals' view. World Journal of Computer Application and Technology, 4(3), 23-30. DOI: 10.13189/wjcat.2016.040301
- Fiorina, C. (2000, October). The digital ecosystem. In Speech at World Resources Institute Conference, Seattle, Washington.
- Fu, H. (2006, December). Formal concept analysis for digital ecosystem. In 2006 5th International Conference on Machine Learning and Applications (ICMLA'06) (pp. 143-148). IEEE.
- Gavigan, J., Scapolo, F., Keenan, M., Miles, I., Farhi, F., Lecoq, D., ... & Di Bartolomeo, T. (2001). FOREN (Foresight for Regional Development Network) a practical guide to regional Foresight.
- Gordon, T., & Pease, A. (2006). RT Delphi: An efficient,"round-less" almost real time Delphi method. Technological Forecasting and Social Change, 73(4), 321-333. https://doi.org/10.1016/j.techfore.2005.09.005
- Heiko, A., Bañuls, V. A., Turoff, M., Skulimowski, A. M., & Gordon, T. J. (2015). Foresight support systems: The future role of ICT for foresight, (97), 1-6. https://doi.org/10.1016/j.techfore.2014.08.010
- Henriette, E., Feki, M., & Boughzala, I. (2015). The shape of digital transformation: a systematic literature review. MCIS 2015 proceedings, 10, 431-443.
- Horton, A. (1999). A simple guide to successful foresight. Foresight, 1(1). https://doi.org/10.1108/14636689910802052
- Ismail, M. H., Khater, M., & Zaki, M. (2017). Digital business transformation and strategy: What do we know so far. Cambridge Service Alliance, 10.
- Kane, G. C., Palmer, D., Phillips, A. N., & Kiron, D. (2015). Is your business ready for a digital future? MIT Sloan management review, 56(4), 37.
- Kaufman, I., & Horton, C. (2015). Digital transformation: leveraging digital technology with core values to achieve sustainable business goals. The European Financial Review (December–January), 63-67.
- Kim, W. Chan and Mauborgne, Renee (2005). Blue Ocean Strategy. Harvard Business School Press. https://doi.org/10.1108/02756660510608521
- Kuosa, T. (2011). PRACTISING STRATEGIC FORESIGHT IN GOVERNMENT: THE CASES OF FINLAND, SINGAPORE AND THE EUROPEAN UNION (pp. 9-13, Rep.). S. Rajaratnam School of International Studies. Retrieved June 13, 2021, from http://www.jstor.org/stable/resrep05909.7
- Li, W., Badr, Y., & Biennier, F. (2012, October). Digital ecosystems: challenges and prospects. In proceedings of the international conference on management of Emergent Digital EcoSystems (pp. 117-122). http://dx.doi.org/10.1145/2457276.2457297
- Linstone, H. A., & Turoff, M. (2011). Delphi: A brief look backward and forward. Technological forecasting and social change, 78(9), 1712-1719. https://doi.org/10.1016/j.techfore.2010.09.011

- Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. Business & Information Systems Engineering, 57(5), 339-343. https://doi.org/10.1007/s12599-015-0401-5
- Matt, C., Hess, T., Benlian, A., & Wiesbock, F. (2016). Options for formulating a digital transformation strategy. MIS Quarterly Executive, 15(2), 6.
- Morakanyane, R., Grace, A. A., & O'Reilly, P. (2017). Conceptualizing Digital Transformation in Business Organizations: A Systematic Review of Literature. Bled eConference, 21. https://doi.org/10.18690/978-961-286-043-1.30
- Nimmagadda, S. L., Nimmagadda, S. K., & Dreher, H. (2010, April). Multidimensional ontology modeling of human digital ecosystems affected by social behavioural data patterns. In 4th IEEE International Conference on Digital Ecosystems and Technologies (pp. 498-503). IEEE. https://doi.org/10.1109/DEST.2010.5610601
- P Dini, et al. (2000). The digital ecosystems research vision: 2010 and beyond. Technical Report, European Commission.
- Rafael Popper, (2008),"How are foresight methods selected?", Foresight, Vol. 10 Iss 6 pp. 62 – 89, http://dx.doi.org/10.1108/14636680810918586
- Razavi, A., Moschoyiannis, S., & Krause, P. (2009). An open digital environment to support business ecosystems. Peer-to-Peer Networking and Applications, 2(4), 367-397. https://doi.org/10.1007/s12083-009-0039-5
- Rogers, E. (2003). Diffusion of Innovations. Fifth Edition. New York, NY: Free Press
- Rohlfs, J. (1974). A Theory of Interdependent Demand for a Communications Service. The Bell Journal of Economics and Management Science, 5(1), 16-37. doi:10.2307/3003090
- Rohrbeck, R. (2012). Exploring value creation from corporate-foresight activities. Futures, 44(5), 440-452. https://doi.org/10.1016/j.futures.2012.03.006
- Rohrbeck, R., & Gemünden, H. G. (2008, June). Strategic foresight in multinational enterprises: building a best-practice framework from case studies. In Emerging Methods in R&D Management Conference (pp. 10-20).
- Rohrbeck, R., & Schwarz, J. O. (2013). The value contribution of strategic foresight: Insights from an empirical study of large European companies. Technological Forecasting and Social Change, 80(8), 1593-1606. https://doi.org/10.1016/j.techfore.2013.01.004
- Sara Polier, (2019), Forward-looking External Search as a Driver for Innovation, Springer Gabler, Wiesbaden, Hamburg University of Technology Hamburg, Germany, 1, P 322, https://doi.org/10.1007/978-3-658-26181-8.
- Sawatani, Y. (2007, August). Research in service ecosystems. In PICMET'07-2007 Portland International Conference on Management of Engineering & Technology (pp. 2763-2768). IEEE. https://doi.org/10.1109/PICMET.2007.4349614
- Scapolo, F. and Miles, I. (2006), ‘‘Eliciting experts’ knowledge: a comparison of two methods’’, Technological Forecasting and Social Change, Vol. 73 No. 6, pp. 679-704. https://doi.org/10.1016/j.techfore.2006.03.001
- Schatzmann, J., Schäfer, R., & Eichelbaum, F. (2013). Foresight 2.0-Definition, overview & evaluation. European Journal of Futures Research, 1(1), 1-15. https://doi.org/10.1007/s40309-013-0015-4
- Shapiro, Carl and Varian, Hal (1999). Information Rules – A Strategic Guide to the Network Economy. HBS Press

- Slaughter, R. A. (1998). Futures studies as an intellectual and applied discipline. American Behavioral Scientist, 42(3), 372-385. https://doi.org/10.1177%2F0002764298042003008
- von Leipzig, T., Gamp, M., Manz, D., Schöttle, K., Ohlhausen, P., Oosthuizen, G., ... & von Leipzig, K. (2017). Initialising customer-orientated digital transformation in enterprises. Procedia Manufacturing, 8, 517-524.

2. Book:

- Birudavolu S., Nag B. (2019) Winning the Competition. In: Business Innovation and ICT Strategies. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-13-1675-3_11
- Christensen, C., Anthony, S., & Roth, E. (2004). Seeing what's next: Using the theories of innovation to predict industry change. Boston: Harvard Business School Press. http://id.lib.harvard.edu/alma/990094423560203941/catalog
- Gawer, A., & Cusumano, M. A. (2015). Platform leaders. *The Strategy Guidebook*, MIT Sloan Management Review. 68.
- Güemes-Castorena D., Amezcua-Martínez J.L. (2013) Strategic Foresight Methodology to Identifying Business Opportunities and Technology Trends. In: Cetindamar D., Daim T., Beyhan B., Basoglu N. (eds) Strategic Planning Decisions in the High-Tech Industry. Springer, London. https://doi.org/10.1007/978-1-4471-4887-6_4*EFP website*
- Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2009). *Dynamic capabilities: Understanding strategic change in organizations*. John Wiley & Sons.
- Heylighen, F. (2008). Complexity and self-organization in Encyclopaedia of Library and Information Sciences.
- Iansiti, M., & Levien, R. (2004). The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability. Harvard Business Press.
- Kuusi, O. (1999). Expertise in the future use of generic technologies. Valtion taloudellinen tutkimuskeskus VATT. http://urn.fi/URN:NBN:fi-fe2018042618782
- Moore, J. F. (1996). The Death of Competition. Leadership and Strategy in the Age of Business Ecosystems. NY, Harper Business.
- Nachira, F., Dini, P., & Nicolai, A. (2007). A network of digital business ecosystems for Europe: roots, processes and perspectives. European Commission, Bruxelles, Introductory Paper, 106.
- Porter, A. L., Rossini, F. A., Carpenter, S. R., Roper, A. T., Larson, R. W., & Tiller, J. S. (1980). Guidebook for technology assessment and impact analysis.
- Rohrbeck, R. (2010). Corporate foresight: towards a maturity model for the future orientation of a firm. Springer Science & Business Media.
- Schaffnit, M. (2020). Digital ecosystems. In Digital Business Development (pp. 53-71). Springer Gabler, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-59807-8_4
- Schreiber, D. A., & Berge, Z. L. (2019). Futures Thinking and Organizational Policy. Springer.

- Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K. G., & Fonstad, N. O. (2020). How big old companies navigate digital transformation. In Strategic Information Management (pp. 133-150). Routledge.
- Singh, A., & Hess, T. (2020). How chief digital officers promote the digital transformation of their companies. In Strategic Information Management (pp. 202-220). Routledge.
- Skilton M. (2016) Digital Workspace Concepts. In: Building Digital Ecosystem Architectures. Business in the Digital Economy. Palgrave Macmillan, London. https://doi.org/10.1057/9781137554123_3

3. Thesis:

- Bergman, K. & Dahlgren, C. (2020). A Conceptual Framework for Long-Term Strategic Foresight. Department of Design Sciences, Faculty of Engineering LTH, Lund University, Sweden.
- Hassanabadi Masoud, (2019). Strategic Thinking, Organizational Foresight, and Strategic Planning in High-tech SMEs in the UK, Bangor University, Published by ProQuest LLC, p. 5. 45. 46. 57
- Karhiniemi, M. (2009). Creating and sustaining successful business ecosystems, Department of Business Technology, HELSINKI SCHOOL OF ECONOMICS (HSE).

4. Website:

- Open Philosophies for Associative Autopoietic Digital Ecosystems (OPAALS), Network of Excellence. http://www.opaals.eu/
- European Foresight Platform. Foresight-platform.eu. (2010). Retrieved 9 June 2021, from http://www.foresight-platform.eu/.