

A decision-supporting framework for job automation and soft skills development, with job criticality as a linchpin

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by

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Executive Summary

The Fourth Industrial Revolution represents both challenges and opportunities for companies, but more importantly, it raises questions about what decisions should be made and what their implications would be. There are two dimensions to this new era of economic disruption that can be seen as opposed or complementary: job automation and soft skill development for humans. Often, discussing these topics is uncomfortable for business actors, because it implies that many people will find themselves unemployed given that machines might replace a good portion of the human workforce. However, multiple studies have demonstrated that machines could relieve humans from their monotonous and repetitive tasks, allowing them to focus on higher value ones, thus enhancing their work experience.

In this context, the objective of this thesis is to construct a decision-supporting framework to help companies determine the best actions to take to fully optimize their resources and capital given the level of potential job automation available by the technological advancement at a particular point in time and the nature of the jobs within the company.

The framework draws its concept and rationale from secondary data sources, and its validity as an analytical tool stems from in-depth interviews conducted with field professionals who have been exposed to such decisions.

The expected outcome is that the framework will be used by companies to assess whether they should invest more in people, machines, or both. Furthermore, it will allow companies to quickly visualize and capture these elements in one place, thus helping in the decision-making process.

Companies could use the job automation and soft skills framework on a quarterly or yearly basis, based on their needs and the pace of technology assessment in their sector, to assess their current situation and project their future needs. Although the future can never be known in advance, any planning is better than no planning.

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1. Introduction

1.1 Motivation

Recent technological advancements, such as artificial intelligence (AI) and machine learning, have started to transform workplace dynamics, creating both challenges and opportunities for companies. An “augmented workforce” made of both humans and artificial intelligence agents is expected to emerge. Overall, a study from McKinsey projects that, in the near future, monotonous and predictable tasks will be automated and the non-predictable and complex ones will be performed by humans. According to McKinsey Global Institute, up to 50% of current work activities could be automated by adapting existing technologies, and around 30% of the hours worked globally could be automated by 2030. The fear of massive job losses and the financial and societal costs that come with them will indisputably be one of the biggest unavoidable challenges for business players, especially for big multinational companies, as they employ hundreds of thousands of people globally according to a study conducted by Oxford University and Deloitte in 2019.

Job automation, also called workplace automation, could represent both challenges and opportunities for states and workers in almost every sector. Indeed, automation technology can free employees from their repetitive and routine tasks, enabling them to focus on more complex, higher-value tasks (KPMG, The augmented workforce 2015, cit. WEF, 2018). However, this transition will require significant steps to retrain the workforce. By 2022, less than 60% of the overall tasks will be able to be performed with the skills most employees currently possess, leaving an average shift of 40% (WEF, 2018). This remaining part is made of both hard and soft skills. The hard skills mainly include skills related to information and communication technology (ICT). According to the European Commission, the demand for ICT skills grows 4% each year, and Europe is currently facing a shortage of more than 700,000 employees.

Interestingly, along with the rise of technological innovation, pure “human skills” such as creativity, collaboration, and emotional intelligence seem to be equally in demand; indeed, according to Deloitte's Australia 2019 report, “The path to prosperity Why the future of work is human”, two-thirds of jobs will be strongly reliant on soft skills by 2030. This report reinforced the one published in 2017, “The evolution of work”, advancing the idea that a balance between technology and human skills is expected to be the key for

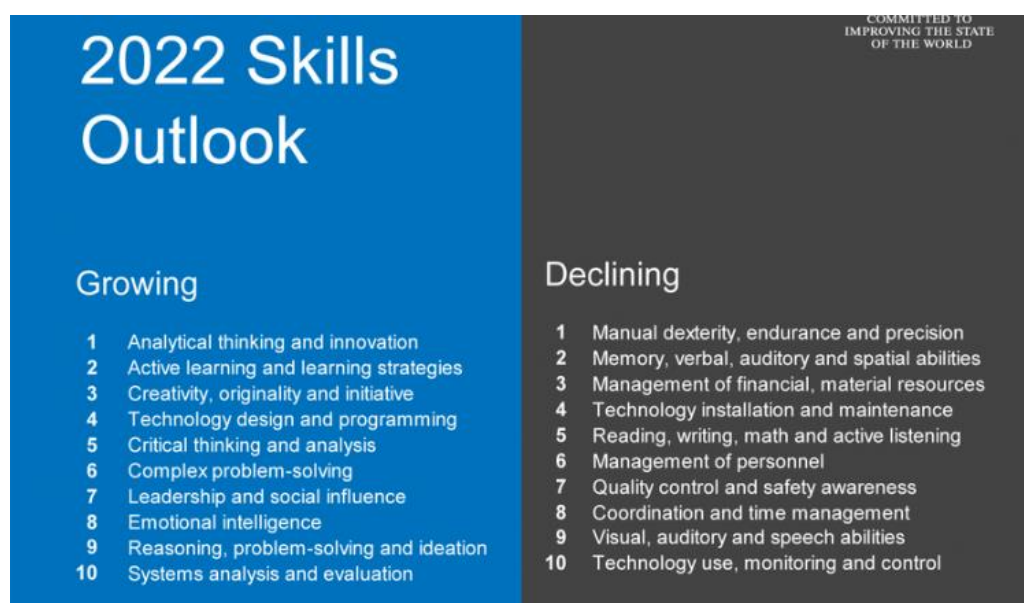
top employee and organization performance. Therefore, to maintain their performance and avoid disruption, companies need to act proactively by preparing their workforce for the future with regard to both hard and soft skill development.

It is essential for companies to have the necessary tools to assess how they position their jobs and workforce with respect to these two dimensions: automation and soft skills. With the right tools, they can identify and assess whether they are investing adequately in the right direction.

Various consulting companies, like McKinsey, Deloitte or PWC, and researchers, like Ravin Jesuthasan and John Boudreau, have already built matrixes and tools to help countries, companies, and individuals assess whether their industries, sectors, or jobs are prone to automation and how to anticipate the changes.

Following extensive literature research and review, it was found that, as of today, automation and soft skills are studied as separate fields, and there is little to no literature on a conceptual framework to correlate them and study their implication simultaneously. With this perspective in mind, the major objective of this thesis is to suggest a comprehensive framework to help companies assess their positioning on the automation versus soft-skills scale and make sound decisions.

Figure 1 - Active learning and creativity are in the top three skills for 2022



Source: WEF, 2018

1.2 Contribution

This exploratory research seeks to contribute to the literature by providing a decision-supporting framework that correlates the potential level of automation of a job (or task) with the level of investment needed in the development of employee soft skills and/or creativity by the business.

An exploration of the state of automation and soft-skills analysis in business will be performed to highlight the gap that currently exists in the literature, and it will be used as a foundation to construct the framework.

The accuracy, usefulness, and potential applicability of the framework in real life will be assessed through interviews with field professionals that have faced investment decisions related to full or partial job automation in their career. Improvements suggested will be analyzed and discussed, and a revised version of the framework will be drafted as a final result.

1.2.1 Research objectives

- A- Examine the relationship between two seemingly independent criteria, the level of job automation and the level of investment in soft skills, to characterize a set of options.
- B- Construct a criticality framework, or criticality matrix, connecting automation and soft skills development with job criticality as a variable
- C- Propose a guideline on how to immediately apply the framework.
- D- Evaluate the framework's usefulness/applicability through in-depth interviews with professionals who have faced decisions regarding the impact of automation on their professional environments.

1.2.2 Research sub-objectives

Under objective C, propose a guideline on how to practically apply the framework, there are three sub-objectives to help make the matrix more concrete.

- C.1- Propose a simplified framework to assess the potential level of automation of a job.
- C.2- Propose a simplified framework to assess the level of criticality.

C.3- Propose a checklist with suggestions on how to stimulate creativity in a working environment and implement traditional measures for soft skills.

The sub-objectives are not final target outcomes in themselves; they are constructed to provide guidance on how the main framework can be immediately applied and support its validity. Their soundness will, however, be appraised in the interviews as well for general coherence.

The expected outcome is to have a better understanding of the nature of the jobs a company has and provide guidance on where to invest—in people, machines, or both—so the company can fully optimize its resources and capital. The matrix will allow companies to quickly visualize and capture these elements in one place, thus helping in the decision-making process.

Furthermore, this thesis analyzes the complex notion of creativity, which lies between a soft and hard skill. Creativity was the number-one soft skill employers sought in candidates in 2020 based on a survey conducted by LinkedIn summarized in the article “The Skills Companies Need Most in 2020—And How to Learn Them”. Creativity is expected to be in the top three of critical skills in the upcoming years according to the World Economic Forum’s (WEF) *The Future of Jobs Report* from 2019 as well, making it a pertinent element for a supporting analysis. Current literature and scientific data will be used as a foundation to propose a simple checklist for companies to assess or look for inspiration regarding the creativity dimension.

Finally, it is important to highlight that illustrative examples will be taken from companies performing in Western Europe and the interviews will be conducted with business decision makers of companies based in Switzerland for practical purposes. Indeed, the concepts do not have geographical restrictions and can be applied by any company operating in a free market that believes it is facing workplace automation challenges.

1.2.3 Theoretical concepts

This section briefly explains the theoretical frameworks that will be used in this thesis to analyze the illustrative examples and construct the final matrix. They will be further developed in the Methodology section.

To approximate job automation

In the illustrative examples, the theoretical framework used to assess the level of potential automation in the illustrative examples will be a simplified version of the McKinsey framework and Jesuthasan and Burdeau's "4 steps approach" to job automation. The reason for this choice is that the McKinsey framework is based on metadata and is meant to analyze a large variety of jobs, on a national or regional level, which would be too large for the scope of the thesis. On the other hand, in Jesuthasan and Burdeau's approach, only the first step of the approach actually deals with assessing the potential level of automation through the set of criteria it provides. The other steps address different types of automation and the roles and returns it might generate for a company, which goes beyond the scope of this thesis.

Consequently, a mix of the two approaches will be used to evaluate the level of automation of the jobs selected in a more accurate way.

To estimate the level of criticality of a job

The level of criticality of a job is a new term introduced by the author. The concept stems from the separation of activities into core and support classifications when performing value chain analysis, a concept described by Michael Porter in 1979¹. In this context, the value chain analysis will only be used for the separation of activities in order to assess which ones are crucial to the business mission and which ones are not. It is relevant to highlight that its relative importance is only based on the business's main mission and not the nature of the job itself.

To approximate the level of soft skills and creativity

The main goal of this thesis is not to build a framework to measure and analyze soft skills. However, soft skills being a crucial dimension of the analysis, a way to measure the level of investment in soft skills is needed. To this end, a simple checklist based on scientific data analyzed in the literature review will be suggested.

¹ The final goal of the value chain analysis is look for either cost saving opportunities or differentiation to achieve competitive advantage (Porter, 1989).

To assess the usefulness/applicability of the final framework

The assessment will be conducted using primary qualitative data attained through in-depth interviews. Data analysis will be performed through thematic coding and work cloud presentation. The choice and relevancy are described in the Findings section.

2. Literature review and analysis

The literature review will cover the main variables articulated in the thesis—namely, job automation, soft skills, and job criticality. A sub-section of the literature review will also cover the notion of creativity, because it remains largely abstract and complex, and plays an essential role in both personal and business growth.

2.1 Job automation

2.1.1 Origin

The displacement of human labor by machines has been feeding people's imaginations since antiquity. Aristotle imagined a future free of slaves where work would be performed by "mechanical slaves," thus leaving humans free to pursue higher purposes in life (Pena-Ruiz, 2012).

Nevertheless, until the 18th century, the topic did not get much attention, because technology was not advanced enough, so workers believed that machines belonged to a distant future.

With the birth of the Industrial Revolution in Great Britain, the fears of mass unemployment due to automation began to rise for the first time. Indeed, steam power and other mechanical inventions transformed most agricultural and handcraft economies into large mechanized factory systems. This change also impacted the demographic landscape in the Great Britain, across Europe, and eventually worldwide (Horn, Rosenband, 2010). Several economic thinkers developed their hypotheses to explain the phenomena that had occurred and predict future societal shifts. Technological unemployment became a hot topic².

Economic thinkers were then divided into pessimists, who believed that technological advancements would lead to global unemployment, and optimists, who were convinced that innovation would lead to only a temporary phase of unemployment but ensure long-term growth and employment in the future. According to John Maynard Keynes, technological unemployment was "only a temporary phase of maladjustment" (McGaughey, 2018).

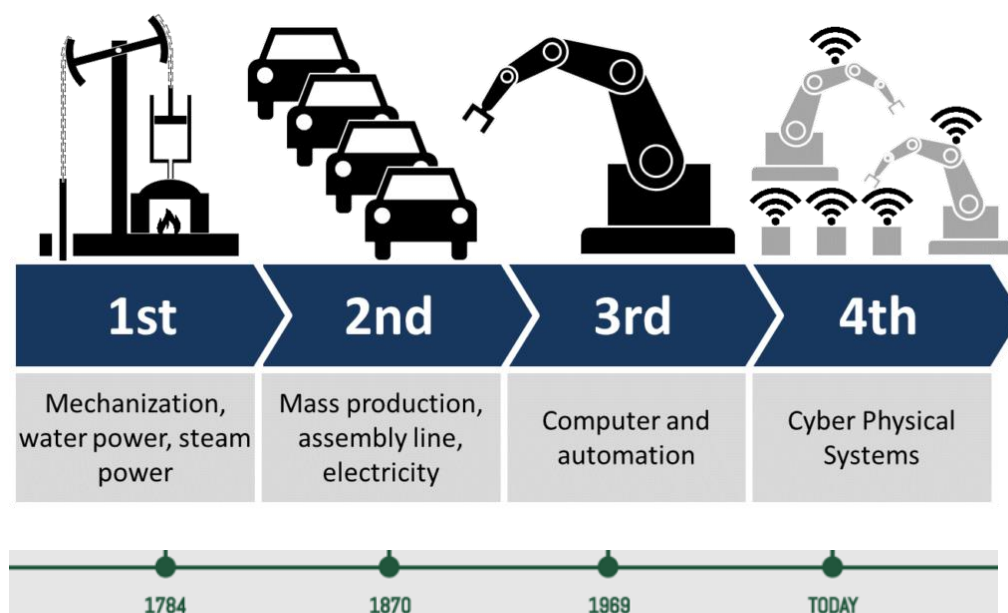
² . Technological unemployment, (which is part of a broader concept known as structural unemployment) occurs when workers lose their job due to technological progress.

Since the beginning of the 20th century, most economists and the general public adopted the optimistic view as more studies shed light on what machines could potentially do and how they were going to be integrated into society.

The dream of being released from the tasks they do not like and focusing on their passion has inspired writers and movie directors well beyond the economic sphere. Oscar Wilde wrote in his essay ["The Soul of Man Under Socialism"](#) (1891) that machines would perform the "ugly, horrible, uninteresting work," while humans could enjoy "delightful leisure in which to devise wonderful and marvelous things for their own joy and the joy of everyone else."

Technology progressed in the following centuries. In hindsight, economists and historians define these areas of irreversible advancements as second, third, and fourth industrial revolutions. This is summarized in the table below.

Figure 2 - The four industrial revolutions in modern history



Source: The Financial Express, 2020

The term Fourth Industrial Revolution, also known as industry 4.0, was first advanced by Professor Klaus Schwab, founder and executive chairman of the WEF, in a 2015 article in *Foreign Affairs* titled "Mastering the Fourth Industrial Revolution." This article described the impact of the numerous technological advancements happening in this

period of time and how they will dramatically transform the way we work and live. In simple words, the major shift with industry 4.0 is that machines will be able to connect, communicate, and make decisions without human involvement. A combination of cyber-physical systems, the Internet of Things (IoT), and the Internet of Systems (IoS) will very probably make industry 4.0 a reality in the imminent future, significantly affecting our working patterns and everyday lives (Jadzi, 2014).

Consulting companies, such as McKinsey and Deloitte, as well as international organizations, such as the WEF, are conducting research studies and publishing annual reports in order to identify trends, risks, and opportunities for businesses, workers, and society overall. In this perspective, job automation is becoming a trending and controversial topic as we are facing an issue of this magnitude for the first time.

Other authors, like Calum Chace, believe that is a déjà vu from a historical perspective. “The poster child for automation is agriculture. [...] In 1900, 40% of the US labor force worked in agriculture. By 1960, the figure was a few per cent. And yet people had jobs; the nature of the jobs had changed.” The World Bank seems to adopt the same view, as shown in its *World Development Report* 2019. It is expected that, while automation will displace workers, technological innovation will create more new industries and jobs to balance the effects.

The study from Deloitte, “The Path to Prosperity: Why the Future of Work is Human (2019),” seems to tackle both perspectives. However, it dispels the idea that robots will take most of the human jobs any time soon. The data from the study conducted in Australia shows that, although companies are integrating new technologies rapidly, the country’s unemployment remains very low and is at its lowest since 2011. On the other hand, the report puts forward that, although new technologies could displace many tasks, more jobs will be created, particularly jobs that are harder to automate.

In the next subsection, it will be summarized how businesses are reacting and anticipating these changes.

2.1.2 Job automation in companies

Companies react differently to the automation challenge. The goal of this section is to give an overview of various approaches that are currently being taken by business players in anticipation of the implications of automation.

Doing nothing

According to John Boudreau, professor and research director at the University of Southern California's Marshall School of Business and known as one of the visionaries of the future of work, “every day automation can do a little bit more of the work in most jobs . . . most of the time you hardly notice, and you don't have to change your behavior.” The idea is that technology is being constantly upgraded, and businesses should be able to integrate the new tools progressively, without having to implement drastic changes. Outsourcing or buying a new software to perform previous internal tasks are a few examples of incremental changes.

On the other hand, Boudreau underlines that “at other times, the upgrade is fundamental, and you have to change your behaviors.” A typical example would be automating part of the production line in a factory and facing the violent reaction of hundreds of employees who might find themselves unemployed from one day to the next.

Seeking institutional help

One of the most known and recognized programs to help companies successfully manage their technological transition is the Closing the Skills Gap Project provided by the WEF to “close skill gaps and reshape education and training for the future.”

The project aims to assist companies and other organizations with training, reskilling, and upskilling the current and future workforce. They are given measurable goals for developing their human capital.

Until now, there have been 44 programs pledged by 33 global organizations, which have reached 17,224,558 people that are expected to be trained by the end of 2020.

The following are some significant figures in relation to the Closing the Skills Gap Project:

- 79.2% of the pledged commitments are from large organizations with more than 50,000 employees.
- Technical and vocational education and training (TVET; 37%) followed by adult learning (35%) are the key focus areas of the initiatives pledged by global organizations.
- Technical skills and employability skills training are key to addressing the gap (up to 50% of skills demanded).

- As per the WEF's *Future of Jobs Report 2018*, average training time needed to address the skills gap is less than one year.

Details on how exactly the programs are designed and implemented are not given. However, this study assumes there is a “fixed” part and an “adaptable” part for each organization.

Asking consulting companies

BCG, McKinsey, Deloitte, and KPMG offer different programs and tools to support companies through the technological transition, such as digital implementation, business model changes, and career development for their workforce. These consulting companies provide customized service to business clients and produce publicly available reports to give a general idea of how things are evolving. The McKinsey report “Industry 4.0: How to navigate digitization of the manufacturing sector” from 2015 serves as an example for the manufacturing industry.

Acting on their own

Some companies decided to tackle the issue by themselves. They decided to meet the challenges of automation through upskilling or reskilling their employees. JPMorgan Chase is an example of a company that publicly announced its plan to prepare for the future of work.

Figure 3 - Extract from a press release from JP Morgan Chase

New York City, NY, – March 18, 2019 JP JPMorgan Chase announced a \$350 million, five-year global initiative to prepare for the future of work and meet the growing demand for skilled workers [...] this investment will provide substantial support to community college and other non-traditional career pathway programs.

Source: JPMorgan Chase, 2019

JPMorgan Chase collaborates with the Massachusetts Institute of Technology's Initiative on the Digital Economy (IDE) to identify and forecast capabilities needed in the future workplace. High-quality education and job training programs are key elements to build and offer opportunities for upskilling or reskilling and expanding the career opportunities for employees internally.

The company aims to lift people out of low-wage jobs by investing \$200 million in innovative education and training programs in digital and technical skills, \$125 million in

collaboration and communication skills, and \$25 million in labor market data and research to ensure they are investing in the right educational tools and programs.

The company also announced that they are willing to share their approach with other companies preparing for the future of work.

Section summary

With the examples above, it is clear that there are many approaches a business can take to meet the challenges that will come with the industry 4.0. With the examples of JPMorgan and the Closing the Skills Gap Project, we can observe that, overall, a decision must be made on whether to invest in “hard skills,” “soft skills,” or both, depending on the situation of the employees and the future expectation.

In this section, there was an overview of the automation. The following section observes the soft skills evolution, from their origin to their current understanding.

2.2 Soft skills

2.2.1 Origin

The term “soft skills” was first advanced by Dr. Paul G. Whitmore in the late 1950s. At that time, the US Army created a series of guidelines called “Systems Engineering of Training” (CON Reg 350-100-1) with the objective of improving learning procedures for the soldiers. The ultimate goal was for soldiers to learn faster and more efficiently.

Dr. Paul G. Whitmore was in charge of redesigning the training. He classified the skills that involved the use of a machine or paper as “hard” and the skills that did not involve the use of any concrete object as “soft.” Therefore, tasks such as supervising people or communicating effectively did not involve machines and were classified as “soft.”

Whitmore worked with John P. Fry on skills analysis and training procedures, and the two presented their research at the 1972 CONARC (Continental Army Command; US Army) Soft Skills Conference.

Figure 4 - Extract from the CONAC Soft Skills Conference report

Page II-7 of the conference report states :

**A tentative definition of soft skills might be formulated as follows:
Soft-skills are (1) important job-related skills (2) which involve
little or no interaction with machines (including standardized because
the situation or context contains a great deal of uncertainty; that is,
we don't know much about the physical and social environments in
which the skill occurs and we don't know much about the consequences
of different ways of accomplishing the job function. In other words,
those job functions about which we know a good deal are hard skills
and those about which we know very little are soft skills.**

Source: DTIC ADA099612: CONARC Soft Skills Training Conference, 1973

Knowing the origin of this concept allows us to break a common misperception of soft skills in comparison to hard skills: soft skills are not less difficult to learn or less important for a person or a job. They simply do not involve the use of a machine or tool (something that we can touch).

2.2.2 Current understanding

Nowadays, soft skills remain largely a vague concept. In the business world, it is a general term usually associated with interpersonal skills (such as communication, attitudes, or personality) that complement the hard or technical skills (also known as cognitive skills). According to the Cambridge Dictionary, soft skills are defined as “people's abilities to communicate with each other and work well together.” In other words, it is about everything that helps a person succeed that cannot be classified as a “hard skill.”

For the time being, there is no consistent, straightforward, comprehensive, and universally agreed upon definition of the abstract and non-cognitive concept of soft skills. Different researchers have studied the ambiguity of the concept, and some have suggested frameworks to help assess life-long learning and employability (Evers, Rush, Berdrow, 1998). Others have suggested taxonomies (*i.e.* naming and classifying something) to help recruiters assess a candidate's soft skills in job descriptions (Khaouja *et al.*, 2019).

Table 13 Soft skill taxonomy in English

Soft skill	Alternative labels
Accountability	Responsibilities, responsibility, transparently, responsible, accountability, transparency, transparent, transparencies, accountable, account, accountabilities
Active listening	Listens, listen, communicator, social skills, listening, conflict resolution, communications, listener, communication, active listening
Adaptive	Adaptability, adaptive, stressed, adapt, adaptable, stressful, stress, stresses, adapting
Analytical	Synthesis, analytically, analytical, analytic, analytical skills, analytics
Argumentation	Interpreting, interpret, debate, opinion, logically, arguments, logical, debated, opinionated, interpreted, debating, argument, logic, opinions, debates, interpretation, logics, argumentation
Coaching	Coaching, coaches, performance management, coached, sprinting, coach, sprints, sprint
Commitment	Commitment, commitments, committed, commit
Communication	Interactive, communicator, communication skills, understandable, interpersonal, communications, understand, interpersonally, communicate, communicating, interact, communication, understand, interpersonals, interact

Source: Khaouja et al., 2019

According to Khaouja *et al.*, the methodologies for building soft skills cannot be the same as the ones used for hard skill taxonomies due to the wide variety of terminologies and diverse interpretations of the concepts. Among the personal or subjective interpretations, there is one unconscious bias that appears to have a palpable impact: gender bias.

Gender is the most used human category (Haslam, Rothschild, & Ernst, 2000). Other research has suggested that the key trait for differentiating males from females is tenderness (Feingold, 1994). In 2010, Michael Slepian, Max Weisbuch, Nicholas Rule, and Nalini Ambady demonstrated in their study that, since soft skills are associated with interpersonal communication, they tend to be associated with aspects of caring and emotional sensitivity, which are often perceived as feminine attributes. This is in opposition to hard skills, which tend to be linked to masculine traits.

Globally, cultural biases consistently overestimate men in comparison to women. It is interesting to know that there are only 26 autochthonous populations in the world that are fully or partially matriarchal (Goettner-Abendroth, 2012).

By implication, soft skills are more likely to be perceived as less important, despite how various studies have shown them to be equally important as hard skills in some cases. A relatively recent example was Google's Project Oxygen, which aimed to identify the characteristics that made Google managers successful at their jobs. The results left little room for interpretation as "Key Technical Skills" only ranked at #8 and being a good coach, empowering, and having genuine direct reports were the top three most valued skills.

Indeed, the so-called “hard” skills, also known as cognitive skills, require high knowledge as well as a certain level of expertise in order to practice them (for instance, the skills required to be a doctor). On the other hand, “soft” skills seem to be more intuitive and easier to understand as notions. That is why they are often perceived as less difficult and are also known as non-cognitive skills. In their 2011 research, Chell and Athayde argued that successful execution of soft skills requires a certain level of behavioral complexity and context analysis that is mostly gained through years of experience.

2.2.3 How companies assess soft skills

Companies measure soft skills differently. The goal of this section is to give an overview of the most common approaches currently being taken by businesses to measure soft skills.

Questionnaires and surveys for self-assessment

Figure 6 - Soft skills self-assessment checklist example

Soft Skills Checklist

Put an X in the column that best matches your opinion of each statement.

	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
I often spend more time trying to think of ways to get out of things than it would take me to do them.				
Asking for help on the job is a sign of being weak.				
I think it's okay to take off time from work for personal reasons, even if I don't have vacation or personal leave available.				
I usually try to avoid doing job tasks that I dislike doing.				
I have held a couple of jobs for less than 3 months.				
If my child was sick my only option would be not to go to work.				
I'd rather quit a job than do something I don't think I should have to do.				
When someone makes me angry I get even.				

Source: Georgia Career Information Center, 2007

360 degree assessment

Figure 7 - 360 degree assessment representation



Source: Pixel Leadership Group, 2020

Behavioral interview questions

Figure 8 - Examples of behavioral questions to assess soft skills at Page Personnel

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Behavioural interview questions

Behavioural interview questions are those that centre around real life experiences, as opposed to hypothetical situations. These questions are probably the most effective way to evaluate the above soft skills during an interview.

By asking for real life examples, you'll get more insight into how well the candidate works under pressure, how they communicate and their work ethic. Some examples of behavioural interview questions include:

- Describe a time when you had a problem with a supervisor and what you did to resolve it
- Tell me about a time when you had difficulty getting others to work together on a critical problem and how you handled it
- Tell me about the best leader you have worked with, why you felt this way, and what you learned from that person
- Describe a problem you faced that was almost overwhelming and how you got through it
- Have you ever made a mistake? How did you handle it?
- Have you handled a difficult situation with a client or vendor? How?

Source: Page Personnel, 2020

As observed in the above examples, the absence of clear and sharp definitions and taxonomies for soft skills and the fact they cannot be measured in the same way cognitive skills are make it complicated for the concept to “truly gain traction in research or in practice” (Matteson, Anderson and Boyden, 2016). Nevertheless, in the scope of this thesis, the definition of hard and soft skills will be inspired by the understanding of the National Academy of Sciences (Pellegrino and Hilton, 2012). Indeed, this model summarizes various studies and taxonomies and connects them to the O*NET definitions. O*NET is a large database that gathers information on approximately 1,000 occupations, including worker characteristics (abilities, interests, work values, and work styles) and requirements (skills, knowledge, and education), and it is a reference for recruiters.

Figure 9 - Hard and soft skills summary

Cluster		Terms Used for 21st Century Skills	O*Net Skills	Main Ability/Personality Factor
COGNITIVE COMPETENCIES	<i>Cognitive Processes and Strategies</i>	Critical thinking, problem solving, analysis, reasoning/argumentation, interpretation, decision making, adaptive learning, executive function	System skills, process skills, complex problem-solving skills	Main ability factor: fluid intelligence (Gf)
	<i>Knowledge</i>	Information literacy (research using evidence and recognizing bias in sources); information and communications technology literacy; oral and written communication; active listening	Content skills	Main ability factor: crystallized intelligence (Gc)
	<i>Creativity</i>	Creativity, innovation	Complex problem-solving skills (idea generation)	Main ability factor: general retrieval ability (Gr)

	Cluster	Terms Used for 21st Century Skills	O*Net Skills	Main Ability/Personality Factor
INTRA-PERSONAL COMPETENCIES	<i>Intellectual Openness</i>	Flexibility, adaptability, artistic and cultural appreciation, personal and social responsibility (including cultural awareness and competence), appreciation for diversity, adaptability, continuous learning, intellectual interest and curiosity	[none]	Main personality factor: openness
	<i>Work Ethic/Conscientiousness</i>	Initiative, self-direction, responsibility, perseverance, productivity, grit, Type 1 self-regulation (metacognitive skills, including forethought, performance, and self-reflection), professionalism/ethics, integrity, citizenship, career orientation	[none]	Main personality factor: conscientiousness
	<i>Positive Core Self Evaluation</i>	Type 2 self-regulation (self-monitoring, self-evaluation, self-reinforcement), physical and psychological health	[none]	Main personality factor: emotional stability (opposite end of the continuum from
2-13				
INTER-PERSONAL COMPETENCIES	<i>Teamwork and Collaboration</i>	Communication, collaboration, teamwork, cooperation, coordination, interpersonal skills, empathy/perspective taking, trust, service orientation, conflict resolution, negotiation	Social skills	Main personality factor: agreeableness
	<i>Leadership</i>	Leadership, responsibility, assertive communication, self-presentation, social influence with others	Social skills (persuasion)	Main personality factor: extraversion

Source : National Academy of Sciences, 2012

Definitions of fluid Reasoning (Gf), comprehension-knowledge (Gc), and general retrieval (Gr) are as follows (Dipboye, 2018):

- Fluid reasoning includes the broad ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures.
- Comprehension-knowledge includes the breadth and depth of a person's acquired knowledge, the ability to communicate one's knowledge, and the ability to reason using previously learned experiences or procedures.
- General retrieval is the ability to store information and fluently retrieve it later in the process of thinking through associations.

Fluid reasoning, Gc, and Gr are three different categories of the Cattell-Horn-Carroll theory (CHC)³.

³ Psychologists Raymond B. Cattell, John L. Horn and John B. Carroll each proposed their own theory on how human intelligence could be structured, in different points of time between the 40s until the 90s. Because of their similarities they were all grouped under a single model, the CHC (Willis, 2011).

Two controversial elements are evident in this cluster's breakdown:

First, it implies, without explicitly mentioning it, that cognitive skills are associated with intelligence, whereas soft skills stem from personality traits (c.f. “Main Ability/Personality Factor” section on the right). However, from a neuroscientific perspective “[t]he brain doesn’t make any difference between what is cognitively relevant and emotionally relevant” (Miendlarzewska, 2020), which means there should be no distinction between hard skills and soft skills. Indeed, for neuroscientists, there would be a difference only if different parts of the brain were activated while “using” soft and hard skills. Consequently, elements of soft skills such as emotional intelligence have no neuroscientific basis and are treated as psychological topics. Knowing this element alone should trigger a reconsideration of the way soft and hard skills are perceived.

Secondly, creativity falls under the hard or cognitive skills category, and the authors do not seem to question it further. Creativity is a very abstract notion, which is not only at the heart of human development but also at the evolution of humanity as a whole, making it a difficult concept to articulate thoroughly, let alone categorize as simply “hard” or “soft.” Indeed, to support this argument, LinkedIn recently mentioned that creativity was the “top soft skill employers are looking for in 2020” (LinkedIn, 2020). For this reason, the next sub-section attempts to shed some light on the concept of creativity and what the business implications are.

2.3 Creativity

Creativity is important, because creativity leads to innovation. Innovation means turning creative ideas into great business opportunities (Heinonen, Hytti and Stenholm, 2011). This is where corporate culture and work environment come into play (Ali Taha, Sirkova and Ferencova, 2016).

2.3.1 The concept of creativity

Once again, we will draw on neuroscientific evidence to define the concept of creativity in this thesis. In their study “Creative Cognition and Brain Network Dynamics, 2015,” Beaty *et al.* discovered that the brains of creative people were—in simple words—wired differently. In Beaty’s words, creativity involves “a complex interplay between spontaneous and controlled thinking – the ability to both spontaneously brainstorm ideas and deliberately evaluate them to determine whether they’ll actually work.” To illustrate

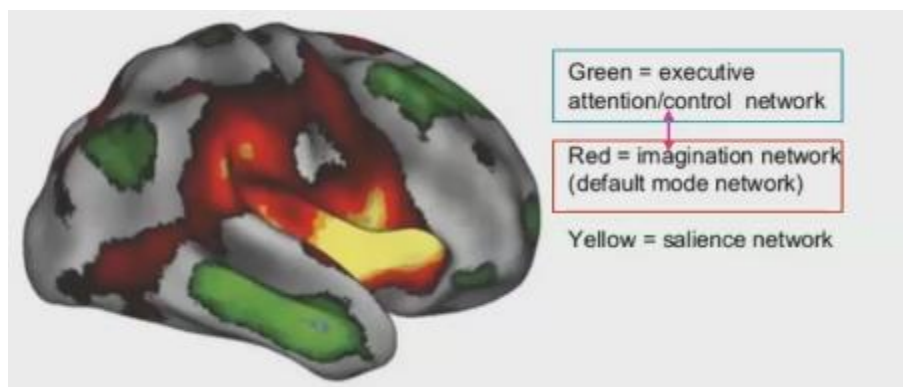
those findings, an MRI image of the brain with the three main networks humans use in their lives is shown below.

In **green** is the default mode network (DMN). This part of the brain is activated when we are “doing nothing,” meaning we are not focusing our attention specifically on performing a given task. The DMN is involved in spontaneous thinking, imagination, and daydreaming; processing autobiographical information; and internal monologues. From a business perspective, the DMN is activate in brainstorming and idea generation activities, also known as divergent thinking.

In **red** is the executive control network (ECN). This part of the brain is activated when we need to focus and consciously control our thoughts. The ECN is involved in rational thoughts, suppression of impulses, and working memory. It is the decision-making part of the brain. In a business context, the ECN is activated in situations such as assessing the ideas previously brainstormed and deciding which to implement. This could be associated with convergent thinking.

In **yellow** is the salience network (SN). The SN is the one that actually decides whether the ECN or the DMN will be activated based on external and/or internal stimuli. This switching mechanism allows for alternation between the two previous states. If we refer to the previous example, SN would create the ability to switch rapidly between sparking ideas and assessing their feasibility and impact.

Figure 10 - Where does creativity lie in the brain?



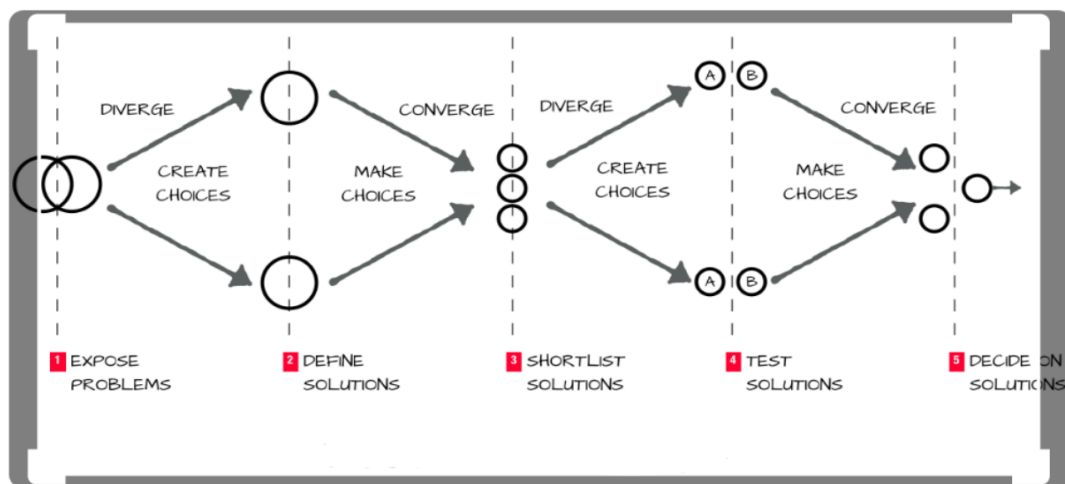
Source: National Academy of Sciences, 2011

The recommendation for companies is to use design thinking (DT) sessions to boost creativity.

Design thinking is, simply put, a framework used to stimulate innovation in a business environment if applied with the required attention and rigorousness (Shiach and Virani, 2017).

Using design principles as a way of thinking to stimulate innovation was first proposed by Herbert A. Simon in his book *The Science of the Artificial* and later by Robert McKim in his book *Experiences in Visual Thinking* in 1973. McKim taught the technique at Stanford University for 10 years before founding IDEO, the firm that popularized design thinking as an innovation framework for businesses (Shiach and Virani, 2017).

Figure 11 - The Design Thinking Framework



Source: Learnstack.com | Pinterest, 2020

Tim Brown, the current chair of IDEO, states that “[d]esign thinking is a human-centered approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success.”

From a business standpoint, design thinking workshops can be useful to develop creativity, as they capture quite well the “switching” between DMN and ECN through the interplay between the divergent and convergent thinking in the double diamond framework.

Moreover, recent scientific evidence argues that studying design creativity techniques “mimic[s] the real-world design creative processes” (Lazar, 2018).

This section demonstrated how the creativity process works from a neurocognitive perspective. The next question that may arise is “how creative can we be?”

2.3.2 Not an easy task

Although some of the most important aspects of creativity have been elucidated from a physiological perspective, coming up with new ideas and implementing them efficiently in the right way is not an easy task. Genetic predispositions aside, the explanation lies in three elements: our memory, the way the brain is designed, and the context in which we operate.

1- Our memory

Both the ECN and the DMN can draw only from our memories. In other words, imagination needs a foundation; we cannot imagine something completely new from nothing. The input the brain uses to imagine is therefore the memory. Memory will determine the realm of possibilities we can imagine. As Ewa Miendlarzewska, a neuroscientist, mentioned in the webinar *The Neuroscience of Design Thinking*, “[t]he things possible to us are only those we can image or have experience with and since.” Therefore, the richer the repertoire, the more resources our brain will have to draw on to imagine future scenarios.

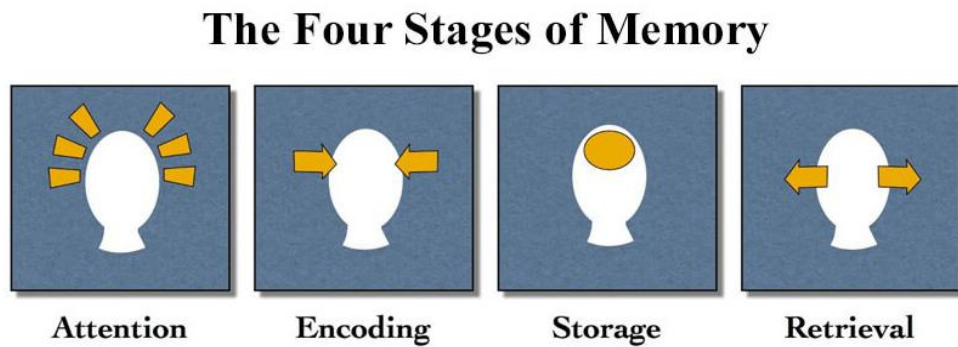
The recommendation for companies is then to foster cultural and artistic breaks to expand the repertoire of possibilities an employee can draw from in their memory.

There is recent scientific evidence that simply exposing employees to visual art in the office and giving them some time to appreciate and experience the pieces enhances their creativity at work and will drive innovation. "Appreciating art induces inspiration, which in turn facilitates performance on creative tasks," claimed the authors Donghwy An and Nara Youn of South Korea's Hongik University, in their 2017 study "The inspirational power of arts on creativity."

2- The way the brain is designed

Originally, there were considered to be three phases in learning and memorizing things: encoding, storage, and retrieval (Melton, 1963). Later on, it was proven that attention plays a key role in the three stages (Muzzio, Kentros and Kandel, 2009). Thus, the full process is as follows:

Figure 12 - The Four Stages of Memory



Source: SuppliMind, 2020

What is important to highlight is that the brain forms neuronal networks in such a way that it will use as little energy as possible to encode but, most importantly, retrieve memory. To do so, it will use schemas (Bartlett, 1932). Schemas help the brain rapidly encode, process, and retrieve information (Gureckis and Goldstone, 2010) by extracting the constant and most important elements from our past experiences. Assume a person sees a car for the first time in their life; the brain will encode the various elements: tires, chassis, plate, steering wheel, and so on.

The brain will connect all the information, associate the distinctive elements, and store them as a car. A neural connection was just formed. The next time the same person sees a car, there will be no need to encode anything. The whole image of the car will pop up. Their brain has formed a car schema to save energy and remove the need to encode the information each time a car appears.

Figure 13 - Example of a car schema

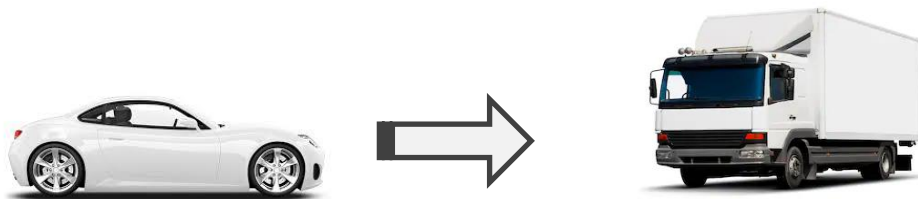


Source: prepared by the author

Assume now that the same person sees a truck. It looks like a car, but the chassis and other elements are different. The brain will retrieve the car schema it had formed and

encode only the new elements, which require significantly less cognitive load than encoding the new object from scratch.

Figure 14 - Example of the use of schema when integrating new information

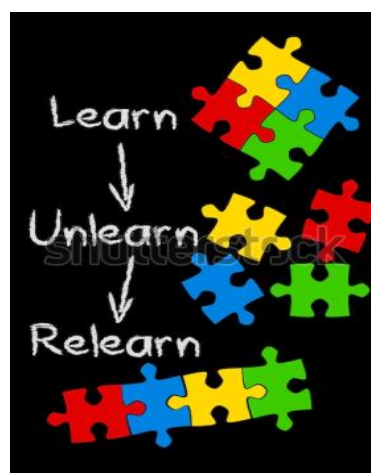


Source: prepared by the author

This natural mechanism helps save significant time in analyzing the environment and making decisions. However, it can also inhibit creative potential.

Imagine this time that a manager or director needs to make a decision in the face of uncertainty, when entering a new market or in a crisis situation for example. Their brain will try to connect it with what they have already seen, learned, or experienced, thus falling in a familiar pattern and limiting the potential for generating new ideas.

Figure 15 - Illustration of the "Learn, Unlearn, Relearn" process



Source : Shutterstock, 2020

Therefore, the first step in combatting this is for individuals to be aware when this natural tendency does not play to their advantage and, secondly, take appropriate action using

learning and development tools. Indeed, training and workshops that foster unlearning are key for innovation (Leal *et al.*, 2014).

Let's revisit the example of the car schema. Assume a car manufacturer produced all the car elements but for various reasons cannot assemble the cars anymore. In order to transform their business, they have to voluntarily deconstruct the car into its basic elements to break the association formed in the schema. This process may allow them, for example, to repurpose the business and use parts of the car for things such as furniture or playground equipment.

Figure 16 - Repurposing car tires in unrelated product categories



Source: Ofdesign.net, 2013

Interestingly enough, schemas also partially explain our natural tendency to resist novelty; indeed, it is easier to remember things that fall into a schema than to make a new schema out of familiar elements.

Fortunately, schemas can be intentionally removed through “unlearning” training.

There is a vast amount of literature available about how to unlearn and relearn successfully. This thesis will not extend on this subject. However, to give an example, a simple way to embark on the unlearning process on a personal level would be to start by proving one's self wrong. As Mark Twain used to say: “It ain't what you know that gets you into trouble. It's what you know for sure that just ain't so.”

The recommendation to stimulate creativity in this respect is to promote and implement unlearning and relearning strategies along with learning and development (L&D).

3- The context

a) External context

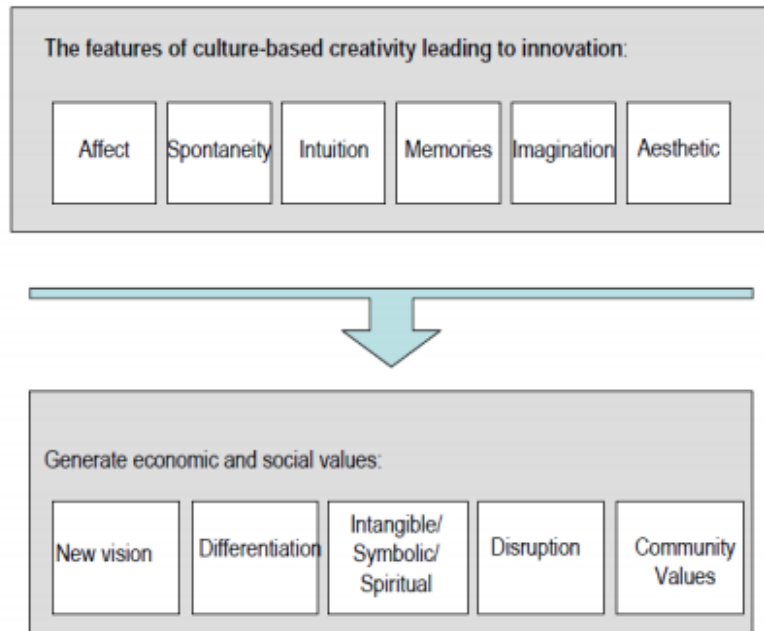
The external context derives from our culture and impacts our beliefs system, which in turn impacts creativity.

Just like the schemas that form our memories, our belief system shapes the range of possibilities we can imagine, thus limiting or enhancing our creative capabilities (Hill, 2012). In other words, we will not actively engage our brain in a domain or field that is considered forbidden or not of interest. According to professor Csikszentmihalyi, the cultural—and by extension social—environment of a person cannot be omitted when analyzing creativity. As he mentioned, “creativity does not happen inside people’s heads, but in the interaction between a person’s thoughts and a sociocultural context. It is a systemic rather than an individual phenomenon” (Csikszentmihalyi, 1996).

Cultural tightness, the degree to which the members of a society are punished when they derive from the norm (Gelfand, Nishii and Raver, 2006), strongly impacts the nature of creativity within a culture’s confines. Societies with a high level of cultural tightness also tend to be less responsive to creative ideas from foreign countries (Chua, Roth and Lemoine, 2014). Therefore, before a creative idea is recognized as novel and of interest, it must be first “appropriate [and] recognized as socially valuable in some way to some community” (Sawyer, 2006). For example, it is very unlikely that an innovative tanner that does not stain bathing suits and resists sweat while sunbathing will come from a country like the Emirates where women have limited rights and physical exposure. This is not because they cannot conceive it, but because it goes against their beliefs.

In the report “The Impact of culture on creativity,” prepared by the research centre KEA European Affairs in 2009, it is demonstrated that culture leads to different degrees of personality features which contribute to economic and societal values.

Figure 17 - The features of culture-based creativity leading to innovation



Source: European Commission, 2009

The recommendation for companies in this regard is to use empathy and immersive cultural trainings along with hard facts when wanting to win a new market or better understand the current market.

b) Personal factors

Beside the external factors, creativity is also highly impacted by personal factors. In this paragraph, the genetic aspect will not be covered. Although it has been observed that genes contribute to the convergent and divergent processes in the creativity process (Zhang *et al.*, 2018), the genetic origin of creativity is still debatable (Runco *et al.*, 2011).

However, what has been demonstrated is the impact of emotional and behavioral states, in particular, fear and stress (Hoffmann, 2019), and psychological behaviors such as “confirmation bias.”

Fear

In simple words, when experiencing fear, the amygdala will redirect all the brain resources to the habit learning system, which means that people will behave and think how they know and are used to, limiting the scope of possibilities and idea generation (Miendlarzewska, 2020).

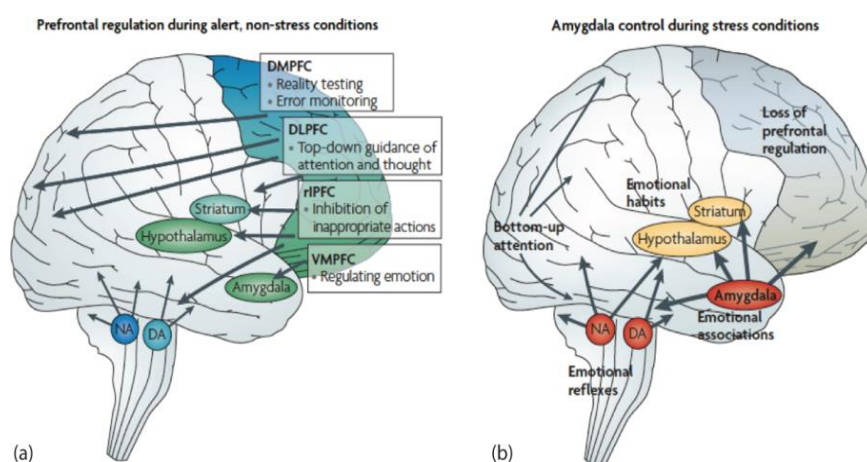
For example, this phenomenon might be experienced in a brainstorming session where there is group pressure and no one says what they truly think for fear of looking ridiculous or unintelligent. Thus, the free flow of thoughts is limited and those involved go back to doing things as they usually would.

Stress

Another factor, very common in modern society, is chronic stress. It has been scientifically demonstrated that chronic stress directly and unambiguously affects brain performance and disrupts the mechanism of memory consolidation (Hoffmann, 2019).

As previously mentioned, memory resources, consolidation, and retrieval are key to creativity enhancement, and all of these mechanisms are inhibited in stressful and fearful situations, because the brain goes back to the habits it already has, drastically limiting its creative potential.

Figure 18 - Brain activity in non-stressed and stressed conditions



Source: Arnsten, 2009 (cit. Hoffman, 2019)

The recommendation for companies in this regard is to create a safe and stress-free working environment.

Confirmation bias

On a side note, the brain possesses an internal reward system that is regulated through the well-known hormone dopamine (Dubol *et al.*, 2017). One very common example is the “I knew it” moment, also known as “confirmation bias.” Indeed, in 1620, Francis Bacon explained that “once a man’s understanding has settled on something (either because it is an accepted belief or because it pleases him), it draws everything else also to support and agree with it).” In terms of creativity, this type of—often unconscious—behavior significantly limits not only the brain’s creative potential but also its ability to recognize and adopt changes when they occur, simply because they do not fit into the current schemas (*i.e.* with what we already know or have experienced). In neuroscientific terms, neural sensitivity to new knowledge is therefore significantly reduced.

The recommendation for companies is to implement training to overcome confirmation bias.

2.3.3 Creativity in the business environment

Companies foster creativity in their organizations in a variety of ways. The goal of this section is to give a glimpse of what non-fundamentally creative companies (like fashion or music) can do to stimulate creativity and innovation. The possibilities are endless, so this study has limited itself to two examples from the two companies that have been viewed as the most creative over the years according to Booz & Company: 3M and Google.

3M - 3M launched the 15 per cent program in 1948. The program gave employees the opportunity to use a portion of their paid time “to chase rainbows and hatch their own ideas,” relates FastCompany. Initially a benefit for scientists only, the “15 per cent time” was extended to everyone, because—as the company spokesperson says—“Who knows where the next Post-It Note will come from?”

Google - Google has chosen to invest in workplace aesthetics and offer its employees a playful, casual, and entertaining working environment. Employees feel like they own the place, so their minds can create freely. According to an interview for the *New York Times*, that is what the engineers like, so the company is “trying to push the boundaries of the workplace.”

Figure 19 - Picture from Google workplace in the USA



The so-called Truck Pit, one of the four cafeterias in Google's East Coast headquarters. Karsten Moran for The New York Times

Source : The New York Times Company, 2013

Research has proven that debiasing training can reduce cognitive bias and improve decision-making (Sellier, Scopelliti, Morewedge, 2019 cit. Forbes).

As shown, creativity remains a fascinating notion not yet completely demystified by scientists. The facts indicate that it encompasses both hard and soft skills, and a number of complex factors are at its origin. However, given the rise of automation and other forms of AI, we can naturally ask ourselves “can a robot replace a human in the workplace?” and “to what extent?”

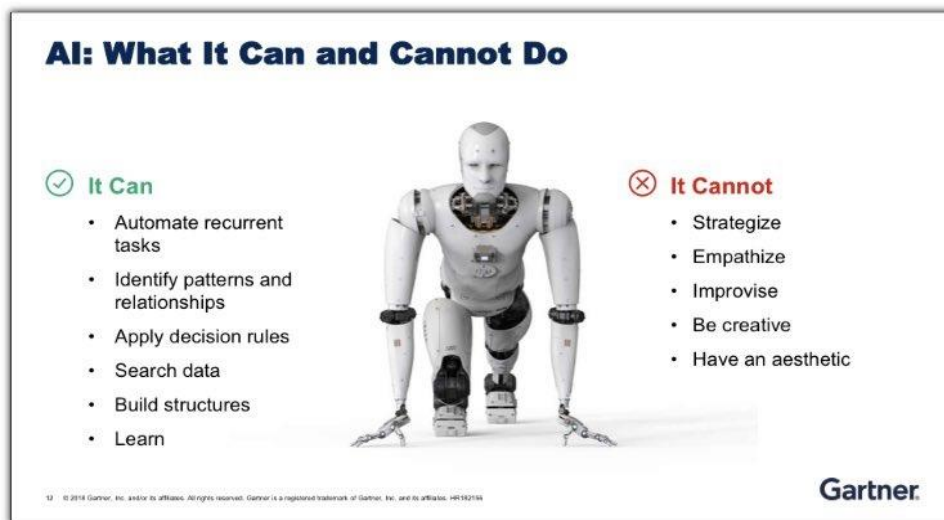
2.3.4 Creativity and automation

There is a vast amount of literature on what tasks robots and other forms of artificial intelligence will be able to perform in the future. Current research states that “while AI and automation can augment the productivity of some workers, it can replace the work done by others and will likely transform almost all occupations at least to some degree” (Frank *et al.*, 2019). From this point, it can be inferred that, besides mechanical and repetitive jobs, AI will also impact highly educated and well-paid jobs, such as medicine, finance, and information technology (Mitchell T, Brynjolfsson, 2017).

The scope of this thesis does not cover a thorough analysis of what machines could do, as it is assumed that this information comes from the current level of technology available at a certain moment in time and requires on-going monitoring from the business.

However, to give a quick overview of the technology today, research and advisory company Gartner summarizes the potential of AI in the table below:

Figure 20 - Where AI can substitute human intelligence



Source: Gartner Inc, 2019

It can be observed that AI is unable to improvise, empathize, or have a sense of beauty. Referring to the section above, it can be seen that memory formation and retrieval is a crucial part of the creative process. Hence, it can be assumed that, since machines do not forget anything, they might outperform humans in the quantity of memory available. However, they seem to be unable improvise and be spontaneous. Improvisation is crucial during brainstorming sessions, as the goal is to break the old patterns of thinking or schemas (Sawyer, 2001), which in turn will allow new ideas to appear and flourish.

The recommendation for companies under this consideration is to implement improvisation training.

It has been scientifically proven that improvisation enhances creativity from a neurological perspective. In laymen's terms, the 2008 study conducted by surgeon, neuroscientist, and musician Charles Limb and neurologist Allen Braun showed that, when reacting spontaneously and improvising, brain activity responsible for self-conscious and self-monitoring mechanisms diminish, allowing the creative and self-expressive part of the brain to increase significantly.

2.4 Job Criticality

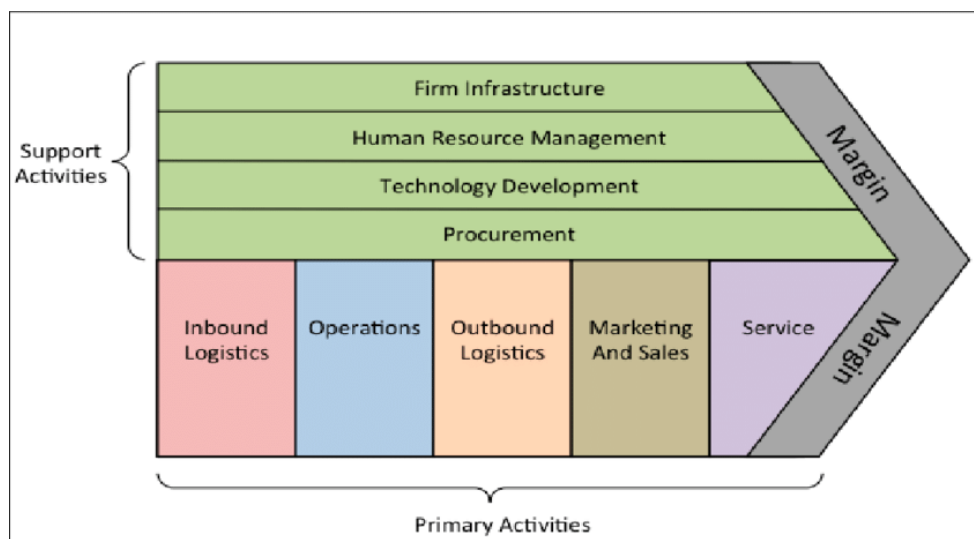
In this thesis, job criticality is a concept proposed by the author to define the relevance of a given job with respect to the business mission and activities. The concept derives from the separation of activities conveyed by Porter's value chain analysis, which states that the activities carried out by the enterprise are divided into core functions and support functions.

Core functions are the activities that will deliver the actual value proposition of a company and help fulfil its mission. They are also known as production-related activities, and their goal is to produce the goods or services for the final consumers and yield income. In Porter's terms, they are referred to as primary activities. Examples are operations, strategy, and marketing and sales.

Support functions are activities that facilitate the core business functions, meaning that their output is not aimed at final consumers, but by supporting the main functions, they help in the overall performance. Examples are human resources, finance, and IT support.

Another characteristic of the support functions is their transferability from one organization to another.

Figure 21 - Michael Porter's value chain analysis



Source: The Investors Book, 2020

It is important to note that the separation between core and support functions remains at the company's sole discretion. Depending on their mission and way of operating, an enterprise may decide to incorporate a support function as part of its core functions and vice versa.

In this perspective, job criticality will be defined as the degree to which a given job is vital to the business's performance in delivering its value proposition. It is key to stress that job criticality is related to the relative importance of the job with respect to the company's mission and not to the nature of the job itself.

For example, the job of a secretary in a pharma company will be less critical to the company's main mission (produce and sell drugs) than the job of a researcher. However, for a company selling secretary services, the job of the secretary is essential.

In this section, the aim and objectives of the research will be defined and the research questions will be addressed. Then, the process and rationale behind the data collected from both secondary and primary sources will be explained.

Section conclusion

In the literature review, the concept of job automation, soft skills, and creativity were analyzed, and the notion of job criticality was introduced. The literature review shows that there is no simple conceptual decision-making framework correlating these dimensions. Therefore, the primary research objective of this thesis, which is to construct a decision-supporting framework to correlate the level of job automation and soft skills development with job criticality as a linchpin, was validated by the literature review.

3. Research Objectives

The research objectives are as follows:

- A- Examine the relationship between two seemingly independent criteria, the level of job automation and the level of investment in soft skills, to characterize a set of options.
- B- Construct a criticality framework, or criticality matrix, connecting automation and soft skills development with job criticality as a variable
- C- Propose a guideline for how to immediately apply the framework.
- D- Evaluate the framework's usefulness and applicability through in-depth interviews with professionals who have faced decisions regarding automation impacts in their professional environments.

Sub-objectives

Under objective C, propose a guideline for how to practically apply the framework, there are three sub-objectives to help make the matrix more concrete:

- C.1- Propose a simplified framework to assess the potential level of automation of a job.
- C.2- Propose a simplified framework to assess the level of criticality.
- C.3- Propose a checklist with suggestions on how to stimulate creativity in a working environment along with traditional measures to develop soft skills.

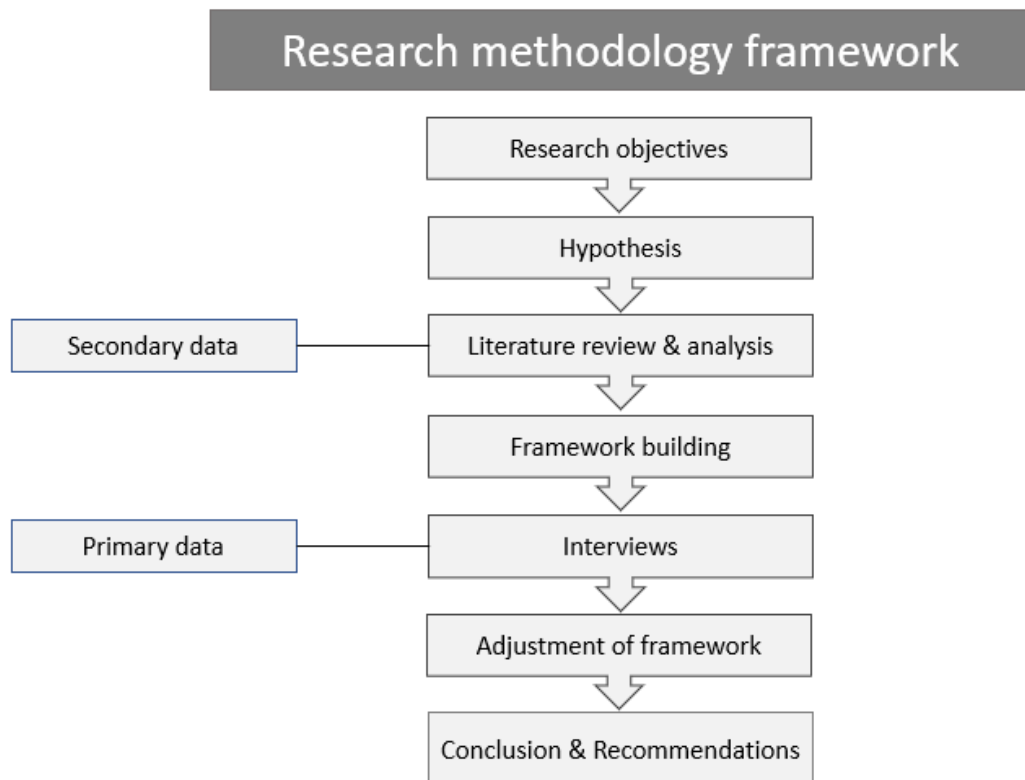
The sub-objectives are not final targeted outcomes in themselves; they are constructed to provide guidance on how the main framework can be immediately applied and to support its validity. Their soundness will, however, be appraised in the interviews as well for general coherence.

4. Methodology

The objectives A, B, and C (including sub-objectives) will be addressed using secondary data sources, deriving from the literature review analysis. Objective D will be addressed using primary data sources from in-depth interviews.

4.1 Research framework

Figure 22 - Research methodology framework



Source: prepared by the author

4.2 Secondary data sources

Secondary data sources were used to screen current literature to discover whether there were previous studies proposing frameworks linking job automation and soft skills. The observations indicated that the two subjects were treated as distinctive and separate topics, which validated the need to conduct research on whether a conceptual framework to connect them would be of use.

4.2.1 Objective A- Examine the relationship between two seemingly independent criteria, the level of job automation and the level of investment in soft skills, to characterize a set of options.

An analysis of the current level of development in the subjects of job automation analysis and soft skills development showed that there was no simple framework available in the current publicly available literature to study the relations, analysis, and implications of those two themes.

Therefore, it appears relevant to suggest one and test its validity.

If a given job position is considered, the two cases below can be used to study the direction of the relationship and how closely the two variables are connected.

Hypothesis 1- The level of potential automation is positively or negatively related to the investment in soft skills needed.

Case 1 - The higher the level of potential automation, the lower the investment in soft skills needed.

True for a cashier at Migros

Consumers go to the cashier only to pay; most cashiers can be replaced by machines, and perhaps a few could become supervisors for the machines.

False for a cashier at Gucci

Consumers expect to have a unique buying experience in Gucci stores, so a cashier at Gucci is the sales point image of the brand and is unlikely to be replaced by a machine. Therefore, although the level of potential automation is high, the company will not choose

to have the task performed by a robot and will instead invest in soft skills to make the sales experience more memorable.

Important note:

The jobs below are taken as illustrative examples, because they are common jobs, and one possesses a general idea of what the tasks consist of without a thorough literature review. The depictions do not mean to discriminate against any job based on its nature.

In this section, soft skills, creative skills, or human skills will refer to the same concept, as opposed to automatable skills.

Case 2 - The lower the level of potential automation, the higher the investment in soft skills needed.

True for a teacher

The level of interaction, unpredictability, and mix of cognitive and non-cognitive skills is very unlikely to be automated in the upcoming years, and teachers might want to find new ways to adapt their teaching to spot individual talents in a class, for example.

False for a plumber

Due to the unpredictability, this service is unlikely to be automated. However, besides the current communication skills, it is very unlikely that more soft skills will be needed; hence, the expected investment in soft skills needed is low.

Therefore, there are the four scenarios below:

Table 1 - Set of options: job automation and soft skills

If	Job automation + (high)	Soft skills + (high)
If	Job automation + (high)	Soft skills - (low)
If	Job automation - (low)	Soft skills +(high)
If	Job automation - (low)	Soft skills - (low)

Source: prepared by the author

Given the above examples, it is seen that the investment in soft skills can be positively or negatively related to the level of automation given the nature of the job and the context in which it is performed.

Until this point, the set of options is not of particular help in decision making; hence, job criticality will be tested as an element that can soundly connect the level of job automation and the level of soft skills needed.

4.2.2 Objective B - Construct the criticality framework, or criticality matrix, with job criticality as a variable to connect job automation and soft skills development.

Looking at the examples above, given the potential level of automation of a certain job, the level of investment in soft skills can either increase or decrease. Hence, the hypothesis that the investment in one or the other will vary based on an external element can be stated. Consequently, there is a need to define a third variable that can explain when the relation is either positive or negative.

As a result, the following hypothesis has been developed:

Hypothesis 2- The criticality of a job in a given company can explain when and if soft skills are needed, given a certain level of job automation.

The following sections will show the construction of a framework that will allow the testing of this hypothesis.

4.2.2.1 *Framework building*

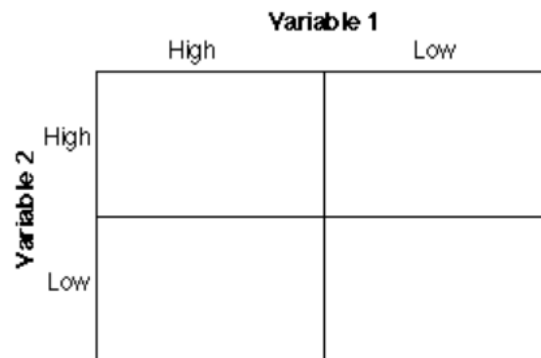
The framework will be built using a 2x2 matrix and the “importance” variable from the Eisenhower matrix.

Step 1: 2x2 scenario matrix

The form, or appearance, of the framework is inspired by the matrixes generally used for product portfolio management (like the BCG matrix) or competition analysis (Porter’s 5 forces). These types of matrixes—also known as 2x2 matrixes, scenario planning, scenario thinking, or analysis—are managerial tools that support organizational decision making by attempting to predict the future (Bradfiel *et al.*, 2005 cit Wikipedia).

According to the University of Cambridge, the 2x2 matrix is particularly helpful in “categorizing things that can be reduced to two simple variables, particularly when quantitative information is unavailable and qualitative judgements must be made.”

Figure 23 - 2x2 matrix



Source: University of Cambridge, 2016

As side information, the origin of scenario analysis lies in the US Army. Herman Kahn, American physicist, strategist, and futurist, collaborated with the RAND corporation⁴ (a think tank) in the 1950s to develop military strategies during the Cold War and was using scenario planning to support and communicate his statements.

Step 2: Eisenhower matrix

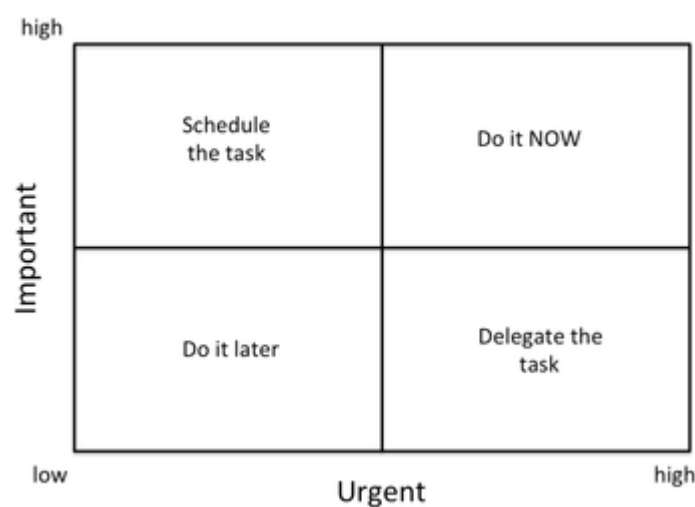
The notion of job criticality was proposed by the author to construct the framework below. In this thesis, it will sometimes be referred to as the criticality framework. Job criticality refers to how important a job is in respect to the business’s mission. The idea of taking importance as a variable was derived from one of the most famous examples of the scenario matrix application, when it was used by former US president Eisenhower. He used two variables, importance and urgency, to manage his time by prioritizing which tasks he should do first.

⁴ RAND Corporation is an American non-profit global policy think tank created in 1948 by Douglas Aircraft Company to offer research and analysis to the United States Armed Forces. Source: rand.org

In a 1954 speech, Eisenhower quoted an unnamed university president who said, “I have two kinds of problems: the urgent and the important. The urgent are not important, and the important are never urgent.”⁵

What became known as “the Eisenhower matrix” found applications in different fields, from medicine (Batra, 2017) to personal development (Kwiatkowski, founder of the app Eisenhower).

Figure 24 - The Eisenhower matrix



Source: Richard LLC, 2013

Starting from this point, given that technology is an external element that companies will have to address regardless of their will (cf. Literature review), it seemed logical that the first variable would be the level of potential automation. The investment in the development of soft skills appeared to be more of an initiative based on the companies will regarding how it could respond to the implications of automation on a human level.

A third variable from the Eisenhower matrix was then tested against the label of potential automation of a job: its relative importance with respect to the business’s mission.

⁵ In the following excerpt Eisenhower used the phrase “President Miller” while referring to Dr. J. Roscoe Miller who was the President of Northwestern University (Second Assembly of the World Council of Churches, 1954).

The level of urgency could have also been tested against the potential automation of a job, but as explained in the literature review, technological transitions might often happen slowly over time, and the sense of urgency does not appear as relevant as the relative importance of the job.

The three main notions involved (job automation, soft skills, and job criticality) were already analyzed in the literature review, but operational definitions⁶ will be given in the sub-section below. The four scenarios will be explained and appropriate recommendations for actions to take in each scenario will be provided based on the analysis made in the literature review section.

Operational definitions

The concepts are thoroughly explained in the literature review. However, for this section, operational definitions are offered below:

Level of job automation: The level to which a machine could perform some or all tasks of a job instead of a human with the current available technology (this can also be defined as the replacement rate).

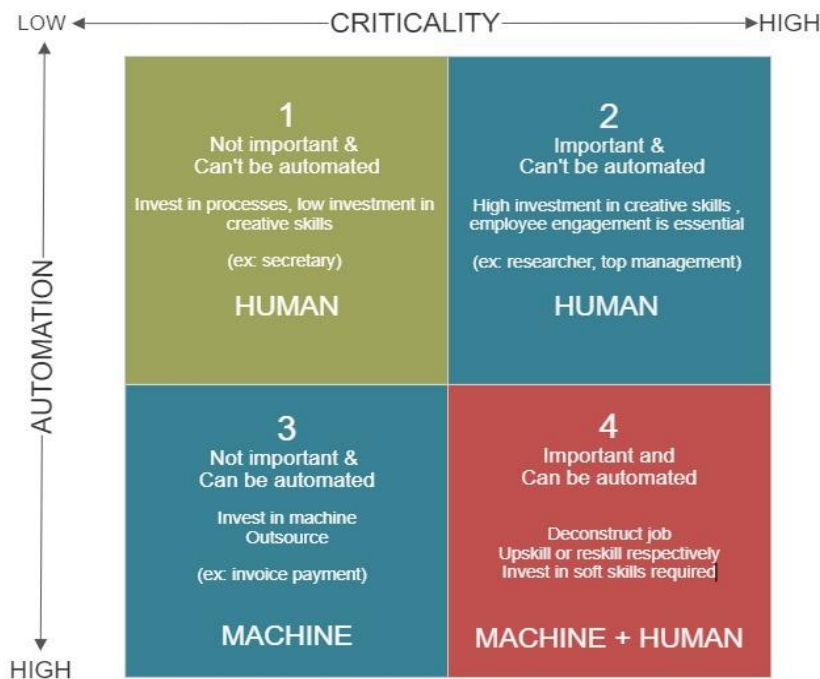
Soft skills: A set of “human skills” that have a considerable behavioral complexity and are unlikely to be performed by a machine with the current available technology.

Job criticality: In this thesis, the criticality of a job is the degree to which a job is vital to the business’s performance and impacts its value proposition. For example, a researcher in a pharmaceutical company would be more critical to the company than an administrative assistant. It is important to highlight that job criticality is related to the relative importance of the job with respect to the company’s mission and not to the nature of the job itself.

When attempting to correlate the level of criticality of a job with its level of potential automation, the matrix below is obtained.

⁶ The operational definition of a variable is a statement of how the researcher in a particular study chooses to measure the variable in question (Polgar and Thomas, 2008).

Figure 25 - Criticality matrix, first version



Source: prepared by the author

This matrix allows us to explain not only the level of soft skills needed but also derive other, perhaps equally important, business decisions, such as whether to invest in a machine, a human, both, or take no action at all.

4.2.2.2 Matrix interpretation

Inputs:

- The level of job automation is determined by the technology available at a certain point in time (External).
- The level of the criticality of a job is determined by the company (Internal).

Outputs:

- Invest in soft skills development (creativity, interpersonal, etc.; HUMAN)
- Invest in a new machine (software, robot, device, etc.; MACHINES)
- Both (new machine and up skill, re-skill employee; HUMAN + MACHINES)

The business will then decide on whether it should invest in a machine (scenarios 3 & 4), invest in human skills (scenarios 2 & 4), or take no action (scenario 1).

Furthermore, the matrix serves as a roadmap for companies to position themselves and have a clear visibility on where they stand when comparing the benefits of automation and soft skills and re-evaluate their value proposition.

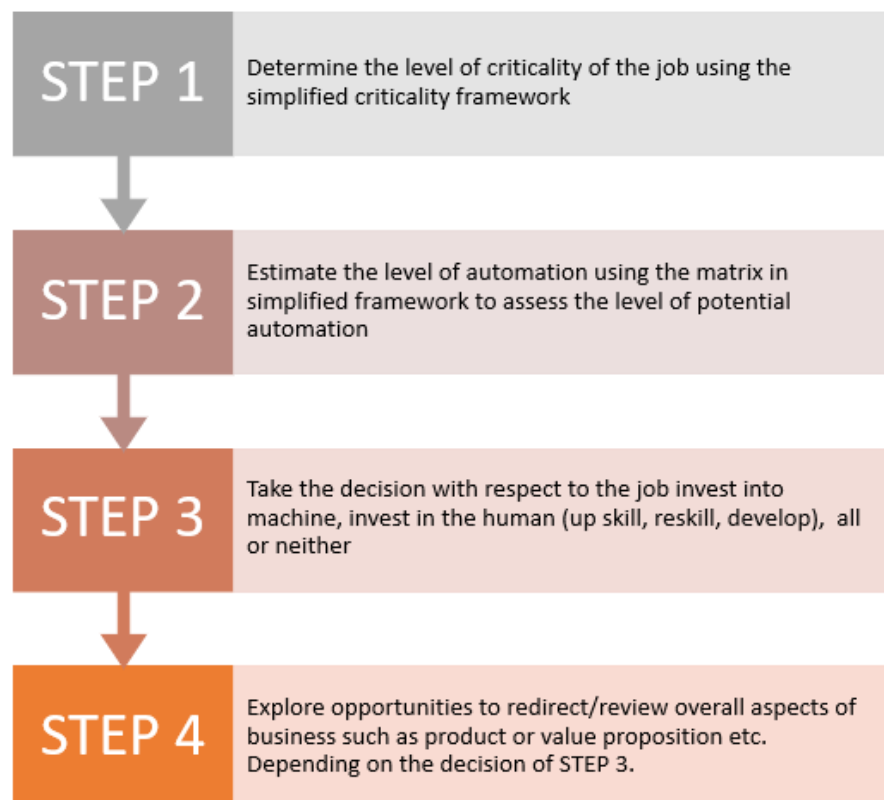
In the illustrative example of supermarket Migros, this could be seen as an opportunity to train their former cashiers to be sales advisors. For example, the former cashiers could be taught how to help customers choose among seemingly similar products; inform them about allergens, the type of food they are looking for, or other valuable information; make in-store activities frequently to reinforce the “Migros community”; and so on. Therefore, by extension, the matrix also gives room for questioning the current and future way of doing business.

Job criticality can therefore explain why job automation and soft skills could have both positive and negative relationships; it appears to be more of a matter of context and business priority.

4.2.3 Objective C- Propose a guideline on how to immediately apply the framework.

How to apply the matrix?

Figure 26 - How to immediately apply the criticality matrix?



Source: prepared by the author

To make the matrix immediately applicable, the following will be proposed as sub-objectives to address the three areas covered by the matrix:

C. 1- Propose a simplified framework to assess the potential level of automation of a job.

C. 2- Propose a simplified framework to assess the level of criticality.

C. 3- Propose a checklist with suggestions on how to stimulate creativity in a working environment along with traditional measures to develop soft skills.

C.1- Propose a simplified framework to assess the potential level of automation of a job.

In this thesis, the level of job automation will be measured using a simplified version of the “4-step approach” of Jesuthasan and Boudreau, detailed in their book *Reinventing Jobs: A 4-Step Approach for Applying Automation to Work* (2018), combined with the McKinsey infographic tool “Where machines could replace humans — and where they can't (yet).”

The reason for using a mix of the two tools is because, although Jesuthasan and Burdeau's approach focuses on applying automation to work, only the first step of their approach actually deals with assessing the potential level of automation with its set of criteria. The other steps address the different types of automation individually and the roles and returns it might generate for a company.

On the other hand, the McKinsey tool is meant to analyze a wide variety of jobs, based on metadata⁷ that are too large and too complex to break down to a company or job level without some considerable intermediary steps. However, some key concepts will be extracted to complement Jesuthasan and Burdeau's approach in some challenging aspects that are detailed in this section.

Jesuthasan and Burdeau's original first step was to discover the automation compatibility of each task.

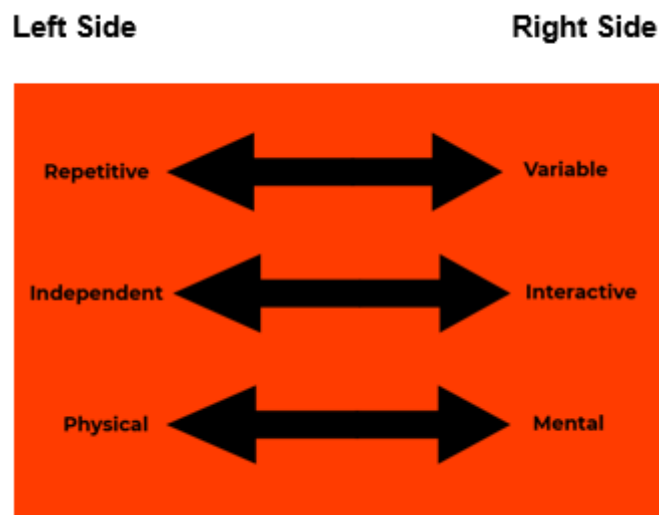
In order to determine whether a job can be automated, it should first be deconstructed into as many individual tasks as possible. Then, each of the tasks will be evaluated to

⁷ A very large set of data that describes other data, often referred to as “data about data” (Lavrakas, 2008).

see if it is compatible with automation, meaning to what extent a software, machine, robot, or other form of AI can perform it without human involvement.

To this end, the authors put forward the scale below:

Figure 27 - Discover the automation compatibility of each task



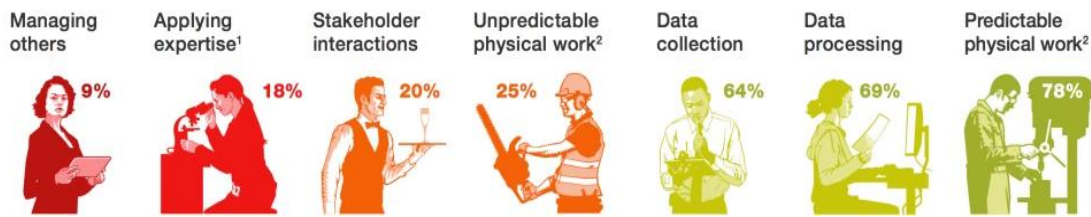
Source: Adapted from Jesuthasan and Boudreau, 2018

If a task can be qualified as repetitive, independent, or physical, there is a high compatibility with automation. In other words, it is very likely that the human worker could be displaced by a machine.

The third element, physical vs mental, does not seem fully accurate due to its wording, because one might think of a caregiver, whose main job might include tasks such as administering their charge's medicine, providing transportation, or other household tasks. These tasks seem physical and mechanical but are very unpredictable, as they might depend on the mood or health imperatives of the elderly, making them unlikely to be automated.

This aspect is captured in a more detailed manner in the McKinsey approach.

Figure 28 - Jobs prone to automation in the US



Source: McKinsey 2016

The percentages given represent the percentage of time spent on activities that can be automated by adapting currently demonstrated technology in the US. The percentage and the country will be ignored in this thesis, but the types of activities will be kept to complete Jesuthasan and Burdeau's first step. The differentiation between predictable and unpredictable physical tasks is evident with the selective use of the McKinsey approach.

Consequently, the following mixed and simplified framework will be used in this thesis to quickly assess the potential level of automation of a task and, by extension, job.

Table 2 - Simplified framework to estimate the level of automation of a given job

Criteria	Scale 1 to 5 *
Repetitiveness (doing the same thing over and over again with little to no novelty)	1 to 5
Predictability (knowing in advance what, when , where to work and the outcome expected from your work)	1 to 5
Interaction with others (managing, caring, leading, coordinating)	1 to 5

Source: prepared by the author

Table 3 - Scale interpretation

*Scale interpretation

	Repetitiveness	Predictability	Interactions
1 very low	The job contains 80% or more variable* tasks	The job contains 80% or more unpredictable tasks	80% or more of the tasks do not involve human interactions
2 low	The job contains between 60% and 80% variable tasks	The job contains between 60% and 80% or more unpredictable tasks	60% to 80% of the tasks do not involve human interactions
3 medium	The job contains between 40% and 60% variable tasks	The job contains between 40% and 60% unpredictable tasks	40% to 60% of the tasks do not involve human interactions
4 high	The job contains between 20% and 40% variable tasks	The job contains between 20% and 40% unpredictable tasks	20% to 40% of the tasks do not involve human interactions
5 very high	The job contains less than 20% variable tasks	The job contains less than 20% unpredictable tasks	20% or less tasks do not involve human interactions

Source: prepared by the author

*Variable = non-repetitive task

Example of scale application: (R is repetitiveness, P is predictability, and I is interactions)

Full Automation: R = 5 P = 5 I = 0

No Automation: R = 0 P = 0 I = 5

C.2 - Estimate the level of job criticality

Based on Porter's value chain analysis mentioned in the literature review, the below framework is suggested.

Table 4 - Estimating the level of job criticality

Estimating the level of job criticality	
Step 1 : Define business mission	
Step 2: Define core and noncore activities	
<ul style="list-style-type: none">• What activities are serving the final consumer = core activities = critical• What activities are enabling the business to serve the consumer in a more efficient way = support activities = non critical	
Step 3: Assess on a scale 1 to 5 the degree of criticality.	
1 - very low	
2 - low	
3 - medium	
4 - high	
5 - very high	
Interpretation: The higher the criticality of a job with respect to the business mission, the more we want to invest in "human" skills.	

Source: prepared by the author

C.3 Draft a checklist with suggestions on how to stimulate creativity in a working environment along with traditional measures to develop soft skills

Assess soft skills

Companies should utilize the tools currently being used in the business, mentioned previously in the literature review:

- Questionnaires
- 360 degree feedback
- Behavioral interviews

Assess creativity

From the literature review analysis and ascertainment, the results can be consolidated into the following checklist.

The checklist, or reference list, below highlights the content that companies can look to for inspiration on how to cultivate what could/should be done and acquire an idea of how much they are supporting and promoting soft skills and creativity in their working environment and populations.

Table 5 - Creativity checklist

Theme	Impact	Variable	Frequency	
Design Thinking	Stimulates Convergent/Divergent	Number of Design Thinking Sessions held	In the last 3 months	In the last year
Art & general culture	Expand the repertoire of possibilities a person can draw in his/her memory.	Number of artistic immersive workshops	In the last 3 months	In the last year
	Workplace	Number of artistic breaks	In the last 3 months	In the last year
		Number of visual arts exposed in the physical workplace (+ rotate them)	In the last 3 months	In the last year
	Awareness of beliefs hindering or fostering idea generation patterns	Number of cultural sensitivity trainings	In the last 3 months	In the last year
L&D upgrade	Break schemas to break obsolete thinking habits	Check if unlearning is embedded in L&D existent programs	ongoing	
	Overcome confirmation bias	Implement debiasing trainings	ongoing	
Working environment	More brain power available	Safe & stress-free working environment	ongoing	

Source: prepared by the author

4.2.3.1 Illustrative examples using random job descriptions

The following job descriptions have been selected to illustrate each scenario. The sources are not mentioned in the bibliography, because the postings are temporary and will very likely be removed after a candidate is hired. Nevertheless, the pdf versions of the internet pages will be provided separately.

- **Scenario (1) Low automation – Low criticality**

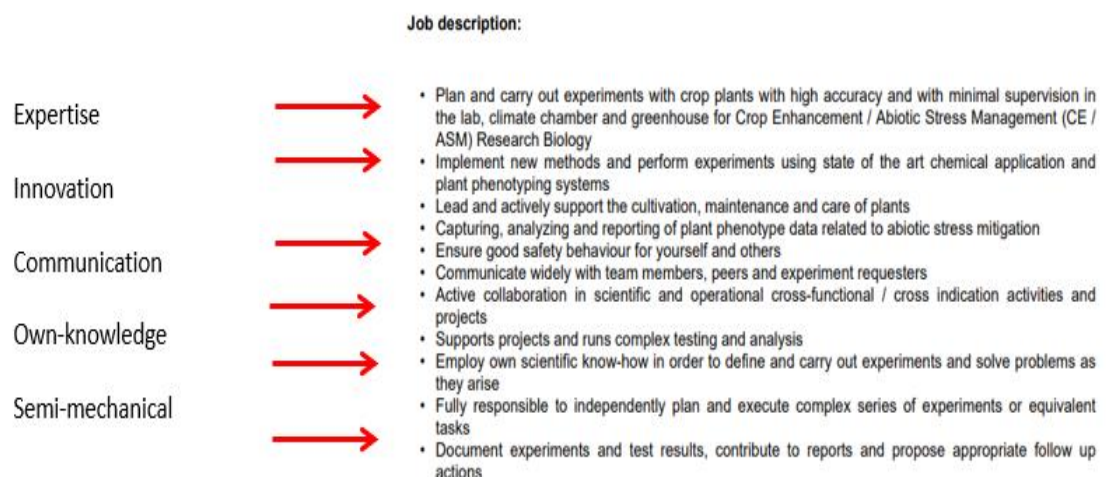


Applying the criticality framework

Business mission	Produce wine
Job position	Secretary
Criticality with respect to the business mission	Low (example of what would have been highly critical: oenologist)
Potential level of automation	Repetitiveness: 4 Interaction: 5

	<p>Predictability: 2</p> <p>Result: Low - Medium</p>
Decision	<p>Job rotation is not an issue given that it is a 100% supported function (vs core), so no need for substantial investment at this stage from a job perspective. Small investment in software and other IT tools to improve the workload can be made. From an employee satisfaction perspective, inclusion and recognition elements are needed. Job title revision is an example of one such change that can be implemented, because this position is the first person a stakeholder might interact with when dealing with a company, thus impacting the image of the company.</p>

- **Scenario (2) Low automation – High criticality**



Applying the criticality framework

Business mission	Agrochemicals
Job position	Research Scientist
Criticality with respect to the business mission	High
Potential level of automation	Repetitiveness: 1 Interaction: 3 Predictability: 1 Result: Low
Decision	Invest in what is needed to provide the researcher the best working environment to find new drugs.

- **Scenario (3) High automation – Low criticality**

		Duties and Responsibilities
Communication, human element involved	→	- Smile, greet, and thank customers with a positive attitude
Very predictable, mechanical and repetitive	→	- Stand for long periods of time while checking out customers quickly and accurately
		- Keep your area clean and presentable
Relatively predictable and repetitive but high in interaction	→	- Answer customer questions and help them with their needs
		- Be available to assist associates across the store as needed

Applying the criticality framework

Business mission	Retail
Job position	Cashier
Criticality with respect to the business mission	High
Potential level of automation	Repetitiveness: 5 Interaction: 3 Predictability: 4 Result: High
Decision	Self-checkout machines have already been implemented in many supermarkets, reducing the need for human cashiers. This could be seen as an opportunity for the supermarket to review the job description and upgrade individuals the position to customer assistants to warmly welcome, guide, and inform customers on the new products and so on.

- **Scenario (4) High automation – High criticality**

High level of interaction	→	The Legal Associate supports the efforts of BJ's in-house Legal Department (currently comprised of ten attorneys and four non-attorney staff members). This individual serves as the point of initial contact for internal and external clients of the Legal Department and routinely liaises with other departments at BJ's Home Office in Westborough, MA, with team members at BJ's Clubs, and with outside attorneys and their billing departments. Additional responsibilities include:
Repetitive, predictable	→	<ul style="list-style-type: none"> • Assist other members of the Legal Department with contract management, litigation management, and maintenance of corporate records and databases; • Liaise with internal clients throughout BJ's Home Office regarding review of contracts by the Legal Department; • Support internal clients, including asset protection, audit, and maintenance functions, with respect to documentation and policy requests; • Serve as primary e-billing contact for outside counsel;
Interactive and semi-repetitive	→	<ul style="list-style-type: none"> • Support attorneys and paraprofessionals in logging, responding to, or routing to other internal departments for action a variety of external legal demands, including litigation pleadings, settlement materials, subpoenas, and government agency inquiries; • Provide light administrative support to the Legal Department, including setting up team meetings and managing inbound and outgoing mail; • Interact cordially and professionally with customers, team members throughout the company, regulatory officials, and outside counsel; and • Other duties as assigned or as circumstances warrant.
Slight unpredictability	→	

Applying the criticality framework

Business mission	Legal services
Job position	Legal associate
Criticality with respect to the business mission	Medium – high
Potential level of automation	Repetitiveness: 3 Interaction: 4 Predictability: 3
Decision	<p>The job can be semi-automated. Thorough job deconstruction is recommended to identify the added value tasks and the time-consuming, repetitive tasks.</p> <p>Furthermore, investment in new software and shielding can be put in place.</p>

4.3 Primary data sources

4.3.1 Methodology

After constructing the matrix from secondary data sources, primary data sources will be used to test its accuracy and usefulness

In-depth interviews will be conducted with professionals who are facing or have faced decisions relating to automation and/or soft skills to collect their feedback on the potential usefulness and applicability of the framework.

The feedback and findings from the interviews will serve as an input to improve the framework. Interviews were preferred over more quantitative methods like surveys or experiments, because at this stage, the framework is conceptual. As a result, the goal of the interviews was to capture the first impressions and reflections and the thinking process a professional would have when they are exposed to the framework for the first time.

Six senior managers and former directors for multinational companies from both core and support functions were contacted. The goal was also to achieve a range of perspectives on the topic through different interviewee backgrounds (HR, supply chain, marketing, legal). Research shows that six interviews is the threshold to reach 70% saturation⁸, meaning that 70% of new information is captured in the first six interviews (Guest, Bunce and Johnson, 2006). The same authors recommend 12 interviews for a data saturation of 92%. Further research confirmed that, in five to six interviews, most new themes were identified (Francis *et al.*, 2009). In this research, and given the particular context of the coronavirus, the interviews conducted may be considered sufficient to improve the proposed criticality framework and make recommendations.

Further details on the interview methodology, such as choice of the sample, location, duration, approach, and communication methods, can be found in Appendix 1.

4.3.2 Discussion on the methodology & reliability of the interview data

Reliability of interview data usually originates from three sources: representativeness of the sample, quality of information obtained, and accuracy of reporting (Bleich and Pekkanen, 2013).

⁸ Saturation in this context is defined as a point at which no new information or themes are discovered (Guest, Bunce and Johnson, 2006).

4.3.2.1 Representativeness of the sample

Non-response bias: In most of the cases, people who are contacted for an interview and do not respond are not taken into account in the study. In some cases, this might lead to inaccurate conclusions, because these people might have contributed with essential information that could change or impact the final recommendations. This is also known as the non-response bias.

Overcoming non-response bias: Nine people were contacted in total. Out of them, eight responded. Out of the eight people who responded, two of them responded with a short email giving only one very short recommendation or impression in one or two sentences without further analysis, so they were not taken into account in the final data analysis. It is inferred that those brief feedbacks or “missed” interviews would not contain enough data to refute the content provided by the six other interviews; hence, the validity of the sample and data collected remains valid.

Snowball sampling: The snowball effect occurs when a researcher interviews a network of interlinked interviewees, thus biasing the results, as they might share a similar perspective on the topic.

Overcoming snowball sampling: Out of the six interviews performed in this thesis, four are former teachers from the author’s time at HEG during their studies, one is the author’s hierarchical superior at the company where they work, and the last one is another teacher at HEG whose contact information was provided by one of his mentees but who shares no direct connection to the author.

Consequently, there is a risk of the snowball effect. The author went forward with conducting the interviews with these participants, because in the context of the coronavirus, it was difficult to obtain responses from people from the field, as they were busy trying to cope with the situation. The author first searched for interviewees within the company they work and, excepting their superior, everyone was unavailable, so the author assumed it was the same for other fast-moving consumer goods (FMCGs) companies in Geneva during May 2020. Of course, the fact that the author knew four of the interviewees previously as teachers increased the chance of the interview being accepted.

Nevertheless, the risk can be mitigated because:

1- The interviewees were contacted by the author individually and were not referred by someone from the same network.

2- All of the interviewees have been in key leading positions and have been confronted with job automation vs soft-skills development issues, and their decisions would have significant impact in the environment they operated in, increasing the validity and reliability of the feedback with respect to the criticality matrix.

3- The sample included one person coming only from the field (the author's superior) and one teacher (although he is the mentor of a classmate) that the author has never had, contributing slightly to the diversity of the profiles in this context

4- The saturation point came only after the fifth interview, which is consistent with the current research suggesting five to six interviews, as explained in the literature review.

4.3.2.2 Quality of information obtained

It is assumed that the interviewees provided accurate information based on their expertise and knowledge and did not deceive the interviewer for any reason. It is assumed that the length of the interview did not have a major impact on the quality of the data, given that the interviewees had the opportunity to reflect on the questions before the exchange. Moreover, given that the style was semi-structured, some of the interviewees went into more detail when relating their past experiences before giving feedback on the framework.

4.3.2.3 Accuracy of reporting

Confirmation bias: confirmation bias occurs when there is a tendency to look for information that confirms with one's existing beliefs. Since the data is gathered only by the interviewer, they might consciously or unconsciously keep the information that best fits their perspective.

Overcoming confirmation bias: To overcome confirmation bias in data collection and analysis, discomforting evidence was actively sought during the interviews. Indeed, to obtain accurate, neutral, and constructive feedback, multiple measures were taken:

1- A written summary of the context and matrix was sent to the interviewees before their interviews, so they could form an idea beforehand.

2- Simultaneous note-taking was the main form of recording the interviews. It was spontaneous, live, and gave room to ask questions to clarify subjects that were not fully understood from the interviewer's perspective. The recording process was complemented with more note-taking immediately after the interview.

3- The quotes were not cherry-picked to fit the interviewer perspective, but they were chosen with respect to their repetitiveness and significance during the interview.

4- Right after introducing the matrix, it was explicitly mentioned that exposing pain points would be particularly appreciated, because the final goal of the interviews with to improve the critical matrix.

5. Findings

To present the data collected from the interviews, two methods were chosen: word cloud and thematic coding.

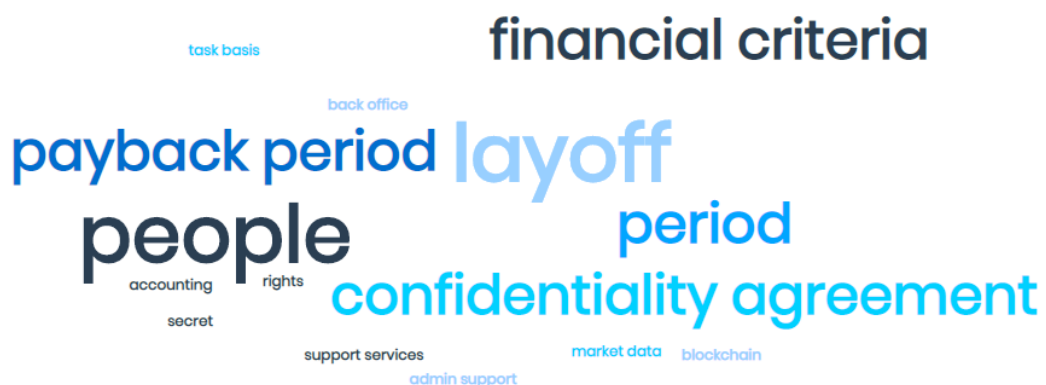
Word cloud is a visually appealing method to communicate messages from different sources in an easy and clear way, in particular when no further analysis is required (Cidell, 2010).

It was chosen to represent the data gathered on the variables that lead to the framework: job automation and soft skills. The purpose of the questions on the framework variables was to obtain spontaneous feedback and an overview of how things are approached within their respective professional circles and capture something that might be different or omitted from the literature review. The responses were consistent with the literature review and analysis content, so a word cloud was a simple way to convey the most important elements that were mentioned during the interviews. The words in capital letters were chosen based on their frequency or when the interviewees insisted on their relevance.

5.1 General feedback

Job automation

Figure 29 - Job automation word cloud



Source: prepared by the author using monkeylearn.com

Soft skills

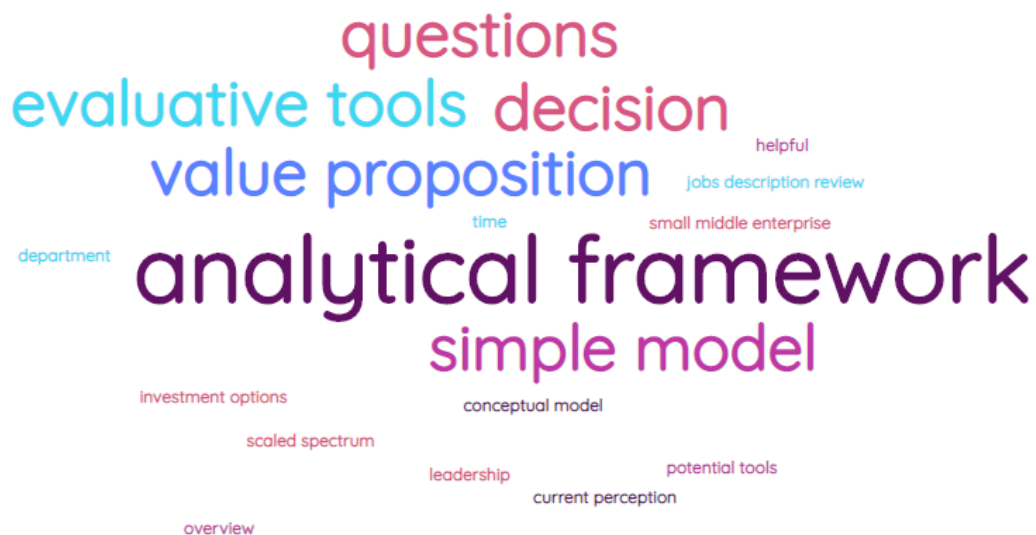
Figure 30 - Soft skills word cloud



Source: prepared by the author using monkeylearn.com

Matrix

Figure 31 - Criticality framework word cloud



Source: prepared by the author using monkeylearn.com

5.2 Suggestions for improvements

In qualitative data analysis, one of the most common methods to analyze data and look for potential pattern is coding. Coding is a method of “indexing or categorizing the text in order to establish a framework of thematic ideas about it” (Gibbs 2007 cit. cessada.eu). Hence, qualitative coding was selected to analyze the recommendations, reflections, and improvements mentioned by the interviewees.

The method requires careful reading and analysis of the data; spotting the patterns, recurrent ideas, or sentences that convey the same meaning; and writing a corresponding word or group of words to summarize it. Indeed, a code can be made of one single word or a small group of words (Sardana, 2013).

Open coding, or data-driven coding⁹, was used for this part of the study, because it required an analysis from the researcher. Moreover, this was the part where most of the time was spent during the interview and which generated more data.

Raw notes	Code	Key message	Outcome
Review box arrangement, reverse axes and use 1 color for each box	Configuration	4 scenarios should have different colors as they lead to different implications	Implemented
Think about a model to be filled out, like a blank version, to make it more practical	Configuration as a tool	Propose a blank version so it's readily applicable	Implemented

⁹ Data-driven coding means to look for ideas/concepts in the text without a preceding conceptualisation, as opposed to concept-driven coding, where data is approached with a developed system of codes that have to be found in the text (Source: cessda.eu)

Be careful with the choice of words, For instance the word “important” can be seen “pejorative”. Moreover, it is an opinion. The language of the matrix should be more neutral. In this case, the word “important” can be replaced by “strategic” or tactical” for instance	Terminology	Replace "Important" as it is seen like an opinion, find a more neutral word	Implemented
Everyone sees their job as very important, perhaps another term could be more accurate	Terminology	Replace "Important"	to consider
Admin assistants usually feel undervalued, and yet, they perform a variety of tasks such as stakeholder management, managing upward, downward etc. Sometimes, they even have to handle the mood swings of their superiors and they still don't feel important.	Recognition	Job description don't seem to capture everything a person do, leading to undermining his/her work	already mentioned
Automation input and output - Problem terminology – like circular Argument – other way to define that - maybe "Deconstructability" if it exists - means propensity to	Terminology	Replace "automation" by "deconstructability" if the word exists	to consider

be decomposed into a set of simple tasks			
Other option "Suitability for automation" - Ability to deconstruct break job into hard tasks - determine what's left-Computer can cumulate many simple well defined tasks	Terminology	Replace "automation" by "suitability for automation" as an example	to consider
Write on a piece of paper exactly what should be done. Ex - How much can you break down into subtasks that are extremely well defined- where there is no argument about it	Clarity	Explain every step of the matrix thoroughly	already done
Another dimension of measuring automation can be Complexity – is it easy to go one level below. <i>i.e.</i> divide into smaller tasks	Job Complexity	Add the dimension "complexity" to the automation assessment simplified framework	Included in the simplified framework as the 4rth dimension
Define thoroughly the notion of Criticality – security important but can be automated !! Careful (say critical with respect to the mission of the company)	Definition	Give thorough definition of "criticality"	already done

<p>Idea – Extract valuable time</p> <ul style="list-style-type: none"> - Delta of the remaining part – how do you integrate that- <p>Impact of the remaining job that is not properly captured</p> <ul style="list-style-type: none"> - It will be included in someone else's job? 	Job description	<p>Make a formula ,</p> <p>delta = to the part that can't be automated</p>	to consider
<p>Where is the line – because different people could have diff appreciation of different things There has to be a line</p> <ul style="list-style-type: none"> - It can also be Intuitively et 	Applicability	<p>Better define how to separate scenarios</p>	to consider
<p>Think of KPI -or Indicator -</p> <p>How I can measure it - Not easy , but it could be semi-objective – For example you can give 5 criteria rate on a scale + explain how to use it</p> <ul style="list-style-type: none"> - Develop sub-criteria or KPI <p>ex. 3 – rate on a scale . Ask manager: Rate this on a scale - Find a sub-criteria – forces to re-think – force you to be more precise - go down 1 level</p>	KPI	<p>Suggest scales to estimate the level of automation, soft skills and criticality</p>	already done
<p>Think about Applicability – i.e. where most money goes</p> <ul style="list-style-type: none"> - Explain how to do fully job deconstruction - To make it into a tool – calibrate it – 	Job deconstruction	<p>Provide guidance for job deconstruction and scale</p>	to consider

turning into something quantitative			
My only suggestion is do not denigrate the value of secretaries, administrative assistants, and/or cashiers at Migros who do play an important personalized interactive public relations/service role for many companies. I hope you were just using them for comparative purposes, and the job migration to sales support at Migros is a good idea.	Choice of examples	Specify that the jobs are chosen illustrative purposes only	already done

Legend :

- Red: Debatable modification, discussed in the next session
- Green: Implemented after the interview
- White: Aspect was already in the report but not in the short summary the interviewees received, so they were not aware of it

Quotes from the interviews regarding the potential applicability of the matrix:

“I see it as part of a presentation. It is something I can give to the head of the department” (M. Shepherd).

“To make it applicable, we need to know where the money goes” (A. Khan).

“If it could be turned into a tool, it would be a beautiful contribution” (P. Willson).

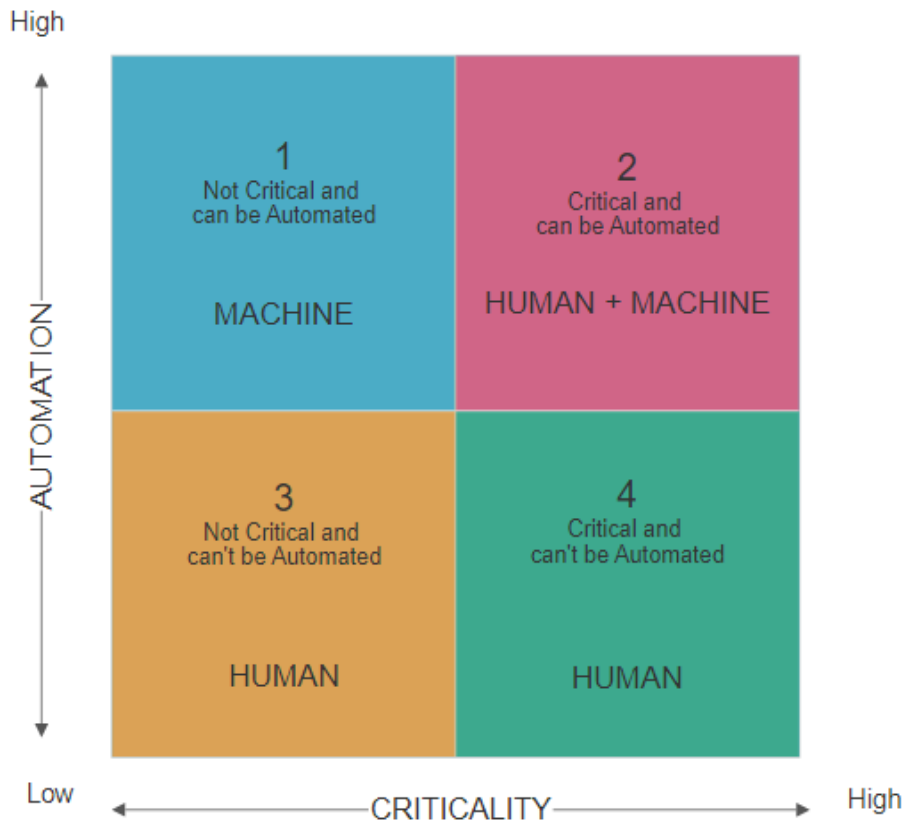
“The employees we have could focus on more value added-skills” (D. Walden).

Section conclusion

The interviews conducted with field professionals showed that the conceptual decision-making supporting framework connecting the propensity of a job to automation, soft skills development, and job criticality was perceived as useful from an analytical perspective. However, the need for quantitative metrics and key performance indicators was highlighted. Further guidance on how to conduct a successful job deconstruction was also requested along with additional guidance for the implications of each scenario.

6. Result : adjusted framework

Figure 32 - Adjusted framework

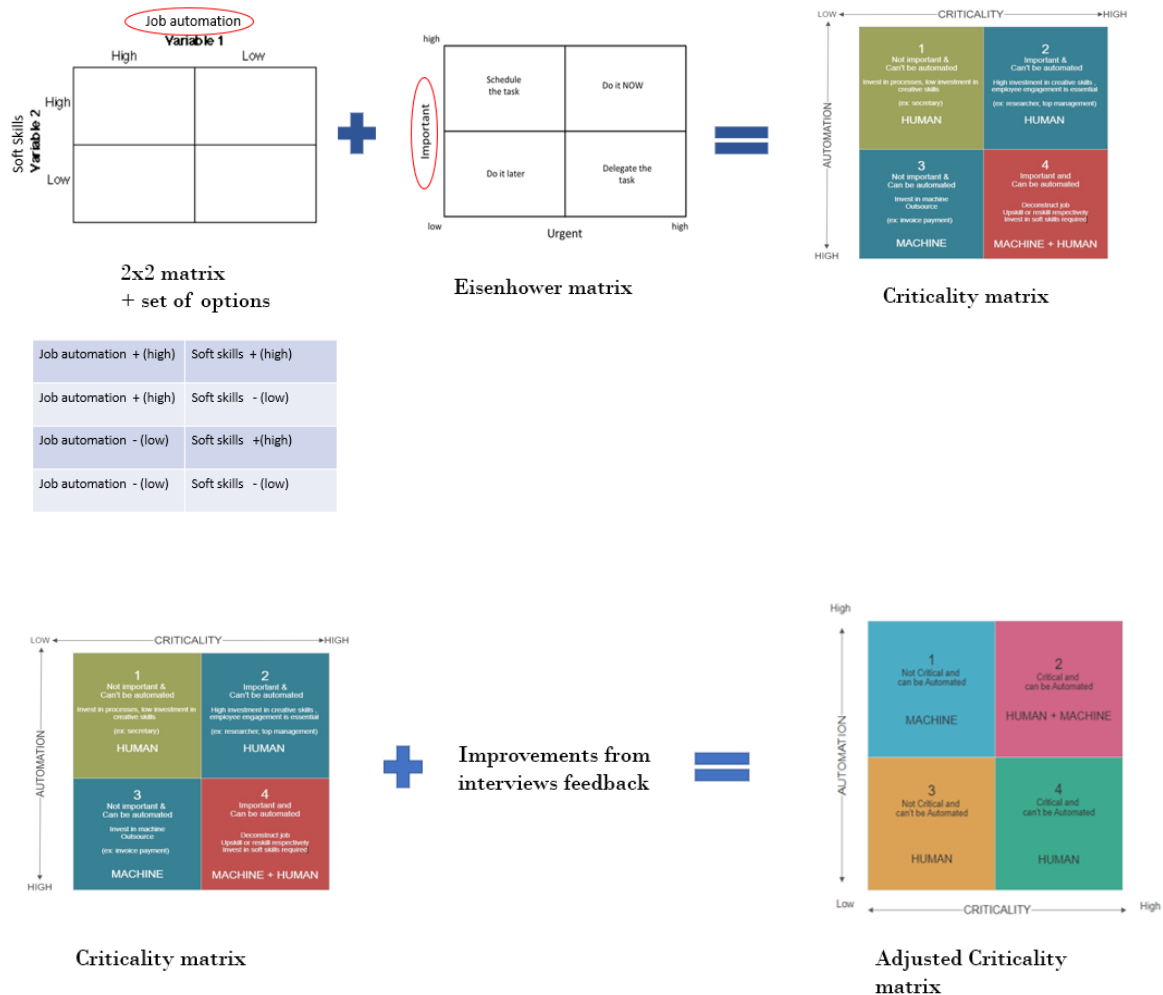


Source: prepared by the author

Changes made to the configurations as a result of interview feedback are listed below:

- ✓ The colors have been changed. All scenarios now have a different, distinctive color to illustrate the different implications.
- ✓ Axes have been inverted to put the most “dynamic” scenario (#2) in the top right square.
- ✓ The content will be discussed in the following section, Discussion.

Figure 33 - Illustration of the framework construction and adjustment process



Source: prepared by the author

7. Discussion on the improvements suggested

In this section, the findings from the interviews and the secondary data sources as well as the limitations of the study will be discussed.

Improvements were suggested in two areas of the framework: the terminology and the applicability.

7.1 Terminology

“Important” vs “not important”

The most frequent feedback received for the matrix was with regard to the terminology used. The word “important” appears to be uncomfortable and was often perceived as implying some sort of subjectivity in the assessment phase. Although it was previously mentioned that the importance was only with respect to the business’s mission and not to the nature of the job itself, it could make the person performing the job feel undervalued. Indeed, “everyone feels like what they do is important” (Walden, interviewed in May 2020). Consequently, a simpler and perhaps more intuitive term was chosen: criticality.

“Automation”

Automation was indicated to be insufficiently concise and not refined enough as a variable. Options such as job “propensity to automation,” “suitability to automation,” or “ease of deconstruction” were suggested as alternatives.

These statements are debatable due to the propensity of automation or ease of the deconstruction of elements to assess the parts of a job that can be automated or not. Therefore, they would be an input to the automation framework, which is a sub-part of the criticality framework.

Consequently, a fourth dimension named “complexity” was added to the simplified version of the job automation assessment suggested in the methodology part. It would answer the question of how easy it is to deconstruct a job into smaller independent tasks. Based on the idea that the computer is able to perform many tasks, the foundation would be that those tasks can first be identified as “self-contained,” or happening independently from each other.

The new simplified job assessment automation framework is as follows:

Figure 34 - Adjusted simplified job automation assessment framework

Criteria	Scale 1 to 5 *
Repetitiveness (doing the same thing over and over again with little to no novelty)	1 to 5
Predictability (knowing in advance what, when , where to work and the outcome expected from your work)	1 to 5
Interaction with others (managing, caring, leading, coordinating)	1 to 5
Complexity (level of expertise, intuition and creativity required to plan or perform a single task) i.e. how easy it is to break it down into smaller simpler tasks	1 to 5 (added after the interviews)

Source: prepared by the author

The acronym RPIC can be given to the revised job automation assessment framework (R standing for Repetitiveness, P for Predictability, I for Interaction and C for Complexity) The corresponding scale for the fourth dimension, complexity, was also developed, as shown here below.

Figure 35 - Scale for complexity assessment added after interview feedback

Complexity
80% of the job can be fragmented into smaller, independent tasks
60% to 80% of the job can be fragmented into smaller, independent tasks
40% to 60% of the job can be fragmented into smaller, independent tasks
20% to 40% of the job can be fragmented into smaller, independent tasks
20% of the job or less can be fragmented into smaller, independent tasks

Source: prepared by the author

7.2 Applicability

From the interviews, it was discovered that the criticality framework as an analytical or a conceptual framework was perceived as an interesting and useful way to look at the problems that might arise from job automation implications.

Nevertheless, a preference was expressed to propose the framework as a managerial/practical tool as well. It is therefore necessary to quantify it (Willson, interviewed in May 2020) in order to forecast its financial implication. To do so, the first step would be to fully understand “how to make a job in construction” (Khan, interviewed in May 2020) to guide the user before “give[ing] it to the head of a department” (Shepherd, interviewed in May 2020).

Understanding how to properly deconstruct a job came as an imperative particularly scenario number four, where the mix between the human labor and the machine is less intuitive to determine compared to other scenarios. Actually, there is a vast amount of literature on how to deconstruct a job, and the scope of this thesis did not include how to perform the job deconstruction, therefore it will not extend on it. It is, however, interesting that the question was raised quite often during the interviews, so it showed that there is somehow a lack of widely known information about it. Meanwhile, a starting recommendation could be to have employees rewrite their own job descriptions. Most of the time, the job descriptions made by companies include only the core tasks of the job, and they are not detailed enough to capture everything an employee spends time doing or what they would like to or feel energized to do (Bapat, 2018). After segmenting the job into individual or self-contained tasks, the simplified automation assessment framework or a more sophisticated framework could be applied.

Another element that arose was the delimitation of the scenarios. At this stage, it might not be very elaborate, but a scale of one to five was given to provide an approximation of the separating line.

Section conclusion

The interest to transform the framework into a practical tool applicable in companies is positive, because it validates the framework from a conceptual and analytical perspective, which was the main goal of the thesis. Simplified sub-frameworks for the inputs (estimation of job automation and criticality) were also provided to make the tool

readily usable in an analytical context. Furthermore, actions to take in each scenario were given with illustrative examples to exemplify the potential outcomes.

The research extended on the complex notion of creativity, a characteristic that falls in between hard and soft skills, and constructed a checklist to draw inspiration from with elements backed up by scientific facts. Indeed, as shown in the findings from the interviews, soft skills and creativity were often subject to personal interpretation and subjectivity, so supporting the statements with scientific data and visuals can help neutralize and clarify those non-cognitive notions.

8. Limitations

The framework was not tested in a school or company environment with people who could apply it either in case studies or real cases for investment decisions. Having it tested in a real-life context would allow for further gathering of empirical data and validation of the causality. Moreover, interviewees were from business, engineering, and law backgrounds; interviews with other professionals, such as artists or doctors, could have given other perspectives to the matrix configuration or implications.

Furthermore, to quantify it and include precise financial metrics and implications, one possibility could be to make a computer or software version of it that is adaptable for companies. At this stage, what was proven was that it appears to be an interesting conceptual framework to look at the challenge from a business decision standpoint.

9. Recommendations

At this stage, the criticality matrix is useful as a conceptual framework in academic or business environments as well as for personal career assessments.

9.1 Case studies

The criticality framework can be a useful tool in case studies and academic environments to analyze business decisions regarding job automation. Through the scenario analysis, it allows students to make holistic analysis and projections about future expectations.

9.2 Business environments

Companies can use the criticality to assess their current positioning regarding job automation and evaluate if more investments in soft skills are needed (through L&D upgrade for instance).

Furthermore, companies should work on defining their KPIs and make it applicable to their particular operating context. Indeed, in a business environment, the matrix can support the decision-making process only if it is adjusted to the specific characteristics of a company. Therefore, companies should conduct further research and refine it into smaller sub-categories based on their specific needs and environment, industry, and competitive landscape.

For instance, a department can refine the framework and add its own key performance indicators to monitor and assess the levels of automation and criticality.

The data feeding the framework can be gathered from:

- the employees, who can draft their own detailed job descriptions;
- the head of the department, who has an understanding of the hard skills and automation implementation;
- the financial department, which can evaluate the costs the company can absorb before having a return on investment;
- the leadership team, which can use the framework to repurpose or augment part or all of value proposition of a business.

The tool will allow them not only to monitor how they are performing regarding automation possibilities (cost saving, asset investment, upskilling, and reskilling) and soft skills development (stimulating creativity and upgrading L&D) but also to review the business value proposition as a whole (augmenting it through service enhancement for example).

9.3 Personal career development

The matrix can also be applied by anyone who wish to examine if the job they are currently doing is likely to be automated or not by simply applying the RPIC framework (Repetitiveness, Predictability, Interaction and Complexity). Depending on the outcome and the personal goals, one can choose to learn new skills or consider a career change for example.

10. Conclusion

Job automation and soft skills development are inevitable topics companies will have to deal with to successfully navigate in the 21st century. The literature review showed that there were no previous metrics correlating these two dimensions in one framework. The main objective of this thesis was to construct a decision-supporting framework that companies could use to decide whether they should invest in soft skills or machines or upgrade the value proposition as a whole based on a given level of potential job automation and the level of importance a particular job has in respect to the business's mission.

By correlating the level of potential automation of a job and the level of soft skills needed to perform it, a set of options was characterized. Potential job automation was extracted as a variable given that it depends on external technological advancement. The second variable, importance, was extracted from the Eisenhower matrix and redefined as job criticality, representing the relative importance of a job with respect to the mission of a company.

Furthermore, to be able to immediately apply the framework, a set of simplified sub-frameworks were introduced as sub-objectives: a simplified framework to measure job automation, another one to measure relative job criticality, and a checklist to provide an overview of how to develop soft skills and creativity if needed.

In depth interviews with field professionals were used to test the accuracy and potential applicability of the matrix in the business environment. The improvements suggested by the interviewees were taken into account, and the necessary adjustments were made to the initial criticality framework. The outcome from the interviews showed that the criticality framework was a useful analytical tool at this stage but needed further refinement to become a practical business tool.

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Appendix 1: Interview methodology

Choice of interviewers -The interviewees were chosen based on their current or past experience in decision-making positions in multinational companies. The reason is that in big companies such decisions are of vital importance as they impact the jobs of thousands of workers and the consequences of such decisions are more visible than in small companies for instance. .

Location - All are based in Geneva physically and the interviews were made virtually by Zoom or MS Teams given the restrictions due to Covid-19. For one of them only I received written feedback. However, the location and media were chosen for practical purposes only but they do not limit or restrict the field of application of the framework to the geographical perimeter

Time - All interviews were conducted during May 2020. 5 of them through virtual calls and lasted between 35 and 60. From one of them I have received written feedback.

Communication/approach - Interviewees were contacted by e-mail, and a written summary of 2 pages providing some context on the objective of the thesis and overview of the main concept of framework was sent (Appendix 2). The subject could seem quite abstract, so the goal of the summary was to give them the possibility to reflect on the subject before the call, since it calls on their previous experience and analytical hindsight. On a side note, it also serves as written support they could print out and take notes before the interview, thus, enabling them to go straight to the essential points right from the start of the interview.

Script - The interview script is constructed around three open questions, inviting the interviewee to share their experience on the criticality framework inputs: soft skills development and automation. Further, they were introduced to the notion of criticality before being confronted to the framework itself. An explanation of each of the 4 scenarios with examples was also communicated to help in the general understanding.

Q1 - How did you and/your company take decisions related to job automation?

Q2 - How was the level and investment in soft skills measured internally?

Q3 - Would the below matrix help in the decision making process? If yes why/how? If not, why?

Q3.1 Is it accurate as a conceptual framework?

Q3.2 Can become a tool for management?

Q3.3 Any recommendation or elements to improve?

Note: Q1 and Q2 were more seen as introductory questions. The final goal of the interview was to get feedback on the matrix.

Summary table of interviews:

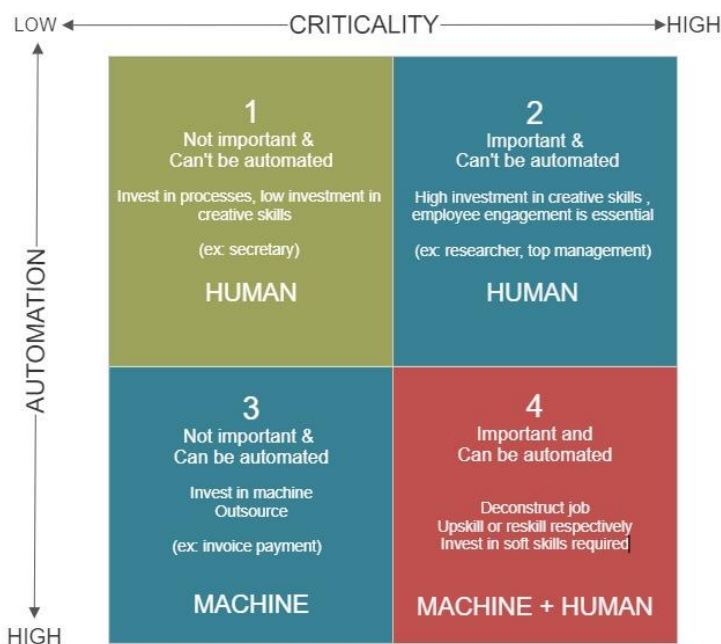
Nr	Interviewee	Professional background	Status	Length	Format	Mean	Recording
1	Federico Mercurio	HR Representative at PepsiCo Switzerland	Conducted in person (virtually)	35 min	Semi-structured	Zoom meeting	Simultaneous typing and post note taking
2	Aftab Khan	Strategy consultant, Law Office (anonymous)	Conducted in person (virtually)	60 min	Semi-structured	Teams meeting	Simultaneous typing and post note taking
3	Kristy Anamoutou	HR Manager	No response	n/a	n/a	n/a	n/a
4	Marc Shepherd	Former BU Director at Nestle (Marketing)	Conducted in person (virtually)	40 min	Semi-structured	Whatsapp	Simultaneous typing and post note taking
5	James McGill	Statistics and software development	Semi-conducted	n/a	n/a	Short email answer	n/a
6	Philip Edmund Willson	Former supply chain and manufacturing project manager	Conducted in person (virtually)	35 min	Semi-structured	Teams meeting	Simultaneous typing and post note taking
7	Pierre Paperon	Former McKinsey Consultant	Conducted	unsignificant feedback	unsignificant feedback	Short email answer	n/a
8	Dana Walden	Former HR Manager at Columbia Sportswear	Conducted in person (virtually)	60 min	Semi-structured	Teams meeting	Simultaneous typing and post note taking
9	Timothy Connerton	Former President and Director of major divisions in Norsk Hydro and Alcoa (Strategic planning)	Conducted	n/a	Semi-structured	Written feedback by email	n/a

Appendix 2: Summary sent to the interviewees by email

1) Setting and purpose of the matrix

Goal: Develop a decision-supporting framework for job automation and soft skills development with job criticality as a linchpin.

Context: With the raise of automation, business decision-makers will face decisions on whether to invest in a machine (automate all or parts of the job) or in “human” skills. After an examination of what could connect these two seemingly independent criteria (**job automation and soft skills**), **job criticality is suggested as the linchpin**. To this end, the following matrix is proposed



Definitions

Level of job automation: The level by which a machine could perform some of all tasks of job instead of a human with current available technology (replacement rate).

Soft skills: A set of “human skills” that have a considerable behavioral complexity and are unlikely to be performed by a machine with current available technology

Job criticality: In this thesis, the criticality of a job is the degree to which a job is vital to the business performance and impacts its value proposition or competitive advantage on the market. (For example, a research position in a pharmaceutical company would be more critical to the company compared to an administrative assistant)

2) What analyzes and/or messages am I seeking to use it for

Matrix interpretation

Inputs:

The level of job automation is determined by the technology available at a certain point in time (External)

The level of the criticality of a job is determined by the company (Internal)

Outputs:

- Invest in soft skills development (creativity, interpersonal etc.) (HUMAN)
- Invest in a new machine (software, robot, device etc.) (MACHINES)
- Both (new machine + up skill, re-skill etc.) (HUMAN + MACHINES)

Furthermore, the matrix will serve as a roadmap for companies to position themselves and have a clear visibility on

- where they stand on an automation vs soft skills scale
- re-evaluate their value proposition or ways of doing business

For example: A cashier job can be 100% automated. However, depending on its value proposition, a business may choose to automate the job or not (or partially)

A cashier at Migros.

Consumers go to the cashier only to pay- most cashiers can be replaced by machines and perhaps a few turned into supervisors of the machines.

A cashier at Gucci.

Consumers expect to have a unique buying experience in stores, so a cashier at Gucci is the image of the brand at sales point and is unlikely to be replaced by a machine. So although the level of potential automation is high, the company should not choose to have the task performed by a robot and will instead invest in soft skills to make the sales experience even more memorable.

Other potential outcome: Perhaps this is an opportunity for Migros to train their former cashiers in “sales advisors” (transl. accompagnement à la clientèle). For example help them choose among seemingly similar products, make in-store activities to reinforce the “Migros community” etc. So the matrix gives also room of questioning the current and future way of doing business.

3) What would I like to know from you

- 1- If this a useful conceptual framework
 - 2- If it can become tool for management
- Any recommendation or elements you would suggest to improve it