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Marketing and Digital Communication

TITLE: REVOLUTIONIZING CORPORATE SOCIAL RESPONSIBILITY: ARTIFICIAL INTELLIGENCE AS A DRIVER OF CHANGE, MICROSOFT CASE STUDY.

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Index:

Introduction:

The evolution of Corporate Social Responsibility is a crucial topic in the modern business context, with a growing interest in the integration of Artificial Intelligence as a driver of change. This thesis explores the transformative role of artificial intelligence in CSR, how they are connected to each other and how they interface on a daily basis, through a case study focused on Microsoft.

Microsoft, a leading technology company, embraces and leverages artificial intelligence to improve its CSR initiatives. Through an in-depth analysis of existing practices, are identified the areas where AI can make significant improvements, increasing positive social and environmental impact.

The investigation develops in three fundamental dimensions:

1. *Historical and Conceptual Contextualization*:

Initially, a historical and conceptual path is traced to understand the evolution of CSR and the emergence of AI as a factor of change. The fundamental principles of CSR and AI are analyzed and the way in which the latter has influenced company dynamics and changed them.

2. *Ethical Implications and Future Prospects:*

The important ethical issues related to the use of AI in CSR are addressed and future perspectives are explored, providing recommendations for an ethical and sustainable application of this technology, providing examples of how artificial intelligence has entered and of how it must be used for the best, both corporately and socially and culturally.

3. *Detailed Analysis of the Microsoft Case*:

Through a case study on Microsoft, we focus on its adoption of AI-based solutions to enhance CSR initiatives. Specific applications are explored, such as sustainable resource management and community empowerment through innovative projects.

Through this analysis, the centrality of AI in the transformation of CSR emerges, with Microsoft emerging as a key player in shaping the future of socially responsible corporate initiatives. The thesis concludes with reflections on the need to balance technological innovation with attention to social impacts, proposing an integrated and sustainable approach to CSR in the context of AI.

The findings indicate how AI can optimize CSR strategies, enabling greater stakeholder engagement, personalization of initiatives and more accurate measurement of impact. However, ethical and governance challenges also emerge, requiring a balanced approach to maximize benefits.

Microsoft case study provides valuable insights for companies looking to revolutionize their CSR through the strategic implementation of AI. In conclusion, the research offers clear perspectives on how artificial intelligence can be a key catalyst for promoting more effective, sustainable and responsible CSR.

Chapter 1 - Corporate Social Responsibility

1.1 Fundamental concepts of CSR and the historical evolution of CSR

The emergence of corporate social responsibility (CSR) takes place in a historical context marked by cultural, academic and operational change, pushing companies to adopt a more

conscientious approach towards stakeholders, environmental and social concerns. The goal is to gain a competitive advantage, particularly among customers sensitive to these issues, to optimize long-term profitability while mitigating negative impacts on the operating system.

CSR assessments should transcend individual entities, encompassing the broader network of relationships, including suppliers and intermediary customers. As pointed out by William C. Frederick, social responsibility involves controlling the functionality of an economic system that meets public expectations, using economic resources to ensure that production and distribution contribute to overall socioeconomic well-being.

The definition of CSR began in the 1950s with Howard Bowen, considered the father of CSR, who described it as: "*the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society*".[1] Bowen stressed the importance of considering the effects of business decisions and actions on the entire social system.

Bowen proposed several measures to enhance business management's responsiveness to social interests, including:

1. *Diversifying the composition of boards of directors* to incorporate perspectives from various stakeholders beyond shareholders.

2. *Ensuring greater representation of social viewpoints in management decisions*, recognizing their effectiveness compared to the Board of Directors.

3. *Conducting social audits by independent external experts* to evaluate company policies across various aspects like pricing, wages, research and development, advertising, public relations, and community engagement.

[1] Cit. da Archie B. Carroll, Corporate Social Responsibility: Evolution of a Definitional Construct, 1999.

4. *Formulating business codes* outlining commendable practices for emulation and establishing ethical codes tailored to each organization's specific context.

Subsequently, in 1960, Clarence C. Walton expanded the definition, shifting the focus to top management and recognizing the impact of CSR on revenues and environmental management. Harold Johnson further refined the concept in the 1970s by delineating between "social obligation," "social responsibility," and "social responsiveness," emphasizing compliance with laws, adherence to high social and environmental standards and alignment of corporate behavior with the needs of society.

Over time, the concept of CSR has evolved from a theoretical concept to a practical and regulatory framework involving top management. CSR now embraces a broader, long-term perspective, helping to maximize corporate utility. Sethi's definition in the 1970s further categorized corporate behavior based on legal obligations, social responsibility and responsiveness to society's needs.

In recent decades, Corporate Social Responsibility (CSR) has garnered significant attention from researchers in the management sector. Numerous scholars have developed diverse models and theories, each offering unique perspectives on CSR and its attributes. By examining the commonalities and disparities among these theories, it becomes possible to formulate an integrated approach to CSR implementation that aligns with both shareholder interests and societal needs. Notable scholars who have investigated CSR definitions, theories, and models include: W.C. Frederick, Reza Safarzad, Milton Friedman, James Brusseau, Archie Carroll, R. Edward Freeman, Elisabet Garriga, Domenec Mele, Maryna Saprykina, Yaroslav Kutovy, D.R. Dalton, and R.A. Cosier. In this paragraph are analyzing the different approach and idea of the scholars.

According to W.C. Frederick, *social responsibility involves entrepreneurs overseeing an economic system that meets public expectations*. The economy's means of production should be used in a way that improves overall socioeconomic well-being. Essentially, social responsibility implies a collective responsibility towards society's economic and human resources, ensuring their use for broader social purposes rather than exclusively for the narrow interests of individuals and businesses.[2]

Reza Safarzad delineated CSR as *a mandatory obligation for companies, entailing ongoing dedication to community welfare*. He underscored that a company's primary objective is to enhance operational efficiency and productivity while maximizing shareholder returns. This necessitates the integration of ethical and environmental considerations from the community into the company's economic processes.[3]

Contrarily, Milton Friedman rejected the concept of CSR in its entirety, advocating that *a company's management is exclusively responsible for maximizing shareholder profits*. He argued that societal issues should be addressed through the mechanisms of the free market system independently. According to Friedman, businesses have a singular social responsibility: to utilize resources and engage in activities aimed at increasing profits while adhering to the rules of fair competition, without resorting to deception or fraud. Managers, as agents, are legally bound to act in the best interests of shareholders, with a primary duty towards them. [4]

[2] 2023 Lesson II Sustainability definitions prof.ssa Genuardi LUMSA
[3] Safarzad, R. (2017). Corporate Social Responsibility Theories and Models, Applied mathematics in engineering. Management and technology journal, 5, 38.
[4] Safarzad, R. (2017). Corporate Social Responsibility Theories and Models, Applied mathematics in engineering. Management and technology journal, 5, 38.

James Brusseau offered two interpretations of CSR. Firstly, *it serves as a broad term encompassing any corporate theory emphasizing both profit-making and ethical interaction with the community.* Secondly, it *represents a specific concept aiming to achieve profitability for a company while contributing to community welfare*. Brusseau outlined four key obligations within this specific CSR theory: 1. economic responsibility to generate profit; 2. legal responsibility to comply with regulations; 3. ethical responsibility to act morally, even beyond legal requirements; 4. philanthropic responsibility to support societal initiatives independent of business interests. [5]

Archie Carroll, a prominent figure in management scholarship, further refined James Brusseau's definitions of CSR, giving rise to what is now known as "*Carroll's Pyramid of CSR*." Carroll delineated CSR into four components: economic, legal, ethical, and philanthropic expectations, imposed on organizations by society. He structured these components into a pyramid, with economic responsibility forming the base and philanthropic responsibility at the apex (it will be better explained in the next section). According to Carroll's framework, CSR obligations should be addressed sequentially, starting from economic responsibility and progressing upward. Achieving each responsibility, it enables a corporation to advance to the next level. [6]

R. Edward Freeman has explored the interaction between stakeholder theory and CSR in business ethics. He defined stakeholders as *groups that had a stake or claim on the*

[5] Friedman, M. (1962). The Capitalism and Freedom. University of Chicago Press.

[6] Carroll, A. B. (2016). Carroll's pyramid of CSR: taking another look. International Journal of Corporate Social Responsibility

company; he meant that any group or person who had a contact or complaint about the company in working life or general life have to be considerate as an interested party. Freeman argued that stakeholders are instrumental in shaping the company's future direction through their involvement. Consequently, CSR should align with stakeholder objectives, prioritizing profit maximization for both the company and its stakeholders. [7]

Elisabet Garriga and Domenec Mele, in their influential piece "*Corporate Social Responsibility Theories: Mapping the Territory,*" undertook a comprehensive classification of CSR theories and related approaches, delineating them into four distinct groups:

1. Instrumental Theories: This category assumes that businesses serve as mere tools for wealth creation, with their social activities aimed primarily at achieving economic outcomes.
2. Political Theories: In this group the importance lies on the responsibility of society to exercise its political power effectively. By supporting organizations that advocate for: human rights, workers' rights, gender equality and anti-corruption efforts; political theories seek to increase transparency in CSR values.
3. Integrative Theories: This batch prioritizes addressing social and ethical needs within society. It involves supporting charitable initiatives and institutions such as: orphanages, elderly care centers and funding programs for youth and sports development.

[7] 2023 Lesson II Sustainability definitions prof.ssa Genuardi LUMSA

4. Ethical Theories: It entails a firm commitment to upholding the organization's ethical standards. This encompasses considerations of transparency and credibility in dealings with stakeholders. [8]

Furthermore, Maryna Saprykina, director of the Corporate Social Responsibility Development Center in Ukraine, highlighted *the legal dimensions of CSR in various regions*. For instance, in the European Union, large companies are mandated to disclose their financial statements to ensure transparency. In the UK, companies are required to annually publish statements confirming that their suppliers uphold appropriate employee rights. Meanwhile, legislation in France mandates ecological audits in company operations to address environmental concerns. [9]

Yaroslav Kutovy, head of the information technology department at the Ukrainian Association of the Local Technology Industry, points out the various interpretations of corporate social responsibility among scholars. While some see it as a way to ensure comfortable working conditions, others prioritize equal treatment for all employees. Furthermore, aspects such as the provision of recreational services, implementation of recycling and environmental protection policies, among others, are considered an integral part of CSR efforts. Kutovy emphasizes that these initiatives are crucial for companies to maintain a positive image and remain competitive in attracting top talent. He suggests

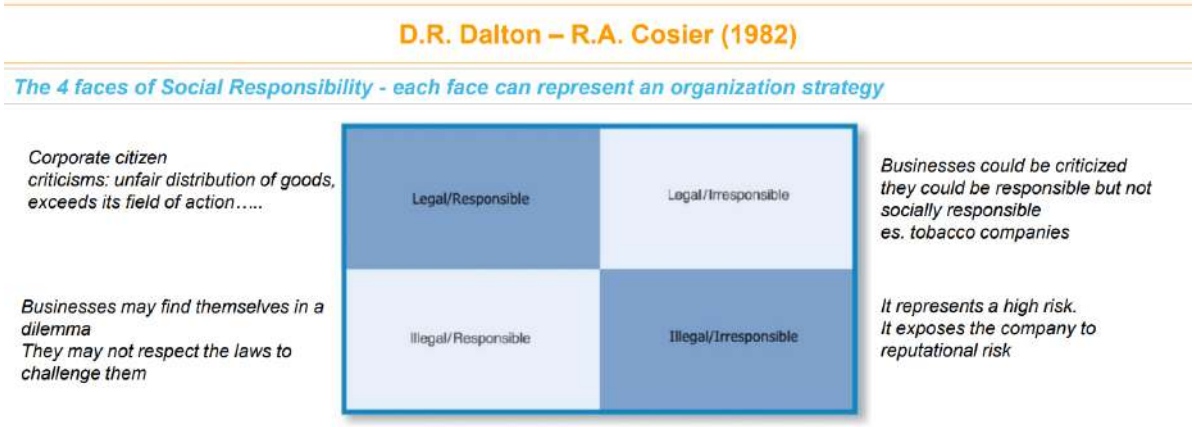
[8] Garriga, E., Melé, D. (2004). Corporate Social Responsibility Theories: Mapping the Territory. Journal of Business Ethics, 53 (1/2), 51–71.

[9] Maryna Saprykina promotes corporate social responsibility in Ukraine (2018). Available at: https://www.kyivpost.com/busi-ness/maryna-saprykina-promotes-corporate-social-responsibility-in-ukraine.html

that, in practice, CSR encompasses several dimensions including profitability, political commitment, environmental sustainability, meeting social needs and upholding ethical values. Therefore, Kutovy advocates the development of a unified framework to guide the implementation of CSR projects.[10]

D.R Dalton and R.A Cosier take into consideration the four faces of CSR, each of these can represent the organization strategy; *"Any action could be subject to criticism but certainly the legal / responsible choice is the best choise".*[11]

The 4 faces are represented in the next figure with the reference meaning of them:



12

GREEN PAPER (2001) [13] "*CSR I Definition"*: Corporate social responsibility (CSR) is commonly understood as the integration of social and environmental considerations into a company's operations and interactions with stakeholders on a voluntary basis. Being socially responsible entails not only meeting legal requirements but also exceeding them

[10] Ukraine's IT firms embrace CSR as key path to success (2018). Available at: https://www.kyivpost.com/technology/ukraines-it-firms-embrace-csr-as-key-path-to-success.html
[11] 2023 Lesson III Sustainability definitions and application prof.ssa Genuardi LUMSA
[12] 2023 Lesson III Sustainability definitions and application prof.ssa Genuardi LUMSA
[13] Idem

by investing in areas such as human capital, environmental sustainability, and stakeholder relationships. Evidence from investments in environmentally friendly technologies and business practices suggests that surpassing legal mandates can enhance a company's competitiveness. Similarly, addressing social aspects beyond basic legal obligations, such as employee training, working conditions, and management-employee relations, can directly impact productivity. Embracing CSR provides a pathway for managing change and harmonizing social progress with enhanced competitiveness. However, CSR should not be viewed as a substitute for regulation or legislation concerning social rights or environmental standards. Instead, it should complement such measures, and efforts should be directed towards establishing appropriate regulatory frameworks in countries where they do not currently exist. This ensures a level playing field that fosters the development of socially responsible practices.

"CSR II definition[14]": Adherence to applicable laws and collective agreements between social partners is essential for fulfilling corporate social responsibility (CSR). To effectively meet CSR obligations, enterprises should establish a systematic process for integrating social, environmental, ethical, human rights, and consumer considerations into their business operations and core strategies, in close collaboration with stakeholders. This process aims to: maximize the creation of shared value for owners/shareholders, other stakeholders, and society as a whole; and identify, prevent, and mitigate potential adverse impacts. The complexity of this integration process varies based on factors such as the enterprise's size and operational scope. While larger enterprises may formalize this

[14] 2023 Lesson III Sustainability definitions and application prof.ssa Genuardi LUMSA

process, small and medium-sized enterprises (SMEs), including microenterprises, are likely to approach CSR in a more informal and intuitive manner. To optimize shared value creation, enterprises are encouraged to adopt a long-term, strategic approach to CSR. They should explore opportunities to develop innovative products, services, and business models that enhance social well-being and promote higher quality, more productive jobs.

In conclusion, CSR has evolved significantly since its first definitions in the 1950s to become a comprehensive framework that integrates ethical, social and environmental considerations into business operations. Today, effective CSR strategies extend beyond individual companies to include entire networks of relationships, such as suppliers and customers, providing a holistic approach to socio-economic well-being.

By adopting CSR, companies not only achieve competitive advantages and optimize long-term profitability, but also contribute positively to the society and the environment. This integrated approach is essential to promote sustainable development and address the complex challenges of modern business. As CSR continues to evolve, it remains a key element in creating a more responsible and equitable global economy, demonstrating that businesses can succeed while maintaining ethical and social responsibilities.

1.2 Theoretical models of CSR

This paragraph is structured into four sections, each presenting a different theoretical model of corporate social responsibility (CSR). The first section introduces Carroll's CSR theory, followed by the triple bottom line CSR theory in the second section and the

stakeholder theory in the third. The final section analyzes the similarities and differences between these three theories and presents a summary of them into a table.

Carroll's CSR Pyramid: Carroll formulated a distinctive theory outlining how corporations interact with their communities and the wider world, now recognized as Carroll's Pyramid of CSR. This theory delineates four core obligations that serve as the foundation for a business's societal responsibilities. These obligations are as follows:

1. Economic Responsibility: This aspect underscores the imperative for a business to generate profits to ensure its viability. Carroll positions economic responsibility as the cornerstone of the CSR Pyramid, underscoring its critical role. Whether an organization operates for profit or as a nonprofit entity, financial resources are essential for its success. Carroll asserts that the initial stride in meeting CSR obligations is engaging in profitable business endeavors. Revenue not only serves to remunerate investors but also facilitates business expansion through reinvestment. Economic responsibility manifests through diverse business activities, including investments, marketing initiatives, and financial planning, involving stakeholders such as employees, vendors, and investors.

2. Legal Responsibility: Corporations are obligated to abide by laws and regulations. Positioned as the second tier in Carroll's Pyramid, legal responsibility underscores the significance of conducting business within the parameters of the law. Compliance with legal statutes ensures that corporations contribute positively to the economy and broader society. Engaging in activities such as tax evasion or producing harmful goods runs counter to CSR principles.

3. Ethical Responsibility: This obligation entails acting as a conscientious member of society, surpassing mere compliance with the law. Carroll stresses that corporations should not only adhere to legal mandates but also embody the ethical principles

underlying them. Ethical responsibility encompasses conducting business ethically in ways that align with societal expectations. Civil societies and associations often shape ethical norms until they are codified into law.

4. Philanthropic Responsibility: This entails voluntary engagement in social activities driven by a business's desire to contribute to society beyond legal and ethical requirements. Philanthropic responsibility involves acts of pure altruism, undertaken without legal obligation or widespread expectation within the business community. Such endeavors are dedicated solely to fulfilling community needs and expectations. Through philanthropic initiatives, businesses can address societal desires and needs. Examples include sponsoring sporting events like annual marathons or participating in donation campaigns through employee volunteering. The underlying goal of philanthropic activities is to enhance the company's reputation by demonstrating good corporate citizenship.[15]

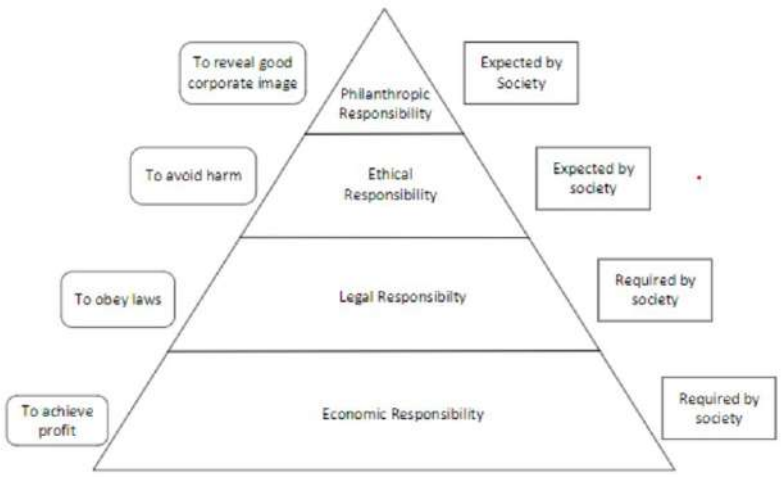


Fig. 1. Carroll Pyramid for CSR [4]

16

[15] Brin, Pavlo, and Mohamad N. Nehme. "Corporate Social Responsibility: Analysis of Theories and Models." *Eureka: Social and Humanities*, no. 5, 2019, pp. 22-30

[16] idem

The core concept of the Carroll Pyramid revolves around the sequential application of CSR principles. According to this framework, companies must first prioritize economic objectives, ensuring sustainability and profitability at the foundational level. Once these goals are met, companies can progress to the next stage, which involves adhering to regional and international laws and obligations. Following this, there is a commitment to ethical standards, ultimately culminating in the fulfillment of philanthropic responsibilities as demanded by society and the environment.

The Triple Bottom line. This theory, introduced by John Elkington in his book "*Cannibals with Forks: The Triple Bottom Line of 21st Century Business*," presents the Triple Bottom Line (TBL) as a comprehensive framework for corporate social responsibility (CSR), incorporating three key dimensions: economic, social, and environmental. Elkington emphasizes the imperative of sustainability across these dimensions, positioning it as the core objective of the TBL concept. Companies are encouraged to adopt the TBL framework to not only drive continuous profitability but also to undertake enduring social and environmental initiatives. Here's a description of the three dimensions:

1. Economic Dimension: According to TBL theory, sustained profitability, rather than just high profits, is critical for businesses. By subscribing to the TBL CSR framework, companies formulate strategic plans that include expense and tax calculations, climate forecasts, market analysis and risk mitigation. A thorough examination of these components allows companies to achieve long-term sustainable profitability.

2. Social Dimension: In addition to financial considerations, businesses must attend to their social responsibilities within the TBL framework. Achieving social sustainability is imperative and requires an in-depth understanding of society's needs and priorities.

Companies collect data from national authorities on various social parameters such as unemployment rates, human rights and access to healthcare and education. Based on these insights, shareholders make decisions aimed at meeting the needs of society and promoting stability within the community.

3. Environmental Dimension: Environmental sustainability is at the heart of the TBL framework. Companies are tasked with monitoring environmental changes and adhering to evolving environmental regulations. It is essential to embrace alternative energy sources and minimize dependence on traditional ones, such as oil and coal. Furthermore, companies must adopt practices that safeguard air and water quality by responsibly managing waste disposal. Through these efforts, companies support environmental sustainability, leveraging the flexibility of the TBL concept to effectively implement socially and environmentally responsible strategies.

The Stakeholder Theory. Stakeholders, as broadly defined by Freeman and Reed, encompass any identifiable group or individual capable of influencing or being impacted by an organization's objectives. In his seminal work "*Strategic Management, A Stakeholder Approach*," Edward Freeman underscores that corporations have stakeholders, described as *groups and individuals benefiting from or connected to corporate actions*. According to stakeholder theory, a corporation's objectives can only be realized by safeguarding and balancing the interests of various stakeholder groups. This theory have both descriptive and instrumental purposes, clarifying the nature of the enterprise, corporate management, and board directors' consideration of corporate constituencies.

Once stakeholder theory and its correlation with CSR are delineated, the pivotal question arises: *how to operationalize stakeholder theory*?

Companies, especially corporate directors and leaders, can improve responsiveness to social interests by integrating stakeholder participation into the company's board of directors. In essence, every stakeholder should be represented on the board of directors, ensuring that their interests are represented. As a result, the board formulates a strategy that aligns corporate objectives with stakeholder interests. In line with stakeholder theory and ethics, active stakeholder involvement in decision making requires stakeholder awareness of both external and internal social factors. This transparency ensures that stakeholders are informed about company operations, mitigating risks associated with sensitive information, such as financial data or dangerous factory operations. Stakeholder theory highlights the imperative for companies to maintain transparency with all stakeholders. However, the risk lies in prioritizing the interests of profit-maximizing stakeholders over other stakeholders, including those directly affected by business operations in the surrounding community.

It's evident that The Carroll Pyramid Theory and The Triple Bottom Line Theory share a common focus on the economic obligation of CSR. Similarly, The Stakeholder Theory places significant emphasis on the economic obligation, aligning with shareholders' interests in maximizing corporate profits. Consequently, conflicts and dilemmas arise regarding other responsibilities among the three theories.

In Carroll's CSR pyramid theory, companies are urged to prioritize legal, ethical and philanthropic business practices. However, the risk lies in potentially overlooking other external factors, particularly social and environmental considerations. Prioritizing social and environmental needs within the business community is essential before applying Carroll's CSR strategy, as these factors can alter the hierarchy of corporate responsibilities.

TBL theory supports similar performance to Carroll's pyramid theory regarding economic and social factors, but incorporates environmental factors as crucial to achieving corporate sustainability. The challenge of practically implementing CSR according to TBL theory lies in balancing these three responsibilities. Simply pursuing financial gain is no longer enough; societies now have a moral imperative to achieve social and ecological goals.

In stakeholder theory, the interests of all stakeholders must be carefully considered in corporate social responsibility strategies. Transparency in all business processes with stakeholders is critical for effective implementation. Without transparency, corporate managers may exploit their influence, ignoring community demands and prioritizing profits.[17]

CSR Theory	Characteristics of CSR Theories		
	Strength of the Theory	Benefits of Applying the Theory	Challenges in Applying the Theory
The Carroll CSR Theory	– Taking into account four main responsibilities for CSR approach: economic, legal, ethical and philanthropic – Arranging the four responsibilities in the order of the hierarchy	– Revealing good citizen image for corporation – Improving the reputation of corporations	Before implementing the Carroll CSR theory, external social and environmental situations must be studied; it will take more time and effort to apply the theory
The Triple Bottom Line Theory	Taking into account three main responsibilities for CSR approach: economic, social and environmental	Supporting the corporation to achieve sustainability	When using the approach any corporation has to balance between the three CSR responsibilities in order to achieve sustainable goals in society and ecology
The Stakeholder Theory	Taking into account the interest of various stakeholders groups	Allowing the corporation to maintain a strong interrelation and interconnection with community and business components. If the aim is achieved, the company will gain the trust and loyalty of all stakeholders	When using the approach any corporation has to balance the interests of all stakeholders and adopt a transparent policy with them

18

[17] Brin, Pavlo, and Mohamad N. Nehme. "Corporate Social Responsibility: Analysis of Theories and Models." *Eureka: Social and Humanities*, no. 5, 2019, pp. 22-30

[18] idem

1.3CSR/ESG comparison: definition and difference

Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) represent distinct frameworks adopted by companies to evaluate sustainability. While CSR is the aim of companies to be socially responsible, ESG refers to the metric used by both investors and companies. Currently, there's an argument that ESG is surpassing CSR as the predominant measure of sustainability in the corporate realm.

In today's socially conscious climate, people are increasingly mindful of CSR, and consumers are willing to pay a premium for sustainable products. Companies can communicate their sustainability efforts to buyers and stakeholders by developing a CSR model, which has become a crucial aspect of brand management. CSR strategies encompass activities such as reducing carbon footprints, engaging in corporate volunteering, enhancing labor practices, and participating in charitable endeavors. For instance, Microsoft aims to minimize its carbon footprint, and Verizon has bridged the digital divide by providing technology to school children for virtual learning.

CSR at least covers human rights, labor and employment practices (such as training, diversity, gender equality and employee health and well-being), environmental issues (such as biodiversity, climate change, resource efficiency, life-cycle assessment and pollution prevention), and combating bribery and corruption. Community engagement and development, the inclusion of people with disabilities and the protection of consumer interests, such as privacy, are integral components of the CSR framework. Furthermore, promoting social and environmental responsibility throughout the supply chain and disclosing non-financial information are recognized as important cross-cutting concerns. The Commission has published a communication on EU policies and volunteering, recognizing employee volunteering as a form of expression of CSR. In addition, the

Commission promotes the three principles of good tax governance – transparency, exchange of information and fair tax competition – in relations between states. Enterprises are encouraged, where appropriate, also to work towards the implementation of these principles.

ESG, representing Environmental, Social, and Governance criteria, is closely tied to the CSR model. These criteria offer a means to measure a company's sustainability, focusing on environmental impact, social responsibility, and governance. Many companies publish annual ESG reports on their websites, detailing achievements, actions, and financial allocations related to their sustainability goals.

Rating agencies condense performance in these areas into a score similar to CSR but with more quantifiable metrics. ESG enhances business valuation, attracting more capital, and serves as a measure for investors to gauge a company's sustainability. The pandemic has heightened awareness of such practices, and without these measures, maintaining corporate reputation and financial success could become more challenging. ESG's quantifiable nature may make it a more popular measure compared to CSR.

Thanks to the ESG analysis it is possible to have a much wider, completer and more precise picture of the impact of a company, both in terms of business results, as well as in terms of the many different dimensions of impact and its exposure to risks. In this regard, the latest ESMA TRV Risk Monitor highlights how the relationship between biodiversity and finance has a very strong relationship with the economy and investments. ESG aims to provide the financial world and business management with a more comprehensive view of the impact, development opportunities and risk factors. With ESG values that were once discretionary now are taking into consideration, such as: the precise assessment of environmental impact, the need to examine factors such as greenhouse gas

emissions, have an accurate reading of energy consumption, waste management, the use of any resource and the impact connected to the supply chain.

To adopt CSR practices, businesses can evaluate company culture, environmental impact, and community relationships. Educating employees on how they can contribute to solutions is also crucial. For ESG incorporation, businesses can conduct materiality assessments, gather stakeholder insights, set goals, conduct gap analyses, develop measurable roadmaps and Key Performance Indicators (KPIs), and report on progress. ESG programs may lead to cost savings by reducing waste and attracting top talent.

CSR is not only about external impact but also internal, empowering employees to contribute positively and fostering diversity. ESG highlights a business's ethics externally, showcasing a long-term vision and appealing to investors. Both ESG and CSR programs can lead to cost savings and attract top talent.

In essence, ESG focuses on the ethics of the business in terms of people and the planet, emphasizing long-term governance. CSR contributes to internal accountability, but ideally, businesses should aim for both CSR and a robust ESG rating to demonstrate overall sustainability. Some argue that ESG, being more measurable, represents an advancement over CSR.

When deciding between ESG and CSR, ESG considers specific factors such as carbon emissions, deforestation, waste management, water usage, diversity and inclusion, fair labor practices, executive pay, internal corruption, and lobbying. While both CSR and ESG can be employed as strategies, some view ESG as a progression due to its greater measurability. CSR is effective for building awareness and highlighting goals qualitatively, while ESG provides quantifiable metrics instilling confidence in investors and the broader market.

CONSIDERING ESG ISSUES WHEN BUILDING A PORTFOLIO (known as: ESG incorporation)			IMPROVING INVESTEES' ESG PERFORMANCE (known as: active ownership or stewardship)	
ESG issues can be incorporated into existing investment practices using a combination of three approaches: integration, screening and thematic.			Investors can encourage the companies they are already invested in to improve their ESG risk management or develop more sustainable business practices.	
Integration	**Screening**	**Thematic**	**Engagement**	**Proxy voting**
Explicitly and systematically including ESG issues in investment analysis and decisions, to better manage risks and improve returns.	Applying filters to lists of potential investments to rule companies in or out of contention for investment, based on an investor's preferences, values or ethics.	Seeking to combine attractive risk-return profiles with an intention to contribute to a specific environmental or social outcome. Includes impact investing.	Discussing ESG issues with companies to improve their handling, including disclosure, of such issues. Can be done individually, or in collaboration with other investors.	Formally expressing approval or disapproval through voting on resolutions and proposing shareholder resolutions on specific ESG issues.

19

Chapter 2 - Artificial Intelligence: origin and definitions

2.1 History of Artificial Intelligence and its developments

Artificial intelligence (AI) is a relatively new field that has emerged over the past six decades. It includes various sciences, theories and techniques, such as mathematical logic, statistics, computational neurobiology and computer science, all aimed at replicating human cognitive abilities. Born around the time of the Second World War, AI has evolved alongside advancements in computing technology. Today, AI enables computers to perform complex tasks that were once thought to be exclusive to human cognition.

From the point of view of mathematical linguistics, AI is the field that includes theories and practical methods for creating algorithms that allow machines to demonstrate intelligent behaviors, mainly within specific domains and applications. This definition is

[19] 2023 Lesson Sustainability Investment prof.ssa Genuardi LUMSA

based on a structured categorization of synthetic/abstract human reasoning, meta-reasoning and learning functions. In this context, the concept of Cognitive Computing is born denoting technological platforms rooted in the scientific disciplines of AI (such as "Machine Learning" and "Deep Learning") and "Signal Processing" (the ability to analyze signals).

A second definition, closely related to the Turing Test describes AI as "*...the enterprise of constructing physical symbol systems that can reliably pass the Turing Test*" (M. L. Ginsberg).

The Encyclopedia Britannica defines AI as follows: "*Artificial Intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience.*"[20]

Treccani describe it in the following way: "*Artificial Intelligence studies the theoretical foundations, methodologies, and techniques that allow designing hardware systems and software program systems capable of providing the electronic processor with performances that, to a common observer, would seem to be the exclusive prerogative of human intelligence.*"[21]

AI definitions can be categorized into two main types: those focused on the reasoning processes associated with specific human activities, and those that describe AI's behavior,

[20] https://www.britannica.com/technology/artificial-intelligence
[21] https://www.treccani.it/enciclopedia/intelligenza-artificiale_(Enciclopedia-della-Scienza-e-della-Tecnica)/

with a distinction between functional and structural approaches. On the one hand the functional approach sees artificial intelligence independently from the physical structure of the system, but implementing it itself, aiming exclusively at emulation, possibly selectively. On the other hand, the structural approach aims to achieve intelligence by simulating the human brain and replicating its structure and characteristics.

From an operational perspective, two distinct approaches to AI can be identified: the top-down and the bottom-up approach. The top-down approach is essentially agnostic at the underlying level (it can be a computer or a brain) and typically takes a symbolic approach: mental states are symbolically represented within a symbolic-physical system. In contrast, the bottom-up or connective approach begins with architectures, particularly artificial neural networks that emulate brain neurons, to build more intricate structures and modes of reasoning. Symbolic approaches formalize reasoning as a result of symbol manipulation, while neural or connective approaches implicitly derive reasoning from the interconnectedness and distributed processing of numerous simple computational units. Symbolic approaches offer greater transparency and interpretability to individuals; while connective approaches manage changing, uncertain, incomplete and dynamic realities more adequately, even at the expense of transparency. Recent progress and remarkable results, particularly in bottom-up approaches to neural networks, increasingly demonstrate the effectiveness of these methodologies, particularly in the perceptive sector.

The term "Augmented Intelligence" replaces "Artificial Intelligence" to point out AI systems' capacity to collaborate and interact with humans. Rather than aiming to replace humans, these systems are designed to assist them in decision-making, enhance their problem-solving capabilities and enrich their overall experience. AI can be viewed

through numerous interpretations, offering infinite facets from both theoretical and implementation perspectives. Therefore, any attempt to provide a definitive classification or definition of AI remains simplistic to this day.

The brief history of artificial intelligence development can be divided into three stages: gestation, formation and development phases. The gestation stage dates to before 1956, the second stage took place between 1956 and 1969, and the third stage covers the time period after the 1970s.[22]

Gestation stage of artificial intelligence

Research results that have great influence on the development of artificial intelligence mainly include the following basics. Leibniz, a German mathematician and philosopher, proposed the idea of universal symbols and the calculation of reasoning. He believed that a universal symbolic language could be established and that symbols could be reasoned with. This idea not only laid the foundation for the generation and development of quantitative logic, but was also the beginning of the modern idea of machine thinking design. In 1936, the British mathematician Turing proposed the mathematical model of the ideal computer, the Turing machine, which laid a theoretical basis for the subsequent advent of electronic and digital computers. Finally, the American neurophysiologist McLoch and the mathematical logician Pitts built the first model of the neural network in 1943, which began Microsoft's artificial intelligence field of research and laid the foundations for the subsequent research of the artificial neural network. From the above development process, we can see that the emergence and development of artificial intelligence is the inevitable product of the development of science and technology.

[22] Da, K., and Cheng, G. (2018). Discussion on Philosophy of Information and Artificial Intelligence. Proceedings of the 2018 Joint International Advanced Engineering and Technology Research Conference

Formation stage of artificial intelligence

This phase primarily refers to a two-month academic seminar conducted by Dartmouth College from 1956 to 1959, aimed at discussing the terminology and concepts of artificial intelligence. During this seminar, the term "AI" was formally adopted at the proposal of John McCarthy. In the years following the conference, this term made significant strides in various domains, including machine learning, theorem proving, pattern recognition, problem-solving, expert systems and natural language processing. The establishment of the International Artificial Intelligence Conferences in 1969 marked a significant milestone in the history of AI, signifying global recognition of this emerging discipline.

The development stage of artificial intelligence

The development stage of artificial intelligence was not without challenges, as for any emerging field. Nevertheless, considerable progress has been made in several areas of research during this period. Different types of expert systems have emerged, each with distinct functions and purposes, which have led to significant economic and social benefits. The success of expert systems has highlighted the importance of knowledge as the foundation of intelligence, emphasizing the need to focus research on the acquisition of knowledge. After the period known as the "*integrated development*" phase, which began around 1986, computational intelligence addressed some of the deficiencies of the mathematical and computational theories of AI. This phase has enriched the theoretical framework of AI, opening a new era of development. Currently, the development of AI has surpassed previous levels, with more tangible and applicable progress in various areas. These advances are characterized by improved performance, efficiency optimization and practical applications across multiple verticals.

The term "cybernetics", gained prominence in the 1940s, referring to the systematic study of the processes of communication and control in living organisms and machines. It explores self-regulation and command mechanisms, emphasizing adaptability to environmental changes through feedback.

Between 1940 and 1960, there was a significant intersection of technological advances, particularly stimulated by the events of World War II, and a growing interest in understanding how to bridge the gap between the functioning of machines and living organisms; these factors have taken an important step forward for artificial intelligence.

In the early 1950s, although they did not coine the term "AI", John Von Neumann and Alan Turing laid the foundation for the technology behind it. They went from the nineteenth century decimal logic used in computer science (operating on values from 0 to 9) to binary logic (based on Boolean algebra, which deals with sequences of 0 and 1). These two researchers formalized the architecture of modern computers and demonstrated their universality, able to execute programmed instructions. Turing, in particular, posed the question of whether a machine could show its intelligence, in its fundamental 1950 article "*Computing Machinery and Intelligence*". [23]From this document he introduced the concept of "imitation game" where a human participant interacts via teletype with both another human being and a machine, with the aim of discerning which one is based on their responses.

The birth of Artificial Intelligence (AI) occurred in 1956 with the "*Dartmouth Summer Research Project on Artificial Intelligence*[24]." This event aimed to define the discipline and foster research projects simulating human intelligence. Over subsequent decades,

[23] https://redirect.cs.umbc.edu/courses/471/papers/turing.pdf
[24] http://jmc.stanford.edu/articles/dartmouth/dartmouth.pdf

attention shifted to computers, leading to the development of programming languages tailored for AI.

It was with the advent of the first microprocessors at the end of 1970 that AI took off again and entered the golden age of expert systems.

The journey began in 1965 at MIT with the development of DENDRAL, an expert system focused on molecular chemistry, and continued at Stanford University in 1972 with the creation of MYCIN, a system designed for diagnosing blood diseases and prescribing medications. These pioneering systems utilized an "inference engine," programmed to logically mimic human reasoning. By inputting data, the engine could generate expert-level responses.

In the 1970s, "*Expert Systems*" emerged as AI systems designed to emulate human experts in specific domains. The 1980s attended their success in areas like diagnosis, design, and monitoring. The 1990s, marked by the rise of the World Wide Web and graphic processors, introduced new possibilities for AI applications.

The resurgence of the AI discipline around 2010 can be attributed to two key factors. Firstly, there was widespread access to massive datasets, which revolutionized tasks like algorithmic image classification and pattern recognition. Previously, such tasks required custom samples, but now, with a simple Google search, millions of relevant examples can be found. Secondly, there was the discovery of the high efficiency of graphics card processors in accelerating learning algorithms. Before 2010, the iterative nature of the process could take weeks to process a complete sample, but the computing power of graphics cards, capable of over one trillion transactions per second, led to significant progress at a reasonable cost.

This marked a paradigm shift from expert systems, where computers were coded with rules, to systems that allowed computers to autonomously discover rules through correlation and classification, exploiting vast amounts of data.

AI is now a driving force shaping the future of the Internet, envisioned as a network of intelligent entities, including software (agents, web services, softbots, avatars), hardware (objects, sensors, robots), and humans. These developments play a central role in research and innovation programs such as the European Commission's "Horizon 2020" and "Industry 4.0." Applications span various social aspects, contributing to the development of smart cities, advancements in mobility, improved communications, efficient energy consumption, enhanced services, climate management, increased security,and progress in the healthcare sector.

In terms of intellectual abilities, AI operates primarily at four functional levels:

1. Comprehension: By simulating cognitive abilities to correlate data and events, AI can recognize texts, images, tables, videos and extract information from them.

2. Reasoning: Through logic, AI systems can connect multiple pieces of information collected through precise mathematical algorithms in an automated manner.

3. Learning: This level involves systems with specific functionalities for analyzing input data and producing correct output. Typical examples include Machine Learning systems that enable AI to learn and perform various functions through automatic learning techniques.

4. Interaction (Human-Machine Interaction): This refers to how AI operates concerning its interaction with humans. Significant advancements have been made in Natural Language Processing, allowing humans to interact with machines using natural language, and vice versa.

2.2 European regulation on artificial intelligence: Artificial Intelligence Act

The AI Regulation emerges as a significant legislative initiative aimed at progress the development and adoption of safe and reliable AI across the EU market and business landscape. Its proposed "risk-based" approach holds particular relevance, as it sets stringent rules based on the potential societal impact of AI, effectively mitigating potential harm and promoting the adoption of secure AI technologies. This proposal not only represents a significant advancement for Europe but also has the potential to establish a global standard for AI regulation. As the world's first legislative proposal of its kind, it could influence international AI regulation, much like the General Data Protection Regulation has done.

In line with the OECD (Organisation for Economic Cooperation and Development) approach, the definition of AI systems in the Regulation provides clarity in distinguishing them from simpler software systems. In particular, the scope of the regulation is limited to the areas covered by EU law, safeguarding the competences of the Member States and excluding systems used exclusively for military purposes[25]. The provisions in support of innovation aim to create an environment conducive to regulatory experimentation, allowing the testing of innovative AI systems under real conditions, while reducing the administrative burden for small businesses.

[25] Ethics Guidelines for Trustworthy Artificial Intelligence, by High-Level Expert Group on Artificial Intelligence, published on 8 April 2019.

In summary, this agreement represents a significant step towards achieving balanced AI regulation in Europe, with innovation at the heart and adequate data protection measures in place. However, the full text will be confirmed by both institutions involved and will be subject to legal and linguistic review before formal adoption by the co-legislators. This meticulous process ensures a clear legal understanding and compliance, paving the way for the practical and uniform application of AI regulation across the European Union. The next objective will be to ensure the accuracy and clarity of the text.

The AI Act, addressed as the world's first AI Regulation from a legal standpoint, establishes a comprehensive legal framework to govern the development, marketing and utilization of AI systems within the EU, all while keeping the protection of EU values and rights. [26]It permits the operation of generative artificial intelligence models like ChatGPT from OpenAI and Bard from Google, on the condition that their outputs are clearly identified as AI-generated. The regulation introduces rules aimed at ensuring the safety, transparency and ethical use of AI in Europe, adopting a risk-based approach that imposes obligations on providers and users corresponding to the level of risk associated with the AI. Companies will be granted a transition period to comply with the new regulations.

After an intense three-day negotiating "marathon", the negotiators of the Council Presidency and the European Parliament reached an interim agreement on the proposal for standardized regulations on artificial intelligence, known as the AI regulation. The draft regulation aims to ensure the safety of AI systems placed on the European market

[26] https://superintelligenz.eu/wp-content/uploads/2023/07/EPRS_BRI2021698792_EN.pdf

and used within the EU, while supporting the fundamental rights and values of the EU. This historic proposal also aims to promote investment and innovation in AI.

Carme Artigas, Spanish Secretary of State for Digitization and Artificial Intelligence, has defined the recent agreement as a historic milestone with profound implications for the future. She has defined that the agreement effectively addresses a global challenge within a rapidly changing technological landscape, affecting a sector crucial to the future of economies and societies around the world. Artigas stressed the delicate balance reached in the agreement, which aims to promote innovation and the widespread adoption of artificial intelligence throughout Europe in full respect of the fundamental rights of citizens.

The new regulation will have wide applicability, extending to all public and private bodies that develop artificial intelligence tools for the European market. This includes not only European companies, but also the main American players, who must adapt to it if they want to continue operating on the European market. Both suppliers and users are required to ensure compliance with the provisions of the regulation.

A significant aspect of the Regulation is its clear definition of artificial intelligence, emphasizing traits such as autonomy, adaptability and impact on the physical or virtual world. This definition, in line with international guidelines, distinguishes AI from traditional software systems based on fixed rules and provides specific criteria for its application. It is important to emphasize that this approach pursues to promote rather than hinder innovation.

In addition, the regulation aligns with other initiatives, including the coordinated artificial intelligence plan, aimed at accelerating investment in AI across Europe.

Parliament's main objective is to ensure the safety, transparency, traceability, non-discrimination and environmental sustainability of artificial intelligence systems used in the EU. They support the human supervision of AI systems, rather than relying solely on automation, to mitigate potential negative impacts. Furthermore, Parliament aims to establish a technologically neutral and standardized definition of AI that can be universally applied to future AI systems.

Compared to the Commission's initial proposal, the main new elements of the provisional agreement can be summarized as follows:

- Rules on AI models for general purposes with high impact that may bring systemic risks in the future, as well as on high-risk AI systems;
- A revised governance system with some enforcement powers at EU level;
- Expansion of the list of prohibitions, with the possibility of using remote biometric identification by law enforcement authorities in public spaces, subject to safeguards;
- Better protection of rights through the obligation for operators of high-risk AI systems to carry out a fundamental rights impact assessment before using an AI system;

More specifically, the Interim Agreement covers the following topics:

- Definitions and scope

In order to establish clear criteria for distinguishing AI from simpler software systems, the compromise agreement ensures that the definition of this application has to be in line with the OECD approach. Interestingly, the AI Regulation will exclude systems used exclusively for military or defense purposes. Similarly, the agreement specifies that the regulation will not cover AI systems used exclusively for research and innovation or by individuals for non-professional purposes.

- Classification of AI systems as high risk and prohibited AI practices

Artificial intelligence systems are estimated to pose an unacceptable risk and are prohibited when they are perceived as a threat to individuals, encompassing anything that poses a "*clear threat to people's security, livelihoods, and rights*". In particular, we refer to:

- artificial intelligence systems using subliminal or manipulative or deceptive techniques to distort behaviour;
- artificial intelligence systems that exploit the vulnerabilities of specific individuals or groups;
- biometric categorisation systems based on sensitive attributes or characteristics;
- AI systems used for social scoring or reliability assessment;
- AI systems used for risk assessment involving criminal or administrative offences;
- artificial intelligence systems that create or expand facial recognition databases through targeted web scraping;
- Artificial intelligence systems that deduce emotions in law enforcement, border management, workplace and education.

Artificial intelligence systems that adversely affect security or fundamental rights will, instead, be considered high-risk. The high risk corresponds to a "significant risk" of damage to health, safety or fundamental rights, understood as "*result of the combination of its severity, intensity, probability of occurrence and duration of its effects and the ability to affect an individual, a plurality of people or a particular group of people*".[27]

According to health it includes the issue of environmental risks; critical infrastructure such as energy networks or water management systems will also be covered. That is why systems based on artificial intelligence in this area will have to comply with European environmental standards and be in line with the environmental footprint standards.

AI systems identified as "high risk" include AI technology used in various contexts, in particular:

- critical infrastructure (such as transport), which could endanger the lives and health of citizens;
- educational or vocational training, which may determine access to someone's education and professional course of life (for example, examination scores);
- product safety components (e.g. AI in robot-assisted surgery);
- employment, worker management and access to self-employment (eg Curriculum Vitae selection software for recruitment procedures);
- essential private and public services (for example, the use of the credit scoring system which may deny citizens the possibility of obtaining a loan);
- law enforcement that may interfere with citizens' fundamental rights;

[27] https://www.cambridge.org/core/journals/european-journal-of-risk-regulation/article/risk-management-in-the-artificial-intelligence-act/2E4D5707E65EFB3251A76E288BA74068

- management of migration, asylum and border control (for example, verification of the authenticity of travel documents);
- administration of justice and democratic processes.

Furthermore, *high-risk* AI systems will be subject to strict obligations before they can be marketed or made accessible. Such systems must be subject to a conformity assessment demonstrating compliance with the mandatory requirements for a reliable AI outlined in the Regulation. These criteria include data quality, documentation and traceability, transparency, human oversight, accuracy, IT security and system resilience. The objective is to ensure that high-risk AI systems are safe, reliable and transparent, thereby reducing potential risks for individuals and society.

These obligations involve an effective risk assessment and mitigation mechanism, the provision of clear and relevant information to users, complete documentation containing all essential details about the system and the intended purpose for authorities to assess compliance and recording of activities to ensure traceability of results.

For *low-risk* systems, the approach is based on self-regulation, allowing suppliers to voluntarily adopt for the implementation of requirements for reliable AI and adherence to specific codes of conduct. This approach strikes a balance between promoting innovation and minimizing risks without imposing excessive regulatory burdens on technologies with limited risks.

The introduction of the regulation will require public and private entities to assess the risks posed by the AI systems they use, which could lead to a critical transition phase. Organizations will need to thoroughly evaluate the AI systems they use to determine

whether they fall into the high-risk category and, if so, ensure compliance with the new legal provisions.

- AI systems for general purposes and basic models

New provisions have been added to take into account situations where AI systems can be used for many different purposes and those where technologies are subsequently integrated into another high-risk system. The Interim Agreement also addresses the specific cases of AI systems for general purposes. Specific rules have also been agreed for the basic models, such as the generation of videos, texts, images, side language conversation, data calculation or the generation of computer codes. The provisional agreement provides that the basic models must comply with specific transparency requirements before being placed on the market.

A stricter regime has been introduced for basic "high impact" models, such as basic models trained with large amounts of data and advanced capabilities and performance well above average, which can spread systemic risks along the value chain.

- A new governance architecture

As a result of the new rules on AI models for general purposes and the clear need for their application at EU level, has been established an AI office within the Commission to oversee these advanced models, to contribute the promotion of testing standards and practices and the enforcement of common standards in all Member States. A scientific panel of independent experts will advise the AI Office on AI models for general purposes, contributing to the development of methodologies for assessing the capabilities of the basic models and monitoring the possible material security risks associated with them.

- Sanctions

The financial penalties for violations of the AI Regulation were set as a percentage of the total annual turnover in the previous financial year of the company that committed the offence or, where it's higher, in a predetermined amount. This would amount to 7% for violations related to prohibited AI applications, 3% for the AI regulation obligations, and 1.5% for the provision of inaccurate information. However, the interim agreement provides more proportionate fines for the administration of SMEs and start-ups in the event of a violation of the provisions of the AI Regulation.

- Transparency and protection of fundamental rights

Is planned an impact assessment on fundamental rights before the high-risk AI systems are placed on the market. Greater transparency is ensured for the use of high-risk systems, including the registration of public entities in the EU database.

- Measures to support innovation

In order to create a more innovation-friendly legal framework and to promote evidence-based regulatory learning, the provisions for measures to support innovation have been substantially modify compared to the Commission proposal.

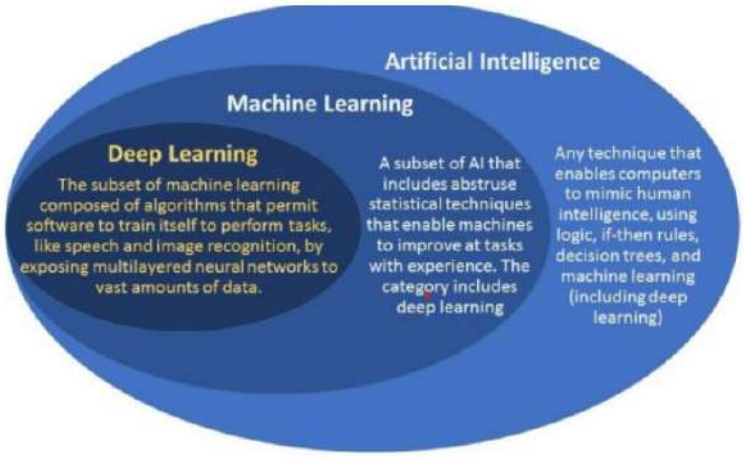
In particular, the interim agreement stresses the importance of creating regulatory testing environments for AI systems that not only facilitate controlled development and validation, but also allow testing under real conditions. In addition, provisions have been added to allow testing under specific real-world conditions. In order to lighten the

administrative problem on small enterprises, the agreement provides for measures to support these operators, together with limited and clearly specified exemptions.

The IA Act, as approved by the European Parliament, aims to promote the adoption of AI based on the humanity and reliable, ensuring a high level of protection for health, safety and fundamental rights, democracy, law and the environment. However, the priority given by Parliament to the fundamental rights of citizens over the interests of big technology and excessive government control sends a strong message. The efforts of the European Commission and the Council to establish safeguards for the development and use of AI represent a significant step towards a future based on these applications. This legislation is the world's first global law on artificial intelligence, representing a potential example for future global legislation.

2.3 Machine Learning and Deep Learning

The differentiation between weak and strong Artificial Intelligence lays in the foundation for defining "Machine Learning" and "Deep Learning," which are two specialized areas within the broader field of AI. What distinguishes AI from a technological and methodological point of view is the learning approach through which intelligence acquires competence in a task or action. These learning paradigms define and differentiate Machine Learning from Deep Learning. The diagram below illustrates the distinctions among Artificial Intelligence, Machine Learning, and Deep Learning.



[28]

Machine learning, also known as automatic learning, is a specific implementation approach within the realm of artificial intelligence (AI). It is a subset of AI that focuses on enabling machines to process data and learn independently, adjusting algorithms based on the information they receive during the learning process. AI and Machine Learning terms are often used interchangeably, particularly in the context of big data.

The term "machine learning" emerged later than AI, referring to "*the ability of a machine to learn without explicit programming*." Machine learning involves the formation of an algorithm to learn from various environmental conditions. This training involves the use of large datasets and efficient algorithms to adapt and improve performance according to the situations encountered.

In essence, machine learning simplifies the development of analytical models using techniques such as neural networks, statistical models and operations research to uncover hidden information within data. Neural networks, inspired by the functioning of the

[28] Apprendimento automatico e apprendimento profondo: differenze chiave - Unite.AI https://images.app.goo.gl/uf9a7dCWS3KhouLu6

human brain, consist of interconnected units (similar to neurons) that process information by responding to external inputs and transmitting information between different units.

To learn effectively, machine learning must sustain a "training" process using examples of desired outcomes. The key feature of machine learning lies in its learning models, which categorize algorithms into various types:

- Supervised learning: learn from input-output examples to teach AI how to respond.
- Unsupervised learning: learning through the analysis of results, where the software discerns patterns and behaviors based on output data.
- Reinforcement Learning: AI receives rewards for achieving the right goals or actions, allowing it to learn which actions produce favorable outcomes over time.

A practical application of these algorithms is in the automatic detection of spam emails: while we label some emails as spam, the algorithm learns to identify new ones it has never encountered before. Another example is in Recommender Systems, which analyzes the correlations and similarities between different elements such as products or users. These algorithms have allowed companies like Amazon or Netflix to suggest products and services to users based on their past consumption patterns. By identifying mathematical models, Recommender Systems predicts whether a user might be interested in a product they have not yet encountered.

Machine learning algorithms play a vital role in numerous everyday scenarios, aiding in decision-making processes by providing insights and facilitating quicker and more informed choices. However, it's important to note that these algorithms do not replace human judgment but rather enhance it.

Deep learning, a subset of machine learning, draws inspiration from the brain's structure, particularly the interconnectedness of neurons. Unlike traditional machine learning methods, deep learning models are designed to emulate the complexity of the human mind. This approach requires specially crafted artificial neural networks, known as deep artificial neural networks and powerful computational resources capable of handling multiple layers of computation and analysis, similar to the neural connections in the human brain. Deep learning employs large-scale neural network models with numerous processing units, leveraging advancements in computational power and training techniques to learn intricate models from vast datasets.

What is the difference between Machine Learning and Deep Learning?

There are numerous differences between Machine Learning and Deep Learning; here are some of the most important.

- *Human intervention*:

  To achieve results, Machine Learning requires human intervention, while Deep Learning, being more complex, requires minimal intervention.

  - *Time:*

  Machine Learning, once set up, works quickly, but the power of data is limited. Deep Learning takes more time to set up, but results are instant.

- *Method*:

  Machine Learning uses traditional algorithms to analyze data, learns from them, and makes decisions based on this learning. Deep Learning structures algorithms to generate an artificial neural network. The neural network learns from data and makes decisions autonomously.

- *Application areas*:

Machine Learning is used for email, speech recognition, image recognition, and disease diagnosis. Deep Learning is used in more complex areas such as autonomous driving cars, surgical robots, and translations.

2.4 The different applications of Artificial Intelligence in the business world

Recent research highlights that large multinational companies, such as Facebook, Google, Amazon, Apple and Microsoft, are not only competing to bring innovative AI startups into their fold but also initiating and fueling ongoing research projects (such as image recognition, facial recognition, voice applications, language translations, etc.).

In the business world, the maturity and availability of technological solutions have brought the potential of AI to many segments. Here are some of the most significant ones:

- **AI and Marketing**[29]

The AI in marketing is gaining ground because of its disruptive impact on both current and future businesses. Over the past decade, the development of AI has led to the increased complexity of marketing efforts, with the goal of enclosing the unlimited potential of technology to deliver personalized experiences to consumers. For example, AI analyzes consumer actions, predicts behavior and understands preferences, habits, and needs.

[29] https://www.brainpull.com/it/blog-agenzia-di-comunicazione/come-intelligenza-artificiale-ai-sta-rivoluzionando-il-marketing.html

Artificial Intelligence Marketing adopts AI technologies to revolutionize every faceting of the marketing process, crafting sophisticated predictive models of consumer behavior. AI marketing not only enhances market understanding and target segmentation but also customizes and optimizes interactions, with a focus on effective and profitable customer relationship management.

AI-driven marketing is characterized by automated decision-making processes powered by data collection, analysis and monitoring of economic trends to derive strategic business decisions. Many marketing professionals already utilize AI to complement traditional methods or handle tactical and operational tasks with minimal human intervention.

AI's integration into marketing is pivotal at every decision-making stage, facilitating the extraction, categorization and synthesis of valuable insights from raw data, enabling well-informed strategic decisions.

Here are some examples of AI applications in marketing:

- Marketing Automation: Utilizes specialized software to automate marketing activities and enhance the quality of communication messages.
- Machine Learning: Creates algorithms and models capable of learning from data without explicit programming for each task.
- Natural Language Processing (NLP): Develops algorithms and models to enable computers to understand, interpret, and generate human language.
- Voice Search: Leverages natural language recognition and processing to enable users to interact with electronic devices using their voice.
- Virtual Assistants and Chatbots: AI tools that engage with users like humans, assisting with tasks such as appointment booking or messaging.

AI has a wide range of potential applications in marketing, each of which brings a series of benefits to businesses and organizations oriented towards investing in the sector. Here are the main advantages of AI marketing:

- Facilitated collection, analysis, and cataloging of data.
- Increased ROI of marketing campaigns.
- Simplified customer relationship management.
- Improved user experience and customer satisfaction rate.
- Real-time communication personalization.
- Advanced measurement of marketing performance.
- Faster decision-making processes.
- Maximum accuracy in micro-targeting.
- Easier prediction of emerging trends and user needs.
- Improved effectiveness of advertising activities.
- Personalization and filtering of content for each user.
- Increased customer retention.

- **AI and Finance**

The financial sector has been at the forefront of the adoption of financial technology (fintech), including artificial intelligence, and its adoption within financial institutions is constantly increasing. Recent research indicates that artificial intelligence and machine learning tools are regarded as the best "revolutionary" technologies in financial services. As early as the 1980s, financial institutions began experimenting with algorithmic models for trading and market analysis. However, it was with the emergence of the Internet and the exponential increase in data availability that AI began to significantly transform the industry.

Over the last few decades, we have seen a substantial evolution from the use of simple algorithms to increasingly sophisticated machine learning systems. This progress has allowed for more accurate market forecasting, more effective risk management and improvements in operational efficiency.

The most prevalent AI technologies in the financial sector include:

- ***Machine Learning*:**

Machine Learning is a branch of AI that focuses on creating systems capable of learning from data, identifying patterns, and making decisions with minimal human interference. In the financial sector, ML is used for predictive analytics, risk management and service personalization.

- *Deep Learning and Neural Networks*:

Deep learning, a subset of ML, utilizes artificial neural networks inspired by the functioning of the human brain. These networks are particularly effective in processing large amounts of unstructured data, such as images, texts, and market data.

- *Natural Language Processing* (NLP):

NLP allows machines to understand and interpret human language. In the financial sector, it is used to analyze legal and financial documents, as well as to enhance customer interaction through chatbots and virtual assistants.

One of the most important applications of artificial intelligence, particularly in business, is credit analysis, a vital business for managing corporate risk and assessing solvency. Credit risk management involves examining large amounts of data and involves non-linear processes, making it conducive to AI development.

Another area that testifies to a significant impact of AI is in investment decisions, allowing investors to make well-informed and timely choices. AI can analyze complete market data to identify optimal portfolio asset combinations, considering risk, desired returns and other investor-specific factors. AI algorithms can tailor investment recommendations to individual preferences, facilitating the creation of custom portfolios that meet the specific needs of each client.

AI is also transforming transaction processing, monitoring and security, leading to a more seamless, secure and personalized payment experience, for consumers and businesses. AI can automate payment processing, reducing errors and improving efficiency. In addition, the use of AI-based virtual assistants for voice-controlled payments is becoming increasingly widespread, providing users with an intuitive, hands-free payment experience.

In addition, AI plays a key role in improving security and preventing fraud in financial transactions. Artificial Intelligent can monitor transactions in real time to identify suspicious activities, significantly reducing the risk of fraud. Using behavioral analysis, the system can detect unusual buying patterns and promptly report or block potentially fraudulent transactions.

- **AI and Agriculture**

The advancement of new methodologies for sustainable agriculture represents a fundamental challenge for contemporary society. In particular, there is a pressing need to develop systems that make cultivation processes more autonomous, thus increasing yield by minimizing the use of chemicals such as fertilizers, herbicides and pesticides. In this regard, recent advances in robotics and artificial intelligence have the potential to significantly revolutionize various agricultural production processes. Next-generation

agricultural robots can be used for both greenhouse and open field cultivation, automating a range of tasks including plant monitoring, pruning, harvesting and weeding.

Within the agricultural sector, artificial intelligence emerges as a cornerstone of agriculture 4.0 and precision agriculture. AI in agriculture is applied in different scenarios: for example, it allows the management and analysis of data to address crop diseases or nutritional deficiencies in advance, uses judiciously pesticides and irrigation water, orchestrate field activities and farm management, automate selection processes and improve product traceability across the agricultural supply chain.

Artificial intelligence in agriculture facilitates the meticulous management of agricultural data. The data collected in real time by the field through dedicated sensors are processed by algorithms experienced in the evaluation and determination of programs of irrigation, soil fertilization and plant protection use. As a result, cultivation operations can be meticulously planned and carried out, without waste or delay. In addition, artificial intelligence can be used for market analysis, trend assessments and demand assessments of agricultural products, allowing farmers to plan their operations and ensure a wide range of products for consumers.

The integration of artificial intelligence in agriculture offers a myriad of benefits, not only for agricultural businesses but also for consumers. Firstly, by strengthening agricultural productivity, there is a clear economic incentive for farmers, who are witnessing higher yields and reduced waste. In addition, ancillary benefits include improving the quality of agricultural products and promoting the sustainability of crops, which ultimately benefits the population.

Another aspect to consider is the potential reduction of manual work due to partial automation. Within the agricultural sector, many tasks are arduous and repetitive:

automating processes such as sowing or harvesting fruit and vegetables could reduce dependence on human work, enabling staff to redirect their efforts towards operations that require greater specialization, typically more intellectually stimulating and rewarding to individuals.

Some examples of the AI in the agriculture sector are:

- *Precision Farming*:

AI is used for precision agriculture, where sensors and drones collect data on crops, soil, and weather conditions. AI algorithms analyze this data to provide insights into optimal planting times, irrigation needs and personalized crop management.

- *Crop Monitoring and Management*:

AI-powered systems can monitor the health of crops by analyzing images and data collected from satellites, drones, or sensors in the field. This helps in early detection of diseases, pests and nutritional deficiencies, enabling farmers to take timely corrective actions.

- *Automated Machinery*:

AI-driven agricultural robots and autonomous machinery are designed to perform tasks such as planting, harvesting and weeding. These machines use computer vision and machine learning algorithms to navigate and carry out specific operations, reducing the need for manual labor.

- *Predictive Analytics*:

AI is employed for predictive analytics to forecast crop yields, market trends, and potential risks. By analyzing historical data and considering various factors, AI

algorithms help farmers make informed decisions about planting strategies, resource allocation and market timing.

- *Smart Irrigation Systems*:

AI is integrated into irrigation systems to optimize water usage. By analyzing data on soil moisture, weather conditions and crop requirements, AI algorithms can determine the precise amount and timing of irrigation, reducing water waste and improving efficiency.

- *Disease and Pest Identification*:

AI-powered image recognition systems can identify diseases and pests affecting crops by analyzing images of leaves or plants. Early detection allows for targeted interventions, minimizing the use of pesticides and reducing environmental impact.

- *Supply Chain Optimization*:

AI helps optimize the agricultural supply chain by predicting demand, improving logistics and reducing waste. This ensures that harvested crops reach their destinations efficiently, minimizing losses and improving overall productivity.

Chapter 3 – The role of Artificial Intelligence in CSR

3.1 Artificial Intelligence for Social Impact and for the technological innovations

Artificial intelligence has extraordinary potential to extend beyond conventional business applications and address some of the most pressing challenges facing humanity. According to a comprehensive study by McKinsey, AI holds the promise to contribute significantly to all 17 of the United Nations Sustainable Development Goals, potentially

improving the lives of millions of people around the world. This section delves into the field of AI for the benefit of society, shedding light on the critical areas that technology companies must prioritize to unlock its full potential.

In 2008, the Institute for Computational Sustainability (ICS) was founded, supported by a grant from the National Science Foundation. The institute focuses on the emerging field of computational sustainability and aims to apply computational techniques to address some of the most pressing challenges related to the sustainability of our time. Its mission is to demonstrate that IT researchers can and must play a key role in optimizing the use and management of natural resources, bringing significant innovations and transformations in the field of informatics.

On January 13, 2020, an article in Nature Communication titled "*The role of artificial intelligence in achieving the Sustainable Development Goals*" was published. The abstract of the article reads: "*The emergence of artificial intelligence and its wider impact on many sectors require an assessment of its effect on the achievement of sustainable development goals. AI can achieve 134 goals, but it can also inhibit 59 goals. The rapid development of AI must be supported by the necessary regulatory knowledge and oversight for AI-based technologies to enable sustainable development. Failure to do so could lead to gaps in transparency, safety and ethical standards*[30]".

According to the field of deep learning, AI plays a central role in crisis management, from aid in search and rescue operations during natural disasters to epidemic monitoring. Its predictive capabilities provide valuable insights for more effective strategies. In addition, it has a wide application in environmental conservation; for example, it can analyze audio

[30] https://www.nature.com/articles/s41467-019-14108-y

sensor data to identify cases of illegal logging in ecologically fragile forest regions, providing timely information to competent authorities.

However, data, an indispensable component for AI applications, often remains fragmented in various private or public institutions. The cost associated with data, compounded by its dual utility in commercial enterprises, often prevents access for non-profit organizations engaged in addressing social issues. In addition, sub-average data quality can distort results, leading to imperfect decision-making processes.

To address these challenges, B2B IT companies must prioritize data verification and validation to ensure the reliability of AI models. This involves the creation of robust data governance frameworks that facilitate real-time monitoring and validation. Improving data accessibility can enable wider and more impactful AI applications for the social good. Strategic collaborations with governments, NGOs and data providers can foster an ecosystem conducive to ethical data sharing and collaborative innovation.

By focusing on these crucial aspects and leveraging the core capabilities of AI, companies can not only mitigate the associated risks, but also amplify their positive social impact. It is the responsibility of companies to use their skills for the greater good and leverage AI to shape a brighter future for humanity. This chapter aims to provide clarity on why artificial intelligence is relevant and significant to organizational success in addressing social innovations by outlining a comprehensive framework applicable to scholars and practitioners.

Artificial intelligence serves as the cornerstone of social innovation, with the two concepts reinforcing each other. The advancement of artificial intelligence has catalyzed the emergence of social innovations. For example, the "Intelligent+X" paradigm has become synonymous with social innovation, encompassing areas such as

"Intelligent+Manufacturing," "Intelligent+Medical," and "Intelligent+Security." reshaping the social development landscape.

In fact, artificial intelligence is the driving force behind the fourth technological/industrial revolution.

The impetus behind the development of artificial intelligence lies in its application to address human needs, which serves as the primary source and driving force of innovation. The realms of artificial intelligence innovation and entrepreneurship are witnessing significant activity. The global industry recognizes the profound importance of artificial intelligence technology in driving a new wave of industrial transformation, adapting its development strategies accordingly.

Unmanned operating system technology has found wide application in the retail sector, including convenience stores, intelligent supply chains, passenger flow analysis, unmanned warehouses and autonomous vehicles. Through the implementation of intelligent logistics robots that leverage artificial intelligence, deep learning, image recognition and big data, industrial robots can independently perform complex tasks, facilitating automation in activities such as goods selection, transport and storage. Similarly, the logistics industry has embraced intelligent research, reasoning planning, computer vision and intelligent robots to automate transport, storage, distribution, and marketing processes, loading and unloading, achieving essentially unmanned operations. Big Data analysis is used for intelligent deployment planning, optimization of logistics resource allocation, matching supply and demand and logistics resource management.

Currently, artificial intelligence has generated significant economic benefits for humanity. It can carry out tasks that human beings do not or cannot do, improving the efficiency of work and reducing costs. Moreover, AI is less focused to error than humans

and can operate continuously. However, there is concern about the potential future impact of AI. While it can continue to replace human labor, which leads to unemployment in some sectors, there is also the risk of spiraling technology out of control. The famous physicist Stephen Hawking warned that the emergence of artificial intelligence could be catastrophic for civilization unless its development is carefully managed. Elon Musk, CEO of Tesla, echoed these concerns, stating that AI could overcome human intelligence and pose a threat to humanity's existence. Advanced systems of AI, capable of independent thinking and adaptation, can pose significant risks for humanity in the future. During the 2024 World Economic Forum in Davos, the Schwab Foundation's Global Alliance for Social Entrepreneurship revealed a significant new project focused on leveraging artificial intelligence for social innovation. Co-launched with Microsoft and supported by EY, this initiative brings together a diverse group of stakeholders including social innovators, impact investors, academics and technology giants like Microsoft, SAP, Salesforce and Verizon. The goal is to encourage and support social innovators in connecting the power of AI for creating positive social change.

It highlights successful applications of technology to benefit communities around the world and develops professional guardrails for its responsible implementation. Artificial intelligence has quickly become the technology of choice for companies to improve efficiency and reshape their business models. AI also provides an opportunity to increase positive impact. Imagine a farmer using it to learn when to plant his seeds or a mother in a remote village accessing AI-based health advice for her sick child. This transformative potential of artificial intelligence is widely recognized. The following five examples were awarded by the *Schwab Foundation for Social Entrepreneurship*, and some of them were

part of Microsoft's "*Entrepreneurship for Positive Impact*" program. They show how AI can be used to create and scale positive impact.

1. Access to justice through natural language models and machine learning.

Using a mixed approach that integrates technology with individuals, Barefoot Law's solution connects digital legal information and services with community stakeholders. The company uses an AI solution called Winnie, an AI lawyer who provides pro-bono legal services to Ugandans, especially to rural community citizens who otherwise would not have access to legal compensation. The machine learning model complements existing tools to provide quality front line legal services. To date, Barefoot Law's solution has enabled over 800,000 users to access its services and has solved over 20,000 cases.

2. AI-enabled learning for children's education.

Enuma Inc. is a mission-driven Educational Technology startup that aims to improve children's literacy and promote their self-learning regardless of different backgrounds. Using tablet hardware, Children with Development Needs, in migration situations, or residents in disadvantaged areas with limited digital access can self-teach basic literacy and computing skills through gamified learning. Enuma products use generative artificial intelligence, including language learning models, both for the development of its learning infrastructure and for interactive educational activities.

3. Create an impact at the intersection of technology and conservation.

In Brazil, the country with the most biodiversity in the world, conservation is very important. MapBiomas is on a mission to trach the way to making Brazil the first zero net emission country by improving land use changes using data. Artificial intelligence and machine learning tools are at the heart of this effort to reduce emissions and enable better decision-making for the preservation and protection of indigenous peoples. Using remote

sensing technology, IT and collaborating with local land use experts, MapBiomas generated maps that the solution is made possible thanks to the synergy of machine learning algorithms integrated with the Google Earth engine platform and real-time dataset hosted in Google Cloud storage, enabling real-time data processing.

4. Philanthropic investments in large-scale AI-enabled solutions as digital public goods

The EkStep Foundation, an India-based philanthropic organization that believes in designing for public and inclusive innovation on a large scale, was at the forefront of implementing technology before artificial intelligence gained popularity. Anuvaad, an open-source AI-based platform supported by EkStep, helps digitize and translate documents into Indian languages. Sunbird (Sunbird.org), an open-source collective founded by the company, has created a versatile and expandable set of digital elements operating on open-source technology. As a digital public asset, Sunbird's applications operate in both the public and private sectors, such as education, skills, healthcare, agriculture, urban, legal and are already having a positive impact on development outcomes.

5. Improving digital solutions in low-data-access regions

Working in Nigeria and Kenya, countries with relatively low rates of access to data and the Internet, Youth for Technology (YFT) is not only committed to providing AI training to high school and college students in these countries, but is also strongly focused on ensuring that training in turn contributes to the development of local language learning models.

These examples demonstrate the significant role of artificial intelligence in creating social impact. They stress the importance of using AI in a thoughtful and responsible way, showing its potential as a powerful tool to address some of the most pressing global

challenges. By ensuring careful use, AI can be a valuable ally in addressing complex social issues.

To facilitate the wider application of this technology, it is essential to educate the ecosystem of social innovators, establish support mechanisms and implement guiding principles to ensure responsible implementation of AI while avoiding the replication of historical prejudices.

A new initiative, jointly launched by Global Alliance for Social Entrepreneurship and Microsoft of the Schwab Foundation, is dedicated to preparing industry and individual social entrepreneurs for this effort. This initiative invites other technology leaders, companies, academics, impact investors, intermediaries and foundations to join forces to make a tangible difference in the lives of individuals and communities through the ethical and responsible use of technology.

3.2 Intersection of Artificial Intelligence and CSR

Below, we explore several examples that illustrate how AI can significantly improve sustainability efforts within companies. In today's corporate landscape, AI has become ubiquitous, with every large company employing multiple AI systems as key components of their strategies. These systems play a key role, whether in logistics planning, financial modeling or improving customer satisfaction through language models. Recent advances in AI efficiency and capacity have further powered its adoption in sustainability operations, enabling organizations to address the challenges of climate change more effectively.

AI has the potential to accelerate the transition to zero net emissions, offering global benefits in various areas of sustainability such as energy consumption, CO2 removal,

education, solar engineering and finance. In addition, AI can facilitate the monitoring of deforestation, the development of new low-carbon materials and the implementation of environmentally friendly transport solutions. Overall, AI is ready to deepen our understanding of climate change, optimize existing systems and accelerate the decarbonization process, strengthening resilience against climate risks.

With the increasing prevalence of reporting mandates for climate data in Europe and the United States, companies are facing increasing pressures to collect, analyze and report on a wider range of sustainability metrics, with greater emphasis on data accuracy. However, the acquisition of data on waste, water and energy emissions can be difficult because of its complexity and fragmentation, which leads to inadequate analyses, inconsistent reports and, at worst, greenwashing declarations. Artificial intelligence has the potential to revolutionize the ESG (environmental, social, and governance) efforts by leveraging its capabilities to analyze vast datasets and generate useful information. AI has become an integral part of automated software solutions that consolidate information and provide emission monitoring capabilities, helping in data validation, in real-time data fusion and alignment with current standards and frameworks.

In addition, AI-based language models are used to help write and analyze corporate sustainability reports, using the latest research and industry standards as benchmarks. For example, emerging online programs like ChatReport allow users to upload and analyze reports in minutes, simplifying the process. AI and machine learning programs emerged as key tools to analyze ESG reports and communications, extracting valuable business data to inform decision-making.

Artificial intelligence is a significant promise in revolutionizing the reporting of greenhouse gases and carbon emissions. Traditionally, carbon footprint calculation has

been a laborious and time-consuming process, often requiring extensive manual effort and data cleanup. Mapping business activities into appropriate inputs and identifying the corresponding emission factors is a daunting task for workers to manually input data, particularly when it comes to supply chain activities. Artificial intelligence presents a solution by speeding up computing time, detecting data anomalies and abnormal values in greenhouse gas emissions, solving inconsistencies and providing intelligent recommendations on emission factors. Companies that use automated solutions for measuring and monitoring emissions are more likely to measure emissions accurately and reduce them effectively, aligning with their emission reduction targets according to the machine learning model recommendations.

In the realm of decarbonization, AI offers valuable contributions. It can reduce energy consumption in buildings, predict weather patterns to help in planning extreme weather events and improve the efficiency of renewable energy systems. For example, AI can predict optimal times and locations to generate maximum energy from renewable sources such as wind turbines and solar panels, thus improving overall efficiency.

Predictive analytics stands out as one of the most transformative applications of AI. AI algorithms, powered by vast datasets, can predict future power consumption patterns. This allows companies to optimize energy use through peak load analysis or demand response programs, resulting in cost savings and, above all, a reduction in the carbon footprint. AI also revolutionizes the approach to estimating future carbon emissions and monitoring organizational goals. By analyzing historical data and using predictive modeling, AI helps companies identify trends and models in their carbon emissions, enabling them to develop emission reduction strategies. Predictive analytics can also improve equipment maintenance efforts. Malfunctioning or poorly managed equipment

is a significant source of energy waste. AI algorithms monitor equipment performance in real time, detecting anomalies or inefficiencies and enabling proactive maintenance actions to avoid energy waste and improve overall efficiency.

Here are some examples:

- Intelligent HVAC systems: Heating, ventilation and air conditioning (HVAC) systems are the main energy consumers in buildings. AI-based HVAC systems are regulated based on employment, external weather conditions and historical data, ensuring optimal temperatures and minimizing energy consumption.
- Smart Grid Management: Power grids are now smarter than ever. These systems can predict peak energy demand, optimize distribution and reduce grid deformation. They also facilitate the integration of renewable energy sources, ensuring efficient storage and use.
- Data-driven decision-making: In addition to automation, AI provides detailed information and analysis of energy consumption patterns. Infrastructure managers and decision makers can use this data to implement strategic changes, further improving energy efficiency.

AI systems can also identify opportunities to invest in risk mitigation projects and technologies. By leveraging geospatial data and advanced machine learning recommendations, investors can identify the impact on climate geographically and assess the riskiest areas of business. Instead, they can identify regions with favorable climatic conditions to conduct commercial operations. AI can also help select specific sites based on renewable energy availability or where the energy grid has a lower carbon intensity.

As climate-related natural disasters become more frequent, improved early warning systems and AI-enhanced disaster management tools have the potential to significantly

decrease catastrophic death rates. For instance, Google's AI-enabled flood forecasting platform can provide advance warnings to people in over 60 countries about impending floods up to seven days in advance.

However, there are some inconveniences associated with artificial intelligence, particularly with regard to the processing and storage of data required for artificial intelligence algorithms. These operations consume significant amounts of energy. The International Energy Agency warns that by 2030, electricity consumption from cooling data centers alone could account for 15-30% of a country's total energy consumption. In addition, the cooling process for a typical data center requires about 400,000 liters of fresh water per day, exacerbating concerns about freshwater scarcity. While we strive to harness the vast potential of AI to drive business and social progress through efficiency gains, it is imperative that we also address the power and performance demands of technology, including its energy consumption needs.

3.3 Ethical and sustainability dimensions: Is AI considered as an accelerator or a detractor of sustainability?

The developments and potential of artificial intelligence have been the subject of debate among technology enthusiasts, who see technology as an opportunity to create prosperity and reduce inequalities, and technophobes, who fear the negative effects of technology.

Max Tegmark, a tech enthusiast, argues that artificial intelligence can contribute to economic growth and global prosperity through automation, without leaving people out of work or purpose. *Yuval Harari*, on the contrary, points out the risk that intelligent machines can manipulate our emotions better than ourselves, rather than worrying about killer robots.

Grady Booch invites us to consider how artificial intelligence can improve human life instead of focusing on existential threats. *Kevin Kelly* predicts a second industrial revolution driven by artificial intelligence, while *Sam Harris* warns about the ethical consequences of creating superhuman machines.

Despite of all these differ opinion among scientists, the relationship between artificial intelligence and sustainability is a key issue, requiring a technological impact assessment and a sustainable development-oriented approach. This topic raises important questions that form the basis of this chapter on computational sustainability and the responsible use of artificial intelligence.

Below are the different dimensions of sustainability, which will be analyzed one by one to see how artificial intelligence supports and discourages them:

- **Economic dimension**. It covers financial aspects and commercial value, including capital growth, liquidity, investment and financial transactions.
- **Technical dimension**. It covers the ability to maintain and evolve artificial systems, such as software, over time. It referred to the conservation and development, adaptability and the smoothness of system shifts.
- **Environmental dimension**. It covers the use and stewardship of natural resources. It includes surveys ranging from waste generation and energy use to the balance of local ecosystems and climate change issues.
- **Individual dimension**. It covers individual freedom and agency (the ability to act in an environment), human dignity and fulfillment. It includes individuals' ability to thrive, exercise their rights and develop freely.

- **Social dimension**. It covers relationships between individuals and groups. It covers the structures of mutual trust and communication in a social system and the balance between conflicting interests.

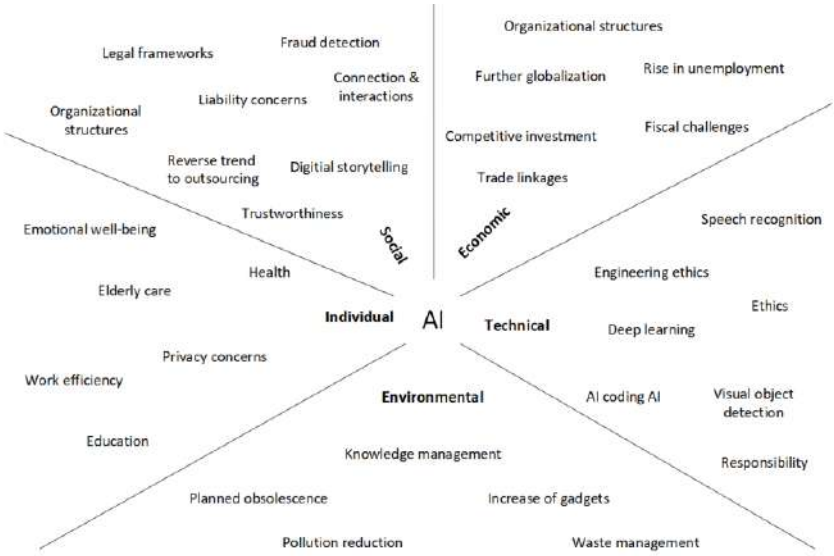


Figure 1. Sustainability analysis diagram of the artificial intelligence (AI) field according to the five dimensions of sustainability.

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Economic dimension

Gartner predicts that by 2022, 40% of public and private employees in direct customer contact will use AI-based virtual agents on a daily basis to assist decision-making or process. In addition, governments in countries with advanced economies and large technology companies are investing heavily in artificial intelligence to gain a competitive advantage.

[31] file:///C:/Users/lucre/Downloads/technologies-06-00100.pdf

For example, the UK government recently announced a £1 billion investment to position the country at the forefront of artificial intelligence development. Similarly, France has planned to invest 1.5 billion euros in artificial intelligence research.

These investments not only give advanced economies a competitive advantage at national level, but also have significant impacts on the globalization of production and services. Currently, many companies in advanced economies outsource services such as call centers and manufacturing to emerging countries to reduce costs. However, with the widespread implementation of artificial intelligence, companies could reduce or completely stop outsourcing, leading to a reduction in product prices and business expenses.

However, critics warn that automating internal production services through artificial intelligence could lead to displacement and pressure on low-skilled workers' wages. Moreover, it could threaten the employment prospects of medium-skilled workers, leaving only the most creative or supervisory roles. To adapt to these changes, workers will have to participate in training programs to acquire new skills and reduce the risk of unemployment. The increase in early retirement could also make it difficult for many governments to maintain the solvency of national pension systems.

Technical dimension

Deep learning models represent a class of machines that can learn a hierarchy of functionality, building high-level concepts from low-level ones. An example of this is convolutional neural networks (CNN), which have revolutionized areas such as machine learning and machine vision. Object recognition, for example, has many applications, from assists for people with visual disabilities, system security and the military field. However, the problem of incorrect classification of objects remains, raising the question

of checking and verifying the correctness of such classification. Each developer is invited to decide for how long a system should be trained before it is considered reliable or fit for purpose.

More recently, deep learning helps to automatically teach sophisticated behaviors, which can be further improved by using recurring neural networks. All of these developments will lead to advances in artificial intelligence that can encode itself.

The impact of these developments is difficult to predict, but it is certain that they will accelerate the research and development in the field of artificial intelligence. On the one hand, we can expect systems to be more capable of dealing with complex tasks, on the other hand, it is essential to strengthen engineering ethics, as more and more responsibilities are delegated to the developers who design systems; these must include a wide range of both desired and unwanted usage scenarios. This growing responsibility requires special attention and a review of existing ethical codes, such as the ACM Code of Ethics, to ensure a balance between individual responsibility and social impact.

Environmental dimension

Artificial intelligence can be useful in helping us take better care of the planet in terms of supporting waste and/or pollution management, but predictive systems can also be used for earthquakes and weather conditions to better recognize the likelihood of occurrence extreme events such as hurricanes and tsunamis occur. Artificial intelligence can also be used for better pollution management.

Furthermore, we can imagine knowledge management systems integrated with deep learning technology that could help analyze animal images captured by motion sensor cameras in the wild. The analysis of these information could provide accurate, detailed and up-to-date evidence on the location, count and behavior of animals in the wild, which

could be useful for improving local population, biodiversity and local conservation efforts.

Additionally, the widespread adoption of autonomous vehicles has the potential to significantly reduce greenhouse gas emissions. Autonomous vehicles offer several avenues for decreasing fuel consumption and, consequently, greenhouse gas emissions. Here are some ways in which this could be achieved: Autonomous vehicles can employ eco-driving principles throughout their journeys, resulting in up to a 20% reduction in fuel consumption and a corresponding decrease in greenhouse gas emissions. By suggesting alternative routes and the most efficient paths through urban areas, autonomous vehicles can reduce traffic congestion. Sharing real-time traffic information with other vehicles on highways further enhances efficiency, leading to lower fuel consumption. Autonomous vehicles can adhere strictly to imposed speed limits, promoting smoother driving patterns that minimize the need for energy-intensive acceleration. This adherence ensures minimal fuel usage. Autonomous vehicles can maintain shorter distances between cars, which reduces aerodynamic drag and, consequently, fuel consumption. Additionally, this practice helps mitigate greenhouse gas emissions.

By implementing these strategies, autonomous vehicles have the potential to play a pivotal role in reducing greenhouse gas emissions and advancing sustainable transportation solutions.

In addition to the positive impact, artificial intelligence can also have a negative impact on the environmental dimension, especially due to the contribution it provides to the further acceleration and consumption of technological devices. The increase in the

production and consumption of technological devices will have two negative effects, namely planned obsolescence and the depletion of natural resources.

The acceleration of technology is closely linked to planned obsolescence, which means designing products that they wear out "prematurely" (they have a useful life well below customer expectations); planned obsolescence was already deemed unethical in 1960. There are obsolescence of physical mechanisms, namely design with limited functional life, design for limited repairs and design aesthetics, which lead to reduced satisfaction, there is technological obsolescence which leads to the generation of electronic waste, i.e. design for fashion and design for functional improvement by adding or updating product features.

Sources indicate that in North America, over 100 million cell phones and 300 million personal computers are discarded every year due to the acceleration of technology. Initiatives that can change this paradigm are public policies, environmental ethics and corporate responsibility. The World Business Council on Sustainable Development includes the following as its main action point: "*Encourage consumers to prefer eco-efficient and more sustainable products and services*." However, Guiltinan identifies two barriers: consumer expectations of frequent upgrades for durable goods and consumers' lack of concern about environmental consequences when contemplating durable goods upgrades.

Planned obsolescence in general is a problem that depletes the natural environment of resources such as rare earths, while increasing the amount of waste that must be managed. However, the rise of artificial intelligence could potentially amplify these negative impacts, for example by further automating mining in more complex and dangerous environments for human operators. Increasing the rate of natural resource depletion will

have environmental degradation (i.e. the deterioration of the environment through the depletion of resources) and devastating consequences on both human health.

Individual dimension

The individual dimension of sustainability is closely linked to the balance between work, well-being and social interactions. In recent decades, despite advances in productivity, people have experienced an increase in working hours, with negative consequences on physical and mental health. Excess work can cause stress, anxiety, depression, and sleep disorders, affecting the overall well-being of individuals. However, artificial intelligence offers opportunities to improve this situation. Advanced algorithms can be used to automate repetitive tasks, allowing people to work fewer hours without compromising work efficiency. Digital assistants, chatbots and analytical tools can support workers in their daily tasks, reducing workload and improving physical and mental well-being.

The widespread adoption of artificial intelligence also raises important ethical and social issues. "Robonomics", the robot-based economy, could lead to mental health problems linked to unemployment and social isolation. Human interaction could increasingly be replaced by machine interactions, reducing the value of human connections and increasing the risk of social isolation and functional decline. Moreover, the increase in data collection and analysis in the age of artificial intelligence raises concerns about privacy and informed consent. Companies may collect personal data without the explicit consent of individuals, raising questions about the transparency and ethics of data collection.

Ultimately, artificial intelligence provides opportunities to improve individual well-being and reduce workload, but it also requires careful consideration of ethical and social implications to ensure a sustainable balance between technology and human well-being.

Social dimension

The social dimension of artificial intelligence presents unique challenges and opportunities for communities and society as a whole. While AI can help strengthen communities through support for development networks, administration and facilitation of collaboration, there are also concerns about the potential for concentration of power in the hands of AI.

Artificial intelligence algorithms can take on supporting roles in various daily tasks, such as nursing and teaching. However, there are mixed opinions on the ability of AI to effectively perform such activities, as they require a social and cultural understanding that algorithms may not fully possess. There are also ethical issues to consider, such as data privacy and boundaries of responsibility between teachers and robots.

Another aspect concerns the legal liability of AI, which is considerate a debated topic, pone questions about who is responsible for damage caused by artificial intelligence systems. It is essential to develop clear regulations to avoid abuse and to ensure that AI is used in a responsible and ethical manner.

In addition, on the work front, AI could lead to significant changes, such as reducing outsourcing and automating routine tasks. For example, outsourced call centers could be replaced by artificial intelligence systems, redefining how companies interact with their customers. These changes will require in-depth reflection on the social and economic implications of widespread adoption of AI in the workplace.

In conclusion it has been analyzed the multiple effects that artificial intelligence can have to amplify development in diverging directions: towards greater or lesser globalization, equality, justice and peace. Many of our current sustainability efforts through IT focus on reducing unsustainability rather than creating sustainability, highlighting the need for a

radical change in our future vision towards a transformative perspective for a shared sustainable future.

Furthermore, it has been analyzed how the society and people can mitigate the negative impacts of AI identified when it spreads across multiple sectors, which, in turn, could affect the UN's sustainable development goals. AI-enabled applications depend on how humans train them, and conflicts over educational values can arise due to the involvement of different stakeholders. These conflicts can have negative consequences for society rather than bring benefits. Therefore, to ensure that the company can benefit from artificial intelligence, it is essential to align the values of all stakeholders during the design process of AI-enabled applications, so that goals and behaviors reflect human values. With such alignment, artificial intelligence systems could pose a lesser threat to humanity, remaining strictly tools aimed at solving the tasks assigned to them.

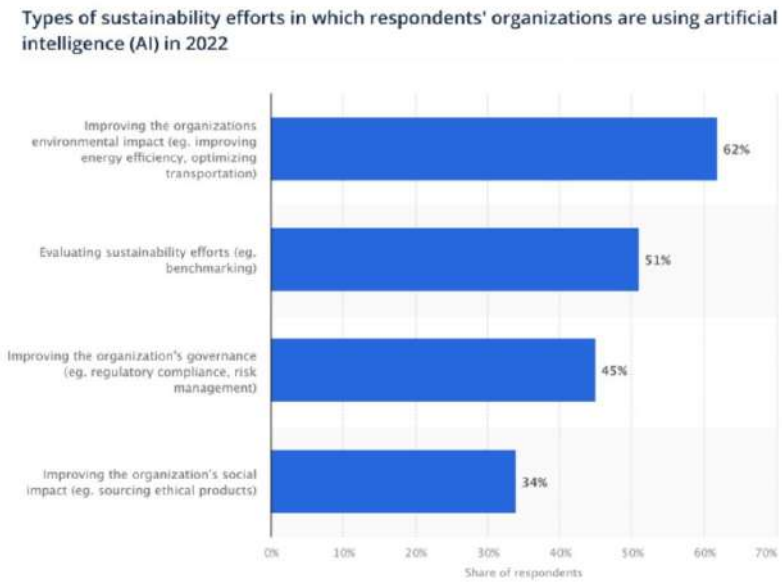
However, there is still a lack of a framework for characterizing and organizing value systems that could help align the values of each actor involved. On the other hand, we live in a world of limited resources, including time, energy, money and great transitions. In this context, nations and organizations compete to design AI-enabled systems to gain power and influence over others. To ensure that society can benefit from artificial intelligence, it is essential that all technology designers, application developers, researchers and users (companies and consumers) cooperate and share responsibilities instead of influencing others. There are several ways in which stakeholders could share limited resources and large transitions to meaningful actions.

Moreover, as a first step, all members of the European Union signed a Declaration of Cooperation on AI to propose a European approach based on three pillars: leadership in

technological progress, preparing for socio-economic change and ensuring an appropriate ethical and legal framework.

In summary, the adoption of shared values, collaboration, sharing responsibility and ethics are critical measures that should be taken by all stakeholders to mitigate the negative impacts of artificial intelligence on sustainability. With such measures, there is a possibility that, despite the advancement of technology, the machines remain such and we remain human.

What can AI do for sustainability and for ESG in particular? Which are the factors where AI has to make leverage in order to exploit all the potentialities for the benefit of the environment and society and in order to reduce and to manage the possible risks? To answer these questions, we need to start from the awareness that Artificial Intelligence and sustainability are two phenomena that have quickly approached each other and become closely interconnected. Artificial intelligence is a powerful tool of knowledge and knowledge is the key to achieving all sustainability goals.



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In the context of the ESG assessment, AI can play a significant role in evaluating business performance through various sustainability criteria. This includes: environmental impact analysis of operations, assessment of social responsibility initiatives and assessment of corporate governance practices. In addition, AI can help identify and manage the risks associated with business activities, such as compliance with environmental regulations, employee relations, and ethical management practices.

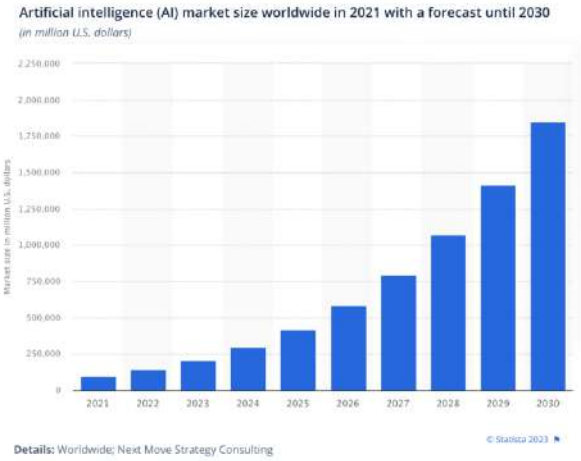
The development and adoption of AI for sustainability and ESG are influenced by several factors. First, the growing adoption of these new tools and applications by companies contributes to the advancement of knowledge and skills in both the aspect.

As more organizations integrate AI into their operations, there is a growing pool of data and expertise available to leverage it in sustainability initiatives. Moreover, the context in which these needs arise plays a crucial role in shaping the development of AI for sustainability. Companies in sectors with a high environmental and social impact are more likely to invest in these new solutions to address sustainability challenges. In

[32] https://www.esg360.it/esg-smart-data/intelligenza-artificiale-e-esg-quali-benefici/

addition, Regulatory Frameworks and Market Demands on Transparency and Accountability guide the adoption of AI for ESG reporting and Risk Management.

In summary, the artificial intelligence has the potential to significantly improve sustainability efforts and ESG performance by providing valuable insights, identifying risks and facilitating informed decision-making. Ongoing collaboration between AI and sustainability stakeholders will be essential to unlocking the full potential of them for the benefit of the environment and society.



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Artificial intelligence can be a factor of acceleration in the improvement of the ESG performance of enterprises thanks to the automation of the decision-making processes based on the data related to the monitoring of ESG factors. For companies that have integrated or are integrating sustainability into their business model, AI allows them to monitor, analyse and manage environmental issues more accurately, social issues and needs relating to corporate governance, relying on the ability to have an important predictive capacity. In such a context, Artificial Intelligence can primarily contribute to the intelligent management of many different sources, data collection and ESG data

[33] https://www.esg360.it/esg-smart-data/intelligenza-artificiale-e-esg-quali-benefici/

analysis. The data on which these analyses are based can come from data inside the company, from the company ERP, from sustainability reports and also from the communication made on websites or from social media shares. Artificial Intelligence can help companies organize a more complete view of these sources, map them and manage them to derive the data needed to determine their ESG impact.

By managing this data and its transformation into knowledge, Artificial Intelligence is in a position to provide tools that can also allow to develop new services or new products or can direct the evolution of existing products to make them more sustainable. Artificial Intelligence can result in better sustainability performance not only with the development of new products and services and with the reduction of any possible waste, but also with the identification and activation of new business models. The ability to analyze the predisposition of the own reference market, or of possible new customers, in terms of propensity to an evolution in the use of products in the form of services can allow the development of projects in the form of servitization with which to plan the achievement of their sustainability objectives.

AI can also be used to analyze all sources that provide signals related to risk factors, it allows to automate risk management evaluation activities, allows you to focus your attention specifically on ESG risks and allows you to improve the accuracy and speed of all these analyses that are not feasible with traditional methods. Specifically, with regard to risk management, AI allows to automate the collection and analysis of risk data; can develop machine learning models that can help increase predictive capacity towards risk and predictive accuracy. With these models it is then possible to support the companies in the identification of the emerging risks putting in relationship more factors and more signs.

If the advantages of using artificial intelligence in risk forecasting and management are increasingly clear, it is appropriate, in terms of ESG and Innovation Governance, focus attention on the risks arising from the use of Artificial Intelligence itself. One of the most important levels of attention is data privacy, as we said before. Artificial Intelligence platforms require huge amounts of data, they are necessarily accompanied by the danger that data can be hacked. The issue of privacy is closely linked to Data Governance and security, the tools and organization that a company is able to put in place to protect its data assets. A risk that can expose the company to hacking dangers and possible cybercrimes.

Another risk that is perhaps more debated is the issue of jobs: there are many considerations according to which AI can be used to automate tasks that are currently carried out by people; they could be replaced by machines with the consequent loss of jobs. In order to turn Artificial Intelligence into a benefit, it must include the introduction of people with dedicated skills. In general, it can be observed that these new models certainly involve an evolution in the skills and competences of the people who interact with them.

Then there is the risk of a possible "loss of control", a risk that is 100% related to the logic of governance and that could happen when the evolution of AI was not followed and governed by adequate skills to the point of not being properly controllable. An example, in this case, could be AI algorithms used for self-driving cars where the impossibility to properly control them could cause accidents.

Economists have long discussed how to address the risk that the evolution towards an economy with less human involvement, accelerated by Artificial Intelligence, can lead to

an impoverishment of the population. This scenario may require a redistribution of wealth, considering that economic production will be increasingly driven by machines.

Alongside economic issues, ethical questions also arise about the evolution of AI and new technologies. One wonders whether the power of algorithms and big data will lead to a superiority of machines over the human intellect. Fears, fueled by prominent personalities such as Stephen Hawking and Elon Musk, may seem exaggerated, but ignoring the impacts of AI could entail significant risks.

Stephen Hawking warned of the dangers of AI, pointing out that while AI could lead to solutions to global problems, such as poverty and disease, it could also threaten the economy and society by destroying millions of jobs. He stressed the risk of powerful automatic weapons and the possibility of oppression and control of the masses.

Elon Musk also expressed similar concerns, calling AI the greatest risk to civilization. He highlighted the risks of a computer-led war and the possible employment catastrophe resulting from decisions based solely on AI, which could replace thousands, if not millions, of human labor.

Artificial Intelligence can be classified into different states or levels of development, each with its specific impacts. Here is an overview of the main states of AI and its related impacts:

1) Weak artificial intelligence

Weak artificial intelligence refers to systems designed to solve specific problems using techniques such as machine learning, based on datasets relevant to the application context. AI algorithms, especially those belonging to machine learning, constitute mathematical-computer systems capable of simulating predictive scenarios independently, assisting

people in their decisions. Based on various learning methods, it is possible to create correlations between input and output data. Data scientists can use additional subsets of machine learning, such as deep learning, which is based on deep neural networks composed of three or more layers. Weak artificial intelligence offers concrete solutions to specific problems known a priori, making processing more efficient than humans or relieving it of repetitive or low value-added operations, allowing it to focus on more strategically relevant business functions.

Weak artificial intelligence is critical in disciplines such as business intelligence and business analytics, used for descriptive and prescriptive/predictive analytics respectively. Applications such as forecasting market demand and financial developments are examples of weak AI widely used in the business environment. Some example applications of weak AI include:

- Behavioral analysis of customers, to improve their knowledge and give rise to more effective marketing campaigns, based on personalized content.
- Automatic fraud detection, through computer vision and machine learning systems, capable of detecting abnormal situations compared to routine.
- Smart video surveillance applications, capable of identifying suspicious individuals and abnormal behavior, to ensure public safety.
- Recognition of identity theft, through behavioral analysis and correlation of events, such as access from devices never used, at unusual times, to unusual applications, etc.
- Spam filters, thanks to machine learning systems that allow you to more accurately recognize malicious content.

- Medical diagnostics, thanks to the ability to identify possible pathologies that the human eye could never find on the basis of radiological support.
- Financial risk analysis and assessment to determine whether or not loans and financing should be granted.
- Autonomous driving systems, supporting various tools, from navigation to recognition of obstacles along the way.
- Analysis and forecasting of the most convenient routes in logistics.
- Optimisation of energy consumption based on predictive analysis
- Predictive maintenance, based on the ability to identify only the interventions strictly necessary to ensure the proper functioning of systems and systems.

2) Generative artificial intelligence

Generative AI represents an advanced evolution of weak AI, capable of understanding, learning and applying knowledge in different contexts, similar to human capacity. It uses complex neural networks to create new and original content, such as: text, images, and music. Some examples of generative AI include language models such as: GPT-4 chat, images generated by GAN (Generative Adversarial Networks), and music composed by AI. This form learns from vast data sets and requires enormous amounts of computing power and financial resources for its training. The high costs arise not only from the necessary infrastructure, but also from the energy consumed during the training processes.

The strong AI, still in the theoretical and research phase, refers to systems capable of simulating human behavior completely independently. These systems can understand and solve problems in any context without a predefined link between the problem and the

solution. It is not limited to emulating human thought in specific situations, but aims to develop a kind of autonomous consciousness that is effective in any situation.

Deepmind, for example, has developed applications based on a generalist approach, oriented towards solving specific problems. AlphaFold is an AI system that solved the problem of protein folding, namely the accurate simulation of the three-dimensional structures of proteins from DNA. This discovery could have a significant impact in the fields of molecular biology, medicine and pharmacological research.

OpenAI, on the other hand, is the developer of Generative Pre-trained Transformer (GPT) technologies, including ChatGPT and DALL-E. These AI-based language models are capable of processing text and images in a way that is not distinguishable from human work, from simple text inputs defined prompt.

The impact of strong AI on sectors consists in:

- Media and Entertainment: the creation of automatic content and user experience customization.
- Medicine: the generation of new drugs and creation of improved medical images.
- Education: the production of personalized teaching materials and virtual tutors.
- Creative Industry: the production of art, fashion design and music.
- Socio-economic Impact: the advanced automation could replace some creative jobs, but could also create new opportunities and markets. Regulation and governance will become crucial to balancing benefits with risks.

The challenges of this new technology include aspect such as: the need to ensure generative AI works ethically and respecting privacy and avoiding data bias; the protection against malicious use of generative AI, such as creating deepfake or generating

malicious content; the balancing innovation with the environmental impact of high energy consumption.

While weak AI is already showing its impacts in various industries through the creation of innovative content, strong AI represents a future goal that could revolutionize our understanding and interaction with smart machines.

3.4 Look at the future

One of the primary concerns driving skepticism about investing in artificial intelligence is the fear that it may just be another passing trend. However, this skepticism is unfounded, as AI is already exerting a significant influence on investment, and the funding for the generative system has exceeded previous levels observed in other trend cycles. Artificial intelligence and machine learning have been an integral part of quantitative investment strategies for several years. Many trading algorithms rely on this innovative new software to make decisions are based on large amounts of high-speed data or to capitalize on potential arbitrage opportunities. In addition, these technologies can optimize asset allocation, build portfolios to improve performance against traditional methods, and facilitate pre- and post-trade processes by analyzing market and credit risks. As companies become more familiar with AI technology, integration between AI and investment strategies is expected to deepen further.

"*What sets Generative AI apart from many previous technological advances is its potentially drastic impact on economies."*

In the first quarter of 2023, companies involved in generative AI secured $2.3 billion in funding from venture capital companies, surpassing the quarterly fundraising peak of $2.1

billion in 2021. In particular, large companies are also showing considerable interest in this field. In the fourth quarter of 2022, only 10 of the 500 S&P companies referenced "generative artificial intelligence." This increase in interest can be attributed, in part, to Microsoft's $10 billion investment in OpenAI. Subsequently, in the second quarter of 2023, this number witnessed a substantial increase, with Mark Zuckerberg, who renamed his company Meta in 2021, stating that "Meta's biggest investment is in advancing AI."

However, the adoption of AI also presents challenges. For example, the increasing opacity of algorithms can make it difficult for humans to monitor, evaluate, and understand how AI models will react to input data, abnormal events or complex tasks. In addition, AI relies heavily on large amounts of data, particularly during the learning phase. The quality and accessibility of this data can lead to inaccuracies in calibration and data bias. As a result, AI can face increasing obstacles, posing a potential risk of market over-reliance on automated decision-making.

Beyond the recurrent question of whether artificial intelligence will take over humanity, investors are increasingly intrigued by the possible strategies they can use to position their portfolios and capitalize themselves on the growing advances of AI. By analyzing the multiple components of the generative AI technology stack, which includes applications, hardware, cloud platforms, model bases and model hubs, companies are exploring investment opportunities to leverage the benefits of itself.

The first among the preferred investment groups are:

1) Large companies with a solid infrastructure capable of effortlessly integrating artificial intelligence into existing platforms.

2) Companies engaged in the production of AI components by simultaneously developing or licensing models of the same generation.
3) Non-tech sector entities showing a growing inclination towards expanding AI adoption.

It is no surprise that major technology companies, equipped with resilient infrastructures, will benefit from the emergence of new technologies. By incorporating AI models into pre-existing productivity tools, these companies can give workers greater efficiency and the ability to leverage multiple data sources within a unified application. Additionally, generative AI holds promise in facilitating tool accessibility among employees less experienced in using software.

In addition to improving productivity through the technology, companies have the ability to quickly integrate generative AI into various industries such as: search engines, DevOps and cybersecurity. Furthermore, there is a global demand for generative AI models, but not all companies have the infrastructure or resources necessary for internal development. For a small business looking to increase productivity, it may be appropriate to subscribe to an externally created AI model. In our opinion, manufacturers of graphic processing units (GPUs) and other AI components could also be particularly favoured. Finally, given that around 66% of jobs are exposed to AI automation, any company that can adopt generative AI to improve efficiency can benefit from this technology. There seem to be compelling reasons to use generative AI in almost all areas, and although there are very few jobs where generative AI can automate more than half of the work, its widespread adoption may allow a double-digit increase in productivity in many areas.

While they are still in the early stages of discovery and adoption, the potential benefits of generative AI are hard to ignore. However, the narrowness of the recent rally could be evidence that markets have not yet fully implemented AI. Not yet clear how exactly the adoption of generative AI will affect business fundamentals. It may be too early to see whether generative AI societies are overrated and it is not clear whether traditional valuation methods should be applied in this area either. However, optimism around generative AI is palpable, with some technology valuations reaching lofty levels. As managers continue to study the sector, markets could dictate new valuation dynamics, potentially with the help of AI. Generative AI can dramatically change both the economic landscape and the investment landscape. As with many new technologies, there are certainly risks, but the benefits of adopting generative AI far outweigh the costs. As humanity struggles to use these tools, the possibilities for innovation can be truly endless.

The widespread adoption of AI technology presents three main risks: 1) privacy and copyright concerns, 2) ethical dilemmas, and 3) job displacement. AI platforms rely on large-scale language models, which require large amounts of data to train. As a result, the risk of cyber-attacks or data breaches poses significant risks. Another widespread problem associated with generative AI is the threat of copyright infringement. While still emerging, examples of AI-generated music that resembles works by famous artists have already emerged in the music industry. According to ethical considerations these can emerge regarding plagiarism and misinformation. Since generative AI models learn from existing datasets, there is a huge risk of content being plagiarized. It is up to users to use generated content responsibly. Furthermore, the accuracy of the information produced by generative AI tools has been called into question, further complicating ethical considerations.

Despite the significant risks posed by misinformation, the most pressing problem of the adventure of artificial intelligent concern the job displacement. About two-thirds of jobs in the United States are exposed to some degree of automation with AI, particularly in administrative and legal fields, while sectors such as construction and maintenance appear to have less impact. Estimates suggest that around 7% of jobs could be displaced in the following decade. However, historical trends indicate that job displacement caused by automation is often offset by the emergence of new types of jobs, such as the effective control of them in the industry.

Amazingly, in 1940, 60% of current jobs were nonexistent, and over the past eighty years, technological advances have fueled 85% of job growth through the creation of new roles. Likewise, with artificial intelligence, there is the potential for new positions to emerge in fields such as, for example, data science and artificial intelligence engineering.

The artificial intelligence industry is ready for significant growth. With the further maturation of technology and increased investment by government and industry, the widespread application of cloud-based AI will accelerate, leading to a period of rapid expansion in the global technologies sector in the next decade. As international competition in these new field will be intensify, the transformative impact of artificial intelligence on our lives cannot be overestimated. Exploiting the benefits of AI while mitigating its potential disadvantages is crucial.

To ensure sustainable development, artificial intelligence must coexist harmoniously with humanity, society and the environment. First, we must prioritize the development of human-centered artificial intelligence, addressing the urgent challenges and needs in people's lives. This involves leveraging AI to improve various aspects of society, including education, healthcare, sports, housing, transportation, disability care, elderly

care and home services. By focusing on improving the quality of life, we can maximize the positive impact of AI on society. Furthermore, regardless of AI advances, it is essential to maintain human control over AI systems to prevent harm. This involves robust research and mitigation of potential risks associated with the development of artificial intelligence, safeguarding both individual rights and national security interests. Establishing and improving laws, regulations, systems and ethical guidelines is critical to ensuring the responsible and ethical deployment of AI. By prioritizing safety, reliability and controllability, we can foster greater public acceptance and trust in this new type of technologies.

In summary, the future of artificial intelligence is very promising, but it is essential to approach its development responsibly. By embracing a human-centered approach and prioritizing ethical considerations, we can understand and apply for the full potential of artificial intelligence while safeguarding the well-being of individuals and society as a whole.

Chapter 4 – Microsoft Case Study

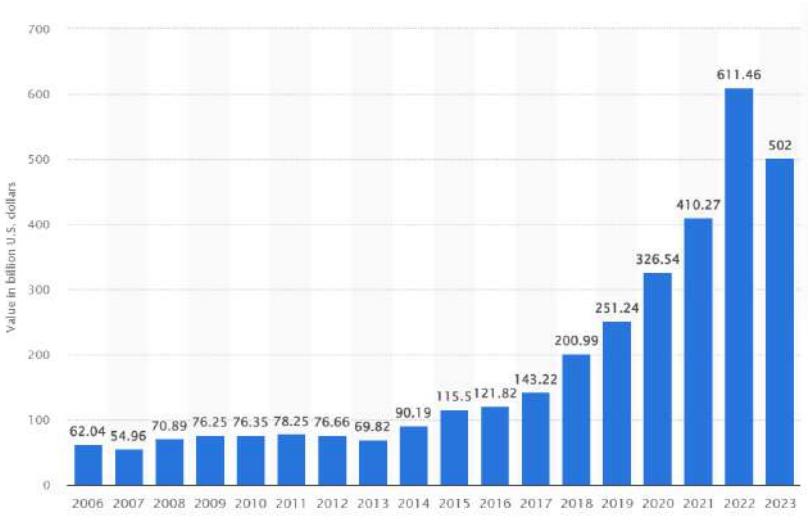
4.1 Company Overview: background of Microsoft. The mission, vision and brand value.

Microsoft Corporation is a multinational technology giant headquartered in the United States of America, it is known for producing software for computers, personal computers and consumer devices, as well as offering related services. Microsoft also publishes books and multimedia titles, operates a line of hybrid tablets, provides email services, markets gaming systems and computer peripherals.

Microsoft's most famous products include the Windows family of operating systems, the Internet Explorer browser, the Microsoft Office productivity suite, and the Edge web browser. Top hardware products include the Xbox video game consoles and the Surface line of touch screen PCs.

Additionally, the company has partnered with around 17 US intelligence agencies to develop cloud-based computing products. The Microsoft Azure Service Platform, launched on October 27, 2008, represented the company's entry into the cloud computing market. In 2016, Microsoft announced the Microsoft Windows Azure Information Protection project, aimed at assisting businesses in protecting their data as it moves between servers and devices.

In contrast to the past, Microsoft has focused more on understanding the specific needs of each industry and supporting customers to work more closely on their needs and new features that can be implemented.



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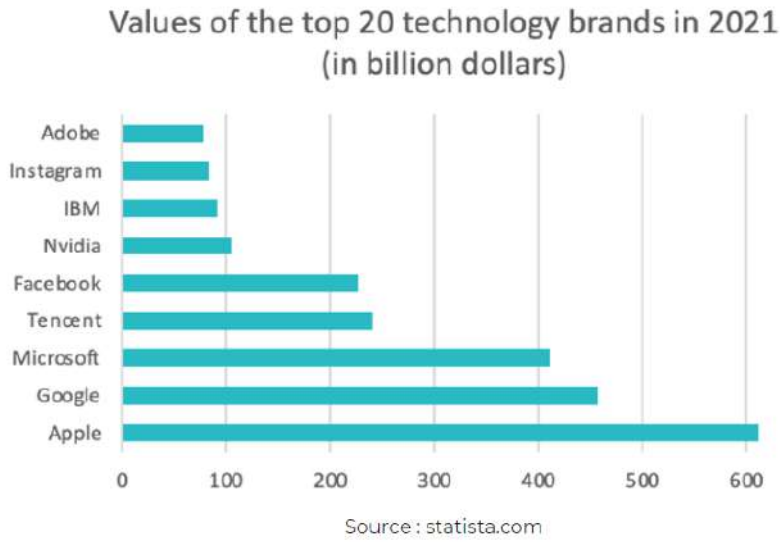
[34] https://www.statista.com/statistics/326058/microsoft-brand-value/

Microsoft was founded on April 4, 1975 in the United States by Bill Gates and Paul Allen. Initially, the company's main focus was the development and sale of computer programs. However, he soon became one of IBM's subcontractors (international business machines). In December 1978, Microsoft reached a major milestone by surpassing one million sales. By the mid of 1980s, Microsoft broke away from IBM and became dominant in the personal computer operating system market with the introduction of MS-DOS.

During the period 1993-2001, with some strategic marketing moves, Windows, originally conceived as a simple graphical environment for MS-DOS, transformed into a complete operating system. This led to Windows quickly becoming Microsoft's major success and the company's leading product, generating considerable profits. This strategy also proved fruitful with the launch of Xbox in 2001, the acquisition of Skype in 2011 and the acquisition of LinkedIn in 2016.

Microsoft Corporation is an American multinational technology corporation engaged in the development, manufacturing, licensing and sale of computer software, consumer electronics, personal computers and services. During the twentieth century, the IT sector experienced a veritable explosion of opportunities thanks to the democratization of the Internet and IT tools. Even though numerous new companies emerge in this industry every year, some have maintained their dominance in the market for a long time, and Microsoft is one of these.

As time passes, the number of customers in this market continues to grow. To stay competitive and stand out, companies must constantly innovate and deliver better performance. This is an extremely dynamic sector, constantly evolving, and market players must be ready to adapt to these changes.



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Microsoft's success can be attributed to its focus on innovation and its ability to anticipate and respond to changes in the technology landscape. The company has a long history of developing groundbreaking technologies, from the introduction of the Windows operating system in the 1980s to the launch of the Xbox gaming console in the early 2000s.

Today, Microsoft is one of the largest technology companies in the world, with a market capitalization of over $2 trillion. The company employs over 180,000 people and is consistently ranked among the most admired and valuable brands in the world.

The business model of Microsoft Corporation is composed by different software development, licensing, devices and cloud computing. Microsoft develops and licenses a wide range of software products, including the Windows operating system, Office Suite, other productivity and business software applications. The company offers cloud-based services through its Azure platform, providing businesses and individuals with access to computing resources, storage and other services. Microsoft designs and produces a

[35] https://www.statista.com/statistics/267966/brand-values-of-the-most-valuable-technology-brands-in-the-world/

variety of hardware devices, including the Surface tablet, Xbox gaming console, and HoloLens mixed reality headset. Its search engine offers search advertising services, allowing businesses to place ads alongside search results. Microsoft also acquired LinkedIn in 2016 and offers various services through the social networking site, including recruitment tools, advertising, and learning and development resources.

On the whole, Microsoft's business model focuses on developing and licensing software, offering cloud-based services, designing and producing hardware devices, providing search advertising and leveraging the LinkedIn platform. The company generates revenue from the sale of these products and services, as well as from advertising and subscription-based models.

Microsoft’s mission consist into enable every person and organization on the planet to achieve more. The company drives digital transformation to create space for an intelligent cloud and an intelligent edge. Microsoft aims to develop local opportunities, growth and impact around the world and supporting the productivity of small businesses such as: startups, the competitiveness of large companies and the efficiency of the public sector, for example, in the context of advanced educational and health outcomes.

Microsoft’s goal is to promote innovation that "generates new ecosystems of inventors, partners, developers, creators, change agents, public officials, frontline workers and knowledge workers who, together, drive the engines of growth and opportunity in ways that benefit everyone". The company pursues its goals by providing platforms and tools that increase the ability of institutions around the world to technology. Their areas of solutions include applications and infrastructure, data and AI, developer tools, power platforms, business applications such as LinkedIn, modern working conditions, cybercrime protection and games.

To address the world's most pressing issues, Microsoft is committed to taking on additional responsibilities, focusing on four interconnected pillars that define their purpose.

1) Support inclusive economic growth

Within this pillar, the specific focus is on reaching all kinds of individuals with the economic growth promoted by Microsoft. In particular, it aims to improve broadband access in rural areas to facilitate access to education, health and economic opportunities, as well as access to digital skills by linking resources from Microsoft, LinkedIn and GitHub. In addition, emphasis is placed on support to bridge the disability gap through a newly developed commitment to creating appropriate technologies and making their technologies available, especially to NGOs, through discounts and donations.

2) Protect fundamental rights

Within this pillar, Microsoft is engaged in special efforts to address racial injustice and inequity with their Racial Equity Initiative, involving various stakeholders to adequately represent their ecosystem. In addition, the company works to protect democratic institutions and processes through the Democracy Forward Program, which aims to safeguard elections, journalism and defend against misinformation. Finally, Microsoft is committed to reducing modern slavery and human trafficking within its operations and supply chain, and to supporting humanitarian actions and emergency interventions by providing various resources.

3) Commit to a sustainable future

Addressing the immense challenge of climate change, Microsoft published its first sustainability report in 2021, presenting progress towards carbon negativity, zero waste

and water positivity by 2030. In addition, the company is creating a Planetary Computer to support the management and safeguarding of the world's natural systems. Special attention is also paid to the need for new technologies and partnerships to solve the global carbon problem. As a result, the Microsoft Cloud for Sustainability was launched and the billion-dollar Climate Innovation Fund was established to accelerate the creation of innovative solutions.

4) Earn trust

To achieve its goal of making customers and partners stand alone, Microsoft values vary important the concept of "trust", building on privacy, security, digital security, responsible use of AI and transparency. To protect individuals' rights over their personal data, Microsoft supports the General Data Protection Regulation (GDPR) and promotes the adoption of comprehensive federal privacy legislation in the United States. In addition, the development and responsible use of AI are crucial elements for the company, which adopts an approach based on principles of equity, reliability, safety, inclusiveness and responsibility. Through the Office for Responsible AI and the CSR Reports Hub, Microsoft provides detailed information and data access to maintain user confidence.

Microsoft's core values revolve around respect, integrity and accountability, with a corporate culture centered on fostering a growth mindset. This mindset has proven particularly effective during the recent pandemic, improving customer understanding and teamwork, supporting the principles of diversity and inclusion. These principles remain central to employee engagement and are seamlessly integrated into business performance and career development frameworks.

Managers at Microsoft prioritize caring for their teams, aiming to empower and hold them accountable for success. The company's ambitions focus on reinventing productivity and

business processes, developing the intelligent cloud and edge platform and advancing personal computing; these goals drive Microsoft's ongoing efforts to innovate and shape the future of technology.

4.2 How Artificial Intelligence driven CSR Projects: AI applications in Microsoft's CSR projects.

Microsoft's business strategy is based on trust in the potential of artificial intelligence, predicting that AI will be ubiquitous on devices, apps and infrastructure to provide information and act on behalf of the user. However, Microsoft's leadership says:

"*Although we believe that artificial intelligence will help solve big social problems, we must look to the future with a critical eye. There will be challenges, but also opportunities. We need to address the need for strong ethical principles, the evolution of laws, the formation of new skills and also labor market reforms*[36]*."*

Microsoft is committed to developing artificial intelligence systems that enable people around the world to more effectively address local and global challenges and help promote economic progress and opportunities. One way the company strives to achieve this is through the recent launch of TechSpark, a national civic program designed to foster greater economic opportunities and job creation through partnerships with smaller rural and metropolitan communities.

Below are described four concrete examples of how Microsoft is addressing its challenges.

Titletown Tech: Microsoft and the Green Bay Packers have partnered to create Titletown Tech, a comprehensive economic development initiative that encompasses a technology

[36] https://digitalcommons.tacoma.uw.edu/cgi/viewcontent.cgi?article=1011&context=miccsr_case

startup accelerator, a venture capital fund and a digital consultancy lab for more established companies. Titletown Tech exemplifies how Microsoft collaborates with communities to leverage its technological expertise, significantly impacting communities and populations historically excluded from the opportunities created by technology.

Artificial Intelligence: Microsoft is committed to developing AI systems that empower people worldwide to address local and global challenges more effectively, promoting progress and economic opportunity. The TechSpark initiatives are part of an ecosystem that emphasizes Microsoft's capacity to unlock the potential of AI, transforming industries, businesses and communities. Utilizing the explosion of digital data and computing power with advanced algorithms, Microsoft aims to enable collaborative and natural interactions between people and machines, extending human abilities to perceive, learn and understand, which is crucial for using technology to make a significant economic impact on communities.

FarmBeats: This is an example of how Microsoft integrates advanced technologies and AI into rural communities to help address global food issues. By overcoming rural challenges related to broadband and energy access, this research advances precision farming practices. Using sensors and AI, FarmBeats delivers water, fertilizers and pesticides only to the crops that need them, creating a more efficient and productive agricultural system.

Airband: The Microsoft Airband initiative aims to empower billions of people worldwide who lack affordable internet access, with projects aimed at closing the digital divide in 17 countries over the past five years. The Rural Airband Initiative is specifically

committed to bringing broadband connectivity to 2 million people in rural areas of the United States.

Microsoft's AI systems offer effective solutions for the challenges they are designed to address, incorporating capabilities that support informed human oversight and control. These AI products are personalized to align with the design concepts of practitioners and reflect their values and principles.

According to the company's corporate website, Microsoft's AI governance is founded on responsible dimensions, including accountability, transparency, reliability and safety, privacy and security, and fairness and inclusiveness. Microsoft assures its customers that it regularly evaluates the operational factors of its AI systems to ensure they perform reliably and safely. These systems undergo continuous monitoring and evaluation to manage and maintain existing systems, enhance them over time, resolve issues and identify new applications. Microsoft methodically quantifies risks to minimize the time needed to address predictable or known failures and to prevent errors that could cause harm to individuals.

Moreover, the technology giant affirms its commitment to protecting user privacy. Microsoft emphasizes that its secure features enhance data reliability and safeguard personal information from being shared inappropriately. Specific AI security aspects mentioned include data origin and lineage, internal and external data usage, data corruption considerations, anomaly detections and monitoring changes in data that could indicate attempts at unauthorized data acquisition.

Microsoft's Framework for Responsible AI highlights the company's dedication to fair treatment of diverse populations. This involves mitigating stereotypes, cultural

denigration, under-representation and bias. The company reports that its AI products are designed to provide equitable service quality across various demographic segments, including marginalized groups, to reduce disparities. Microsoft's AI systems are inclusive, aiming to empower people globally and ensure no one is excluded. The company involves members of minority communities in the research, development and testing of AI designs and solutions.

Microsoft is responsible to customers and partners for the impact of its AI systems, enabling informed decision-making. The company asserts its transparency with stakeholders, clearly communicating the strengths and limitations of its AI systems. This transparency, often referred to as interpretability or intelligent capability, ensures that content generated or manipulated by AI, including visual, verbal or vocal communications, is understood and reliable.

Microsoft believes that technology, particularly artificial intelligence, can be transformative in saving lives, alleviating suffering and restoring human dignity. Microsoft has announced AI for Humanitarian Action, a new five-year program worth $40 million. This initiative leverages the power of AI to focus on four key priorities: addressing the needs of children, aiding disaster recovery, protecting refugees and displaced people, and promoting respect for human rights. The AI for Humanitarian Action program is part of Microsoft’s AI for Good suite, a broader $115 million, five-year commitment to using AI to tackle some of society’s biggest challenges. Modeled after the AI for Earth and AI for Accessibility initiatives, Microsoft collaborates closely with selected non-governmental organizations and humanitarian groups through financial grants, technology investments and partnerships. These collaborations blend AI and data science expertise with the core capabilities of these organizations.

Microsoft is optimistic that AI for Humanitarian Action will accelerate the pace of innovation by strategically managing AI projects that demonstrate new applications, deliver reusable solutions and partner with others to expand initial projects. The goal is to expedite and broadly deploy new AI solutions in the following four areas:

- Disaster response: No place on the planet is immune to the devastating consequences of natural disasters. Artificial intelligence and data modeling hold enormous promise for forecasting and detecting early signs of impending disasters, helping responders to better target their aid. AI technologies, like machine vision, can quickly analyze images of roads damaged by an event, enabling faster and safer response efforts.
- Needs of children: Microsoft believes that AI can equip NGOs and organizations with better tools to protect children. For example, human trafficking is one of the world's largest criminal industries. By using predictive analytics and bot frameworks to target both the supply and demand underpinning human trafficking, AI can ultimately disrupt criminals and bring relief to victims worldwide.
- Refugees and displaced people: The number of refugees and displaced people in the world is at a record high, presenting a seminal challenge. AI can help optimize the delivery of aid, services, and supplies to refugees, and scale the efforts of NGOs to communicate with and understand the needs of displaced people. Microsoft is currently working with organizations such as the Norwegian Refugee Council, NetHope, and University College Dublin to develop a chatbot using AI technologies like speech recognition, language understanding, and machine

translation to assist displaced youth by connecting them with free, high-quality educational resources.

- Human rights: Microsoft collaborates with NGOs and humanitarian organizations to accelerate breakthrough solutions for monitoring, detecting and preventing human rights abuses. Deep learning has enhanced the ability to better predict, analyze and respond to crucial human rights situations. Utilizing AI-powered speech translation, people can connect with pro bono lawyers who are protecting human rights.

Microsoft is currently focused on leveraging AI technologies, such as cloud and edge computing, to uncover new economic and social opportunities. The company encourages organizations to explore how AI's capabilities can address global challenges. One of Microsoft's key initiatives, "Humans and AI," aims to share the stories of individuals across various sectors who use AI to tackle issues in their lives, communities, or the world at large. The narratives highlighted on Microsoft's "Humans and AI" webpage for 2020 exemplify this mission. Additionally, Microsoft has developed the "AI for Good" initiative, which comprises six programs:

1. AI for Earth; 2. AI for Health; 3. AI for Humanitarian Action; 4. AI for Cultural Heritage; 5. Data for Society; 6. AI for Good.

Through these programs, Microsoft aims to provide both intellectual expertise and financial resources to organizations dedicated to solving global challenges with AI. The "AI for Good" initiative underscores Microsoft's commitment to harnessing the power of artificial intelligence for the betterment of society.

AI for Earth is a program focused on supporting organizations and individuals addressing environmental challenges related to climate, agriculture, biodiversity and water. It aids initiatives that track and model changes in biodiversity and the effects of climate change using advanced computing techniques. Microsoft awards grants to help organizations reach new heights in their sustainability efforts.

The AI for Earth initiative encompasses numerous projects and provides technical resources such as tools, models, infrastructure, data and open-source codes for various applications like: classifying birds in acoustic recordings, detecting beluga whale calls and accelerating camera trap survey workflows. Additionally, Microsoft facilitates internal research by collaborating with partners and exchanging ideas at the Microsoft Research lab to further the use of AI for environmental sustainability.

A notable collaboration within this initiative is with the Radiant Earth Foundation, a non-profit organization dedicated to advancing Earth observation technologies through machine learning algorithms. Together, Microsoft AI for Earth and Radiant Earth Foundation are tackling environmental problems. One significant innovation resulting from this partnership is the Planetary Computer, which monitors the Earth’s environment and gathers data through intuitive application programming interface. This data is then cataloged, making it easier for users and conservation stakeholders to access and utilize the information effectively.

In a podcast, Microsoft's Head of Healthcare Innovation, Jim Weinstein, discusses the significant impact Microsoft has had on communities lacking access to medical care or medication. The company has been dedicated to addressing their needs by providing health resources and remote medical attention. One of Microsoft's innovative products, "EmpowerMD," helps doctors store patient information using natural language

processing without the need for manual entry. Additionally, chatbots have proven to be invaluable assistants when patients contact healthcare practitioners.

In 2020, Microsoft published its first annual Environmental Sustainability Report titled "A Year of Action." The company pledged to become carbon negative across its supply chain by 2030, develop technologies to monitor and protect ecosystems, restore water resources and reduce consumption in its operations and address waste issues by adopting a circular economy approach.

In its latest Sustainability Report, Microsoft highlighted continuous progress toward becoming carbon-neutral by 2030. The company has achieved numerous ESG/CSR targets using AI in 2021. These results include the optimization of offshore wind turbines with AI, aiming for carbon neutrality with Azure Digital Twins (an iot-based solution), improving service efficiency through remote assistance, meet the demand and supply of carbon sequestration with artificial intelligence and machine learning. In addition, Microsoft has developed AI-based methods to predict the electrical load, predict carbon reduction and other climate-related outcomes and classify defects in solar panels early on. According to Presas (2001, 205), "*Sustainable development is the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs*". [37] Microsoft is committed to becoming a leader in sustainable development, recognizing the imperative of meeting current needs while safeguarding future generations. To this end, it integrates the principles of sustainable development into its daily operations to achieve long-term goals. Microsoft prioritizes three key issues in its development agenda, in line with the triple framework, which assesses business

[37] 744-1454-1-SM.pdf

performance based on its impact on people, planet and profit. However, the company faces challenges in implementing sustainable practices and evaluating their effectiveness. Over time, significant progress has been made in sustainable development systems, notably through initiatives like the Global Reporting Initiatives. These frameworks provide guidelines and key performance indicators across economic, society and environmental dimensions. Microsoft's Environmental manager emphasizes the company's commitment to sustainable development, focusing on pillars of innovation, information technology and energy efficiency. Microsoft actively participates in Earth Day activities, highlighting the urgency of addressing climate change issues.

Acknowledging that IT products contribute to approximately 3 percent of carbon emissions and environmental challenges, Microsoft is dedicated to innovation to reduce its carbon footprint and energy consumption. By prioritizing sustainability, Microsoft aims to mitigate its environmental impact and contribute to a greener future.

"*For instance, Microsoft's use of Unified Communications virtual meeting and telework software is already reducing employee travel by approximately 1 million air miles a year and cutting back carbon footprint by 17,000 metric tons annually*" (Pearce et al, 1989).

Microsoft aspires to achieve efficient and sustainable development by adopting strategies focused on environmental sustainability. This involves creating new and innovative technologies that can be adopted globally. Additionally, the company employs performance indicators, such as ISO 14000, to ensure effective and efficient green business practices within its operations.

Since late 2013, Microsoft has implemented a system requiring its suppliers and distribution chains to provide data on their compliance with the company's environmental guidelines. These guidelines serve as a benchmark that all stakeholders must adhere to.

In the coming months, Microsoft plans to launch a sensitization program aimed at informing key stakeholders about its policies on sustainable development. This program seeks to promote transparency and encourage active participation in its sustainability initiatives.

Despite numerous obstacles in achieving their current and future objectives, Microsoft aims to adopt some of the best sustainable practices in the industry. Its policies encompass both qualitative and quantitative approaches, creating a comprehensive and robust framework. Microsoft acknowledges that achieving fully sustainable development practices will take time. To address this, the company has scheduled performance indicators to introduce these practices on a timeline basis, considering potential challenges from different stakeholders. This phased approach allows Microsoft to systematically overcome obstacles and progressively move towards its sustainability goals.

Microsoft also aims to adopt proactive sustainable approaches that will be applied not only in its production plants but also throughout its supply chains. To achieve this, it has developed policies and internal control systems (ICS) to ensure that its suppliers and distributors, who are spread across the globe, adhere to these standards. This global reach presents various social and environmental challenges along the supply and distribution lines. Microsoft is committed to operating in a sustainable business environment, but it acknowledges that it has not yet fully realized this goal. Despite having policies and guidelines to promote green practices, achieving sustainable development remains a complex and challenging task. However, Microsoft recognizes that the long-term benefits of these efforts make the pursuit worthwhile.

Sustainable development requires companies, including Microsoft, to make significant changes to their traditional practices. This transformation demands substantial time, capital, and human resources, factors that many companies often overlook. Additionally, these changes can lead to significant shifts in operating systems and potentially a decline in profit margins, which management and shareholders may resist. As a result, companies like Microsoft lack a robust and immediate structure for the rapid adoption of sustainable development, making it a long-term goal rather than an immediate achievement.

Despite these challenges, Microsoft consistently invests substantial resources in the welfare of society, focusing on supporting the poor, the needy and the marginalized. Environmental protection and sustainability are integral to Microsoft's operations. As the company's revenue has grown in recent years, so has its commitment to social welfare and community empowerment. Leveraging its technological prowess, Microsoft aims to empower people and protect the planet, with a mission to help everyone achieve more.

While generating financial returns is essential for businesses, they must also meet societal expectations. This dual focus benefits both society and the business itself. By helping communities and protecting the environment, businesses can cultivate a socially responsible image, which can be advantageous in the long term. Microsoft's social responsibility and sustainability efforts have produced remarkable results. Some key highlights of these efforts include: investing in community welfare projects to support the underprivileged; prioritizing environmental protection through sustainable practices; using technology to empower individuals and communities and committing to transparency and accountability in meeting societal expectations.

Microsoft believes that technology can bridge the opportunity divide and secure a prosperous future for young generations and for the global economy. This belief drives

their commitment to empowering youth by increasing access to technology and equipping them with essential tools and skills. Through various initiatives, programs and partnerships, the company inspires young people to envision and create a better future for themselves and their communities. To succeed in today's economy and build the economy of the future, young people need direct access to technology and relevant skills. By connecting youth with the necessary resources, Microsoft aims to enable them to make a significant impact and contribute to a brighter future for all.

In some cases, Microsoft has implemented environmental sustainability as a core business strategy, which benefits the company in several ways. For example, by reducing costs and increasing production efficiency, Microsoft can enhance its reputation while conserving resources and minimizing waste. Additionally, the company has invested significantly in Corporate Social Responsibility under its social sustainability strategy, which is vital for making informed decisions centered on social impacts. Microsoft's social sustainability efforts focus on four key areas: healthcare, safety, charity and employment equity. The company has made significant progress in these areas, achieving notable success in its CSR initiatives. For instance, by using advanced manufacturing facilities and recycled materials, Microsoft has not only reduced production costs but also increased its profitability. This holistic approach to sustainability demonstrates how integrating environmental and social responsibility into business operations can lead to both economic benefits and a positive social impact.

4.3 The social impact and effectiveness of Microsoft's CSR

Microsoft Corporation's company profile aligns with the Global Reporting Initiative (GRI) standard requirements. Microsoft has published a sustainability report that uses the

GRI Standards as a framework for reporting its sustainability performance. The GRI Standards are a widely recognized set of guidelines for sustainability reporting that are used by companies to disclose their sustainability impacts, policies, and practices.

Microsoft's sustainability report covers a wide range of sustainability topics, including climate change, water stewardship, responsible sourcing, and human rights. The report provides detailed information on Microsoft's sustainability goals, targets, and initiatives, as well as its progress towards achieving these goals. The report also includes a GRI index, which shows how Microsoft's sustainability report aligns with the GRI Standards.

Microsoft defines sustainability as follows: "*Meeting the needs of the present without compromising the ability of future generations to meet their own needs*."

Microsoft Corporation approaches sustainability with layers of increasing impact with their operations in consideration. Following the United Nations Brundtland Commission's definition of sustainability stated above, Microsoft gears towards committing to become carbon negative, water positive, a zero-waste company and protect ecosystems.

The company believes that sustainability involves a commitment to environmental, social and economic well-being, both within the company and in the communities where they operate. For them, sustainability is crucial in ensuring that the planet remains suitable for living for the current and next generation. In order to do this, Microsoft acknowledges that technology can make contributions in measuring the impact of well-intentioned efforts through their sustainability guide that is based on global data standards.

After analyzing Microsoft's sustainability and annual report, several commonalities can be identified between their sustainability goals and the definitions of sustainability of different scholars.

According to the AA1000 definition, "*Sustainability is the capability of an organization or society to continue its activities indefinitely, considering their impact on natural, social, and human capital*". Microsoft is committed to reducing carbon emissions, increasing the use of renewable energy, conserving water and minimizing waste to preserve ecosystems and biodiversity. Their goals align with the AA1000 definition of sustainability.

Furthermore, Microsoft aims to take care of the environment to ensure a better future for generations to come, which is aligned with the World Commission on Environment and Development's definition: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (World Commission on Environment and Development, 1987).

With 25 million monthly active users, Microsoft is committed to sustaining its customers by putting cybersecurity in place to protect customer data and use Artificial Intelligence to assist organizations in writing assistance, data analysis and code generation. Additionally, Microsoft modernizes and develops new apps, including GitHub Copilot, a first-of-its-kind AI pair programmer, and Microsoft Teams, the most used platform to connect people worldwide.

Beyond innovation and creation of new technologies, Microsoft aims to support and protect fundamental human rights, democracy, and eliminate racial injustice by safeguarding electoral processes through its AccountGuard nation-state threat notification service, protecting over 4 million accounts of election officials, organizations, journalists and others. The company's global response to the war in Ukraine has also been extended through a €257 million in financial and technology assistance.

On the whole, Microsoft's sustainability goals align with the definition of the Green Paper, "*It as a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis*"(1° definition, 2001), as it takes into consideration the needs of society and stakeholders. More importantly, the company's initiative is admirable as it states that, "*It remains at the company's choice, rather than reflecting rules put in place by governmental authority or other types of institutions*".

Microsoft has made a significant commitment to sustainability in its mission. The company's mission statement is to " *empower every person and every organization on the planet to achieve more*", and it recognizes that sustainability is a critical component of achieving that goal.

To address sustainability in its mission, Microsoft has set a number of ambitious goals for reducing its environmental impact and increasing its positive social impact. Microsoft has committed to being carbon negative by 2030, meaning that it will remove more carbon from the atmosphere than it emits. In addition, the company aims to remove all the carbon it has ever emitted by 2050. The company has set a goal to power its data centers with 100% renewable energy by 2025 and has committed to reducing its waste footprint and increasing its use of recycled materials. Microsoft is working to create sustainable products that are designed to last longer, use less energy and have a lower environmental impact. The company is committed to using its technology to address social and environmental challenges, such as improving access to education and healthcare, and promoting human rights and social justice.

In addition to these specific goals, Microsoft has also integrated sustainability into its business practices and culture. The company has a Chief Environmental Officer who

oversees its sustainability efforts and reports directly to the CEO. It has also established an internal carbon fee, which charges each business unit for its carbon emissions at $15 per metric ton and uses the funds to invest in sustainability projects. Microsoft's commitment to sustainability is a core part of its mission to empower people and organizations around the world, and the company is taking concrete steps to make that vision a reality.

According to Sustainable Development Goals (SDGs) these are a set of 17 interconnected goals defined by the United Nations as a strategy for achieving a better and more sustainable future for all. Their aim is to address a broad range of economic and social development issues, including poverty, hunger, the right to health and education, access to water and energy, work, inclusive and sustainable economic growth, climate change and environmental protection, urbanization, production and consumption patterns, social and gender equality, justice and peace.

Microsoft shares the belief digital transformation of the worldwide economy and innovative constructions of digital cooperation bear the potential to support tackling the challenges described by the UN Sustainable Development Goals. The organization believes in its shared responsibility as an organization as well as its societal role aligned with their mission and executes a wide range of initiatives directly and indirectly linked to all of the 17 SDGs. While acknowledging technology as their essential asset, Microsoft is highlighting innovators must pair technology-enabled with standards promoting all kind of individuals. Numerous programs, partnerships and supports have been implemented regarding especially the four target SDGs, but also all remaining ones, stated in detail within the Microsoft United Nations Sustainability Development Goals reports from 2020 and 2021.

Below, are listed the SDGs that are particularly significant for Microsoft Corporation:

1. No Poverty: Microsoft is working to generate economic opportunities for people around the world through initiatives like the AI for Good Lab. The Lab supports sustainability in many ways, from mapping the world's solar and wind installations and measuring their capacity using AI, to bolstering climate resilience in the Global South by opening locations in Egypt and Kenya. Data scientists are working to better analyze climate change using satellite imagery, and helping conservationists monitor wildlife species.
2. Zero Hunger: The Company is using technology to improve agricultural productivity and create more sustainable food systems.
3. Good Health and Well-Being: AI and other technologies are also used to improve healthcare outcomes and expand access to healthcare.
4. Quality Education: Technology and training are provided by Microsoft to help students and educators achieve more and prepare for the future.
5. Gender Equality: Microsoft is working to create a more inclusive workplace and promote gender equality in the tech industry.
6. Clean Water and Sanitation: At the same time, technology is utilized to monitor and manage water resources more efficiently and sustainably.
7. Affordable and Clean Energy: The Organization is committed to using 100% renewable energy and investing in innovative solutions for clean energy.
8. Work and Economic Growth: New job and working opportunities are being created, in order to promote economic growth in communities around the world.
9. Industry, Innovation and Infrastructure: The Corporation is also investing in new technologies and infrastructure to help businesses and communities thrive.

10. Reduced Inequalities: Develop a more inclusive and equitable society through initiatives like the AI for Accessibility program, a Microsoft program committed to empowering people living with disabilities, is one of the company objectives.
11. Sustainable Cities and Communities: Microsoft is making important use of technology to help build more sustainable and resilient cities.
12. Responsible Consumption and Production: The Company is committed to reducing waste and promoting responsible consumption and production practices.
13. Climate Action: The Organization is also committed to achieving carbon neutrality and has set a target to be carbon negative by 2030.
14. Life Below Water: Technology is significantly applied to monitor and protect marine environments and promote sustainable fishing practices.
15. Life On Land: Microsoft is working to protect and restore forests and other ecosystems, and promote sustainable land use practices.
16. Peace, Justice and Strong Institutions: Technology is also used to promote transparency, accountability and good governance.
17. Partnerships for the Goals: The Company is working with governments, NGOs and other partners to achieve the SDGs and create a more sustainable future for all.

These SDGs are relevant for Microsoft Corporation and reflect the company's commitment to sustainability and responsible business practices. The company's sustainability targets are designed to address these goals and to create positive impacts for society and the environment, while also supporting its broader business objectives. At the same time, the company's sustainability strategy extends beyond these specific goals and covers a wide range of issues related to social and environmental sustainability.

Microsoft is deeply committed to corporate social responsibility and making a meaningful impact in key areas such as sustainability, addressing racial injustice, inequity and investing in digital skills. In terms of sustainability, Microsoft focuses on reducing carbon emissions, conserving water, minimizing waste and preserving ecosystems. By significantly reducing the harmful effects of its operations and maximizing the positive impact of its technology, Microsoft aims to scale its efforts and benefit communities while influencing product strategy. Instead of focusing solely on internal operations, Microsoft leverages its position to extend its impact by ensuring that its measures also advance communities and align with product strategy. Through the adoption of technology by customers and partners, along with active support through financial resources, legal engagement and innovation, Microsoft promotes global impact.

Microsoft emphasizes that its most valuable asset in driving these efforts is its employees. In addition to targeted actions to reduce the footprint in areas such as carbon, water, waste and land, the company also pursues broader approaches to create impact, such as the Climate Innovation Fund (CIF) and AI for Earth. With a commitment of $1 billion US over four years, the CIF will finance climate technologies, including the development of new or niche technologies, to address climate change challenges.

The AI for Earth initiative was established with the goal of giving scientists and organizations around the world access to cloud and AI technology to help protect the planet. This initiative facilitates research and development efforts by promoting collaboration between individuals, providing training on cloud and AI technologies to improve community engagement and offering grants to promote access to these new systems. Progress of the four commitments is regularly reported in publicly available documents such as the *2020 and 2021 Environmental Sustainability Reports*, which

provide detailed and metric information on carbon negativity, water positivity, zero waste and ecosystem conservation. In addition, information about Microsoft's impact is summarized in the *Microsoft Impact Summary 2021* and the *Microsoft Corporate Social Responsibility Report 2020.*

In its efforts to combat racial injustice and inequity, Microsoft is committed to reaching out to and empowering all communities. The company has devised a series of actions to improve experiences within Microsoft and foster positive change in the communities in which it operates. These efforts focus on three main pillars: 1. increasing representation and promoting an inclusive culture, 2. engaging with ecosystems and 3. strengthening communities over several years. Given its extensive business network, Microsoft places particular emphasis on promoting diversity within its communities. Therefore, it actively engages in various aspects such as banking, supply chain operations and its wider ecosystem of partners, particularly in the United States.

Microsoft continues to increase access to financial resources in order to help Black and African American businesses, as well as the communities in which they operate, broadening the possibilities for suppliers to achieve long-term sustainable growth and with the intention of achieving further inclusive growth for partners providing access to capital, finance and training.

In addition, Microsoft has partnered with stakeholders and engaged in initiatives within local districts and collectives to initiate and scale various campaigns and projects. A different attempt to address racial injustice and inequity has been undertaken in increasing the volume of transactions with Black and African American owned financial institutions, and the increase in deposits with the latter allowing higher funds for local communities.

In addition to its broader initiatives, Microsoft is committed to promoting diversity and inclusion within its workforce. The company actively promotes a variety of employee resource groups, which are highly engaged communities for women, families, racial and ethnic minorities, military, individuals with disabilities and members of the LGBTQI+ community. These groups provide support and socialization opportunities. Microsoft also prioritizes pay equity and transparency, as evidenced by its Racial Equity Initiative, which includes detailed metrics and pay equity indices for employees with disabilities. This information is made available in reports such as the *Global Diversity and Inclusion Report,* and the *Progress Report on the Racial Equity Initiative*, which broadly cover topics such as banking, supply chain operations and partnerships in the United States.

In terms of investing in digital skills, Microsoft launched its global skills initiative in June 2020. This initiative aims to provide enhanced digital skills training to individuals who have been disproportionately affected by job losses, particularly in light of the significant economic impact of the pandemic. Leveraging resources from LinkedIn, GitHub, and Microsoft Learn, the initiative offers tools to identify employment opportunities and the skills required for them through data-driven insights. It also provides free learning tracks and content for acquiring necessary skills, as well as affordable certification options. Furthermore, Microsoft announced its commitment to supporting nonprofit organizations with $20 million in cash grants; with $5 million allocated to nonprofits-community led by people of color in the United States.

Aligned with its core areas of focus, Microsoft is deeply committed to responsible sourcing and the prevention of modern slavery and human trafficking. The Microsoft Devices business group, responsible for the conception, design, development, manufacturing, packaging and distribution of Microsoft hardware and related software

products, established a responsible sourcing program in 2005. This program aims to ensure that suppliers adhere to the standards outlined in the Microsoft Supplier Code of Conduct and the Social and Environmental Accountability Specification.

Microsoft does not directly source natural resources, but works with suppliers to produce goods and components. This approach recognizes the risks in the supply chain, including social, environmental and economic factors, as well as the location, function and regulatory environment of suppliers and their ability to address those risks. Given the complexity of its global supply chain, Microsoft's responsible procurement strategy is based on values of integrity, accountability and respect. The company's responsible procurement approach is therefore based on integrity values that relate to the integration of adaptation processes and work with suppliers to address risks and maintain standards; fairness and dignity is promoted through the responsibility of reference to the definition of clear rules and ensuring high standards of safety and a favorable environment.

In 2018, Microsoft established a Central Human Rights Group to focus on responsible sourcing through its global supply chain and simplify human rights initiatives.

Drawing on the *UN Guiding Principles on Business & Human Rights* and the *Global Network Initiative Principles*, Microsoft articulates concrete responsibilities and initiatives in documents such as the *Standards of Business Conduct*, *Microsoft Human Rights Statement, Microsoft Devices Responsible Sourcing Report, and the Microsoft Stakeholder Engagement Report*. Key focus areas include prohibiting child labor and discrimination, ensuring the use of voluntary labor, providing access to work-related documents for workers, offering return transportation for foreign workers, ensuring fair compensation, raising awareness of human trafficking concerns, establishing clear

working conditions and treatment based on respect and dignity, complying with working hour and rest day requirements and upholding freedom of association.

In line with its climate action initiatives, Microsoft is deeply committed to leveraging its knowledge and resources to reduce carbon emissions and promote clean energy technologies. The company aims to use its influence as a global technology leader to promote the integration of climate change measures into national policies, strategies and planning. In addition, Microsoft seeks to improve education and awareness-raising efforts on climate change mitigation, adaptation, impact reduction and early warning systems.

In January 2020 the organization made an announcement to follow a forceful program decreasing carbon emissions by more than 50 percent for direct issuance as well as their whole supply and value chain until 2030 to being carbon negative. As top goal Microsoft is seeking to withdraw all the emitted emissions since its foundation by 2050. In addition, Microsoft has updated its code of conduct for suppliers and expanded its internal program for carbon tax to include emissions of scope 3. This tax keeps each business unit financially responsible for its emissions, including those associated with its value activities and supply chain. The funds generated by this tax are reinvested in sustainability initiatives aimed at promoting further reductions in carbon emissions.

While ensuring that all of their products adhere to strict energy standards, Microsoft is actively working to improve energy-saving features across its hardware product portfolio. In addition to minimizing the use of materials and reporting greenhouse gas emissions, the company commissioned Level 1 suppliers to participate in the Carbon Disclosure Project to monitor and reduce their carbon footprint. Microsoft has also banned the use of ozone-depleting chemicals and is exploring alternatives to hydrofluorocarbons to mitigate emissions and related costs. The implementation of innovative server cooling

techniques, such as immersion cooling, is part of a broader initiative to develop data centers with significantly reduced energy and water consumption. In addition, Microsoft introduced the Sustainability Calculator to assist organizations in assessing the carbon emissions generated by their IT infrastructure.

Furthermore, the Microsoft Sustainability Calculator was created to support organizations assess their carbon emissions caused by their IT-infrastructure. Microsoft itself is decreasing emissions by reducing their need for diesel-fuel backup power at their datacenters by 2030 anchored in their supplier code of conduct. Through major partnerships as the Transform to Net Zero initiative, the firm aims to conduct and provide research, advisory as well as analyzed instructions for organizations of all kind to accomplish net zero emissions.

In addition, Microsoft has invested $50 million in the Energy Impact Partners platform to support the development of innovative technologies that can reshape global energy and transportation systems. Leveraging Microsoft Azure in partnership with organizations like Terrafuse, Microsoft empowers companies to better understand climate risks through physics-enabled AI models. In addition, collaborations with the polar scientist Joseph Cook allow the use of drones and satellite data to improve the understanding of melting glaciers on Earth.

In the 2018 *Fortune 500 rankings*, Microsoft has reached position 30 among the largest companies in the United States, because of the measurement of the total turnover. Additionally, Microsoft claimed the top spot-on *Corporate Responsibility Magazine's 100 Best Corporate Citizens 2018* list for both environmental and social scores, which evaluate corporate performance using over 200 factors.

Microsoft conducts CSR materiality assessments, incorporating input gathered from stakeholder engagement processes, consultations with experts in social responsibility and consideration of the impact of its core business. This approach ensures that decisions made by the company have significant implications for both the business and society. While Microsoft has already undertaken numerous actions towards social improvement, there remains space for further enhancement in the future. Sustainability is a key component of Microsoft's CSR programs, focusing on environmental, social and economic issues to foster holistic development.

As the business landscape evolves, Microsoft Corporation recognizes the evolving importance of environmental management and its role as a major global entity. Understanding its significant influence, Microsoft embraces its duty to lead by example and serve as an inspiration for sustainable practices. Accordingly, management must guide efforts to ensure that the company’s operations are in line with the sustainable development goals.

Microsoft is committed to integrating sustainable development strategies into its systems development processes, proactively supporting initiatives that prioritize environmental responsibility. In addition, Microsoft recognizes the global reach of its business, with operations covering markets, distributors and suppliers around the world. Therefore, it gives priority to ensuring that all stakeholders adhere closely to the principles of sustainable development. By fostering a culture of sustainability and collaboration, Microsoft aims to unify its workforce and stakeholders towards the common goal of creating a better world. This collective effort is crucial in driving significant change and promoting environmental management on a global scale.

In addition, the company should focus on developing software solutions that not only prioritize sustainability, but also help companies address key issues within their operations. These solutions should enable suppliers and distribution chains to collect and analyses relevant data to assess performance and simplify day-to-day operations. Fundamentally, these systems can serve as benchmarks, to drive organizations to promptly take corrective action if their practices do not meet sustainable development standards. Moreover, these systems should provide efficient and cost-effective performance analysis tools, providing practical support to businesses. Sustainable development is crucial to ensuring the success and accountability of organizations, as it mitigates environmental impact and promotes the concept of "green businesses."

Green companies operate according to the principles of balancing environmental, social and economic concerns, stressing the interconnection of these aspects. By adopting sustainable practices and integrating them into their activities, organizations can support their social responsibility and contribute to a greener and sustainable future.

Microsoft, as one of the largest companies globally, has actively pursued a balance between three fundamental concepts: environmental sustainability, social responsibility and economic prosperity. Achieving sustainable development in organizational activities requires harmonization these three dimensions. In addition, government regulations and growing social awareness have pushed organizations to prioritize environmental awareness, an area where Microsoft has consistently demonstrated leadership. Supporting a "green image" not only safeguards market value, but also aligns with the regulatory frameworks that address environmental issues. Moreover, contemporary consumer attitudes give priority to sustainability, with a growing preference for environmentally friendly products. Microsoft recognizes this change and strives to offer sustainable

solutions to meet the evolving consumer needs. Beyond environmental management, the company takes its social responsibilities seriously, actively engaging in philanthropic efforts to support those in need.

In conclusion, the integration of Corporate Social Responsibility into corporate decision-making is crucial. It not only contributes to long-term profitability and improves corporate reputation, but also ensures that future generations and the environment benefit from responsible business practices. Microsoft's ongoing commitment to sustainability and social responsibility testifies to the transformative power of CSR in promoting a fairer and more sustainable future.

Conclusion

This thesis explored how artificial intelligence can help companies become more sustainable and ethical, with a specific focus on Microsoft as case studies. Through the analysis of Microsoft's strategies and implementations, it became clear that AI not only facilitates the monitoring and management of environmental resources, but also offers innovative solutions to reduce the ecological impact of business activities and this makes the companies more ethical from a social point of view, taking into consideration the environment for the well-being of all.

The social context related to the use of artificial intelligence by companies is adapting in a scenario where the expectations of consumers, investors and local communities are changing rapidly. In recent years, there has been a growing awareness of the environmental impact of business activities and the need for more sustainable and ethical business practices. This change is related to increasing information and awareness of

environmental issues, thanks to the media, environmental movements and increasingly sustainability-oriented government policies. Companies are adopting artificial intelligence as a key tool to meet these new social needs.

In addition, Microsoft's approach to sustainability is not limited to internal operations, but also extends to its extensive network of suppliers and partners. Through outreach programs and the demand for compliance with environmental standards, the company is creating a sustainable ecosystem that involves all stakeholders.

Despite the many benefits of using new technologies, adopting AI for sustainability also presents many challenges. Data complexity management, the need for significant investment in technology and training and ethical issues related to the use of AI are issues that companies need to consider carefully. Moreover, it is crucial to maintain a balanced approach that combines technological innovation with responsible and ethical business practices.

In conclusion, artificial intelligence offers extraordinary opportunities for companies that aspire to become more sustainable. By adopting AI solutions, companies can not only improve their environmental performance, but also gain significant competitive advantages, driving sustainable and responsible growth. To maximise these benefits, it is essential that companies continuously invest in technology, research and development, and adopt an integrated approach that considers both economic and environmental aspects. In this way, AI can become a key driver for a more sustainable and prosperous future.

Microsoft is an example of how artificial intelligence can be a powerful ally in the fight for environmental sustainability. Its initiatives show that it is possible to reconcile economic growth and ecological responsibility, by offering a roadmap that other companies can follow to achieve similar goals. Integrating AI into sustainability practices not only helps preserve our planet, but can also lead to significant innovations that transform the way we operate and interact with our environment.

Below I would like to report the message of Pope Francis for the 58th World Communications Day, which this year was celebrated on 12 May 2024, because I was very impressed:

"*Dear brothers and sisters! The evolution of the systems of the so-called "artificial intelligence", on which I have already reflected in the recent Message for the World Day of Peace, is also radically changing information and communication, through them, some foundations of civil coexistence. This is a change that involves everyone, not just professionals. The accelerated diffusion of wonderful inventions, whose functioning and potential are indecipherable for most of us, arouses a wonder that oscillates between enthusiasm and disorientation and inevitably poses us with basic questions: what is man, what is its specificity and what will be the future of our species called homo sapiens in the age of artificial intelligence? How can we remain fully human and direct the ongoing cultural change towards the good?"*

Although the term "artificial intelligence" has now replaced the more accurate term "machine learning", the very use of the word "intelligence" is misleading. Machines certainly have an immensely greater capacity than man to store and correlate data, but it is the exclusive task of man to decipher its meaning. It is therefore not a question of

pretending that the machines appear human, but rather of awakening man from the hypnosis in which he falls because of his delirium of omnipotence, believing himself completely autonomous and self-referential. Artificial intelligence systems can contribute to the process of liberation from ignorance and facilitate the exchange of information between different peoples and generations. However, they can also be tools of "cognitive pollution", altering reality with partially or totally false narratives, which are believed and shared as if they were true.

The challenge we face is to make an effort to understand the challenge of a complex, multi-ethnic, pluralist, multi-religious and multicultural society. It is up to us to reflect on the theoretical development and practical use of these new tools of communication and knowledge. Alongside the great opportunities for good, there is the risk that everything is reduced to an abstract calculation; this risk could deny the uniqueness of each person and his history, dissolving the concreteness of reality in a series of statistical data. The digital revolution can make us freer, but not if it imprisons us in models known as echo chambers. In these cases, instead of increasing the pluralism of information, we risk getting lost in an anonymous swamp, supporting the interests of the market or power. It is not acceptable that the use of artificial intelligence leads to anonymous thinking, unverified data assembly and collective editorial deresponsibilization. Information cannot be separated from the existential relationship: it requires relating not only data, but also to the experiences and knowledge that we all have, and that we can share thanks to the new information systems.

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