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ARTIFICIAL INTELLIGENCE AND THE CREATIVE INDUSTRIES

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ABSTRACT

In recent years, the world has witnessed the rise of Artificial Intelligence (AI) and its increasing impact on various sectors. One of the most intriguing areas where AI has been making waves is the creative industry. The use of AI in this sector is provoking significant changes in the way artists, designers, musicians, and writers work, think, and create. This paper explores the impact of AI on the creative industries and how it is reshaping the future of creativity.

The study focuses on the ways in which AI is being used in creative industries by analyzing the opportunities and challenges that come with its integration into the creative process, as well as the ethical dilemmas that arise from its usage. To accomplish this, an overview of relevant theoretical frameworks is presented alongside data analysis and a case study of the music industry and its relationship with the technology.

Moreover, the paper explores the role of AI in promoting creativity and innovation, how it is changing the nature of work in the creative industry, creating new job opportunities, and requiring a new set of skills and competencies from creative professionals.

Overall, this study provides a comprehensive overview of the current state of AI in the creative industries, its potential for growth, and the challenges and opportunities it presents. Therefore, this paper is suited for anyone interested in understanding the impact of AI on creativity and the future of the creative industry.

Keywords: Artificial Intelligence, Creative industries, Music industry, AI models, Machine Learning

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF IMAGES

TABLE OF TABLES

1. INTRODUCTION

The creative industries have always been associated with human ingenuity and intuition due to the creativity they require and the unique outcomes they produce. These aspects differentiate the sector for their capability to evoke emotions in consumers in a way that no other does. Therefore, the adoption of artificial intelligence (AI) and machine-oriented production is likely to revolutionize the industry, from the way that content is produced to how the ultimate user consumes it. The intent of this paper is to analyze the potential effect of the introduction of AI in the creative sector by discussing the possibilities, drawbacks, and challenges that the technology presents.

The methodology used consists of the revision of previously published papers, the analysis of relevant data, and the development of a case study. The paper is divided into four main parts, each of them consisting of different sections leading to the presentation of the main findings and conclusions.

The first part relates to the theoretical framework where the terms creative industries and artificial intelligence are introduced. The first section introduces vital information for the understanding of the creative industries, such as a definition of the term "creativity," the drivers of innovation in the sector, and the role and relevance it plays in the broader economy, culture, and society. On the other hand, the second section is centered on providing a short but thorough explanation of AI as a term, as well as its functioning, current state of development, recent adoption, and main concerns and ethical dilemmas. This part is intended to provide a base ground of information and theory for the proper understanding of the study.

The second part establishes the existing relation between AI and the creative industries. The section mentions the inherent attraction between the creative sector and the technology. The paper continues by providing information about the areas of the industries where the technology is being utilized, the roles that AI is performing, and the current scope of its adoption. To complete the section, a series of real-life cases of creative companies implementing AI are presented to exemplify the opportunities for the use of the technology in the sector.

The third part consists of a case study of AI technology being implemented in the music industry. The part opens with a brief introduction of the industry before delving into a deep analysis of its relationship with AI. The first topic addressed is the way in which AI is currently being used in music creation, enhancement, distribution, consumption, and

rights protection. This is followed by the introduction of several AI models developed targeting the industry and real cases of AI being used in the music projects. The part concludes with a segment discussing the current and future impact of the technology in the music industry. The case study is intended to provide an example of the real application of the technology in a creative industry.

The paper concludes with an overview of the creative industries in the era of AI before presenting the final remarks. This section is intended to summarize the main findings encountered through the paper. Firstly, the main opportunities, risks and concerns, and challenges of the adoption of AI are discussed. Lastly, a section concludes with an exposition of the most relevant ideas and conclusions identified with an additional mention of the limitation of the study in data collection and reach.

2. CREATIVE INDUSTRIES

2.1 Creativity

Creativity is a human trait that has played a fundamental role throughout history in developing cultures, art, and technology, and shaping the way humans perceive reality and interact with each other. The concept of creativity encompasses a range of activities, namely artistic expression, problem-solving, and innovation.

The concept of creativity has been studied by professionals across different fields, including psychology, sociology, and philosophy. Despite extensive work surrounding the term, a consensus on a unique definition has yet to be reached. Creativity remains an elusive phenomenon that even experts are unable to define due to its complexity and abstract nature. As the 2021 study 'Creativity and Innovation' exposes researchers can be divided into two main groups when it comes to approaching creativity. Some focus on the cognitive process that prompts creative thinking, such as idea generation, divergent thinking, and associative thinking, while others center on cultural and social factors, including education, socialization, and exposure to different perspectives and realities. Both currents of thought are valid and present interesting nuances and innovative approaches to this complex term. Table 1 collects a series of definitions formulated by authors belonging to both currents of thought.[1]

Table 1. Definitions of 'Creativity'

Approach	Definition	Author
Cognitive process	Creativity is the ability to combine ideas, things, techniques, or approaches in a new way.	Romey. (1970)
	Creativity is typically defined as the ability to generate novel associations that are adaptive in some way.	Ward, Thompson-Lake, Ely, & Kaminski. (2008)
Cultural and social factors	Creativity is the degree to which outstandingly creative individuals feel influenced by social and environmental factors.	Amabile. (1983)
	Creativity may be defined as the capacity to transform experience into original and meaningful interpretations.	Runco, & Cayirdag. (2012)

Source: Own elaboration.

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[1] Categories of researchers provided by Doboli, Kenworthy, Minai and Paulus (2021)

By combining all the aforementioned definitions, a general definition of creativity can be reached: Creativity is the capacity to generate something new by combining pre-existing ideas, things, techniques, and approaches with social and environmental factors to create something original and meaningful. This definition of creativity will be used throughout the paper.

2.2 Introduction to the Creative Industries

Creativity can be attributed as an inherent human trait that is present in all human endeavors. However, there are limited industries that are primarily organized to capture the potential of human creativity and exploit it in the open market. These industries are known as the creative industries, which regard human creativity at their core. Combined with intellectual products and cultural values, they serve as the basis for their activities and the creation of their products. The outcomes generated by the creative industries can be defined as intangible and cultural in nature. Therefore, the creative industries form a bridge that connects art and culture with the economy and technology.

As can be seen, the definition of creative industries that is commonly presented is overly broad, which hinders the determination of where the border of the term should be traced. This translates to some industries being either included or excluded from the list depending on the author's preferences. For the purpose of this paper, the list of industries considered under this term has been limited to those comprised in Table 2.

Table 2: Creative industries by segments

SEGMENT	INDUSTRIES
Fine Arts	Venues for the Arts, Museums, Performing Arts, Music, Visual Arts, Arts Organizations
Design	Engineering, Architecture, Manufacturing Technology, Fashion
Support Services for Creative Industries	R&D Services, Consulting, Post-Secondary Education
Media and Communications	Advertising, Graphic Design, Marketing, Public Relations, Publishing, Broadcasting
Entertainment	Media, Educational and Training Film Development, Post-Production, Recreation, Video Gaming Development
Data Sciences	Communications, Internet, Telecomm
Software and Hardware	Manufacturing and Retail Software, Healthcare Devices

Source: Own elaboration.

The size of these industries in the global economy is difficult to calculate, and as such, it is impossible to offer an accurate scope. According to UN estimates in their paper "Lunch if the 2018 Global Report" of 2017 the creative industries combined weight over 6.1% of the global GDP. These figures vary depending on the country, averaging between 2% and 7% in most of the studied economies. The UN estimates that these numbers translate into $2 trillion globally, of which a significant percentage is generated by the television and visual arts industries.[2]

However, these figures are not equally distributed across the globe. Due to their reliance on innovation and the importance of technology and communication in the current creative industries, the sectors tend to represent a larger portion of the economy in more developed areas than in developing or underdeveloped areas. Figure 1 represents these differences by showing the significant contrast between the relevance of the sector in the developed areas of the northern hemisphere and the mostly still developing economies of the southern hemisphere. The map also exposes how some areas like North America host a more productive creative climate than others such as the Asia-Pacific and thus can produce larger revenues with fewer employees.

Figure 1. Creative industries in the world
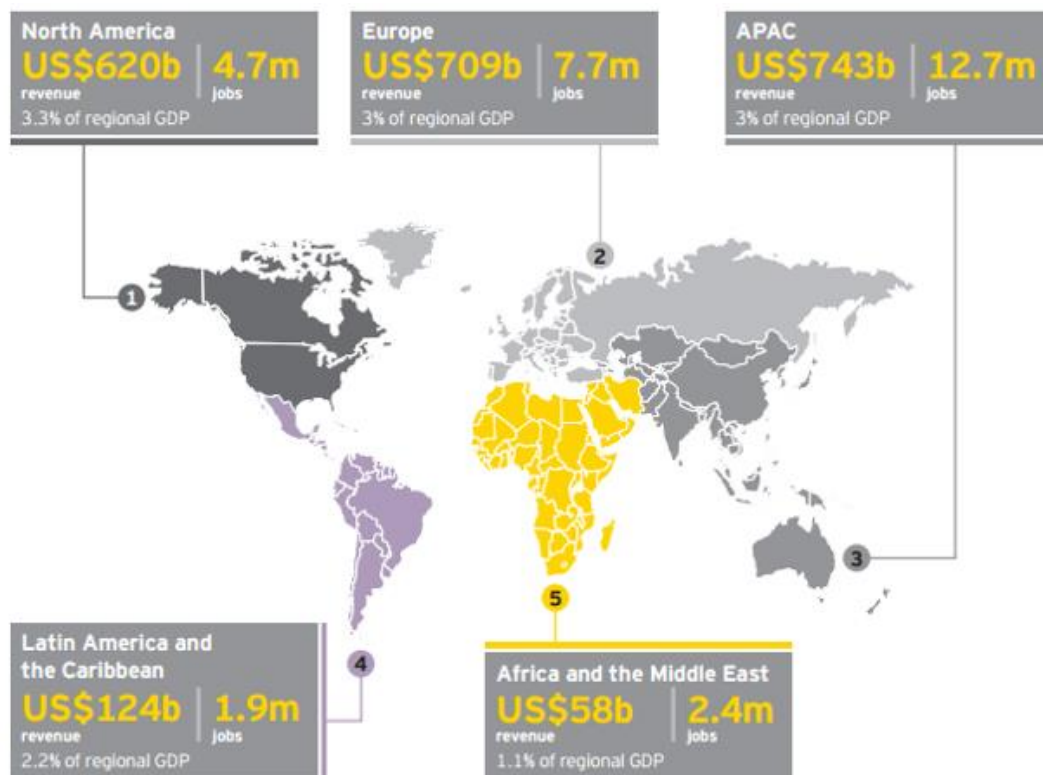
Source: Cultural times: the first global map of cultural and creative industries. EY (2015)

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[2] Data provided by UNESCO HQ. Room II (2017)

The creative industries provide employment to over fifty million people worldwide, with the visual arts and music industry being the ones that generate the most employment. Half of these employees are females, and the majority belong to the 15-29 age group. These numbers can be explained by the dynamic environment of the creative industries that is usually better suited for young workers. [3] Figure 2 represents the size of the creative industries in the employment market of nine selected economies with total and percentage figures.

Figure 2. Scope of the creative industries in the job market
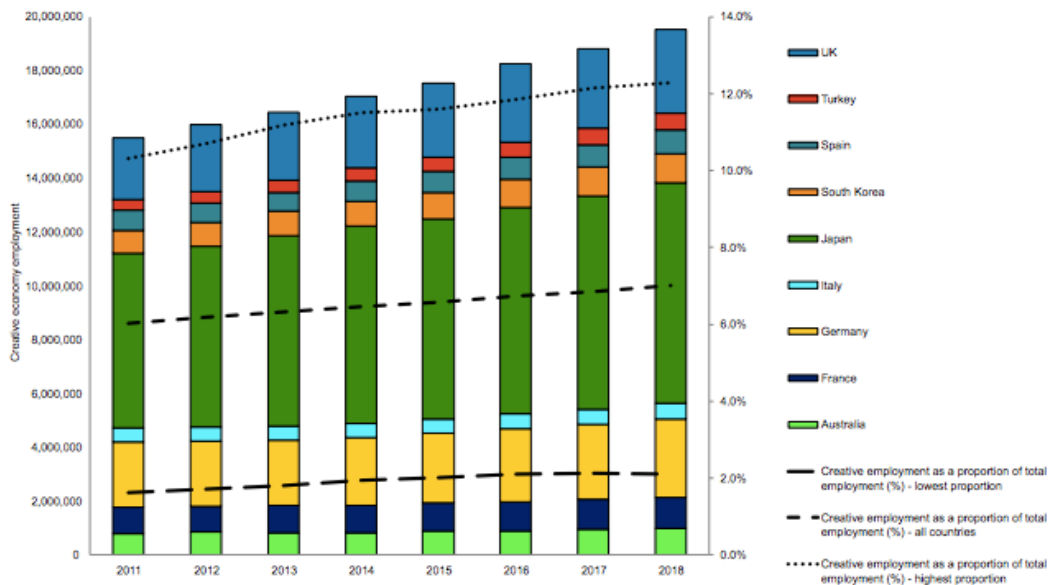
Source: The creative economy (2022). The policy circle.

Organizations within the creative industries are characterized by their project-based approach and the organization of their products, performances, and services around these projects. The roles and routines within these organizations are designed to fulfill the requirements of the project while also promoting employee learning to facilitate the application of new knowledge in future projects. Continuous learning and skill development are essential in the creative industries due to the managerial challenges and the highly unstable and constantly changing environment in which they operate.[4]

However, it is important to note that due to the wide range of industries and companies encompassed by this term, it is impossible to provide a detailed explanation of how these companies operate beyond generalizations. Additionally, the complexity of the creative environment necessitates that each company develops its unique operational style.

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[3] Data provided by The Policy Circle (2022)
[4] Information and definition provided by Jones, Lorenzen, and Sapsed

2.3 Drivers of Innovation and Creativity

Innovation and the continuous search for novelty is a staple of the creative industries and the trait that differentiate the sector from the rest. Therefore, understanding how innovation is originated in the industries is necessary for their proper understanding.

Creativity does not have a single origin, instead it is the culmination of several factors influencing various parts of the creative process. A seen in figure 3 to understand how these factors, influence innovation they must be studied from three different perspectives: to an individual level, a company level and lastly an industry level. Each of these factors do not act individually but rather they are all combined to reach the final goal of fostering creativity and innovation.

Figure 3: Factors that influence creativity and innovation
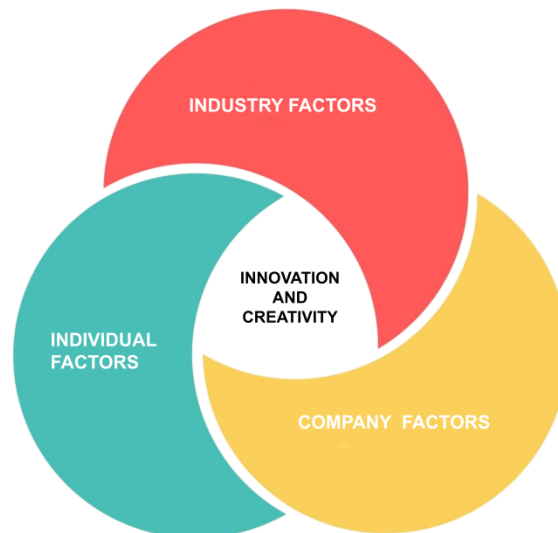
Source: Own elaboration

Individual creativity and innovation are shaped by numerous factors, including psychological, cognitive, and socio-cultural aspects such as:

- **Passion:** Passion drives individuals to pursue their interests and engage in creative activities. An individual with passion is more likely to thrive in their position and develop new skills to enhance their outputs.
- **Knowledge and expertise:** Individuals who possess a deep understanding of their field or industry are better equipped to generate novel ideas and solutions. Expertise is not only based on accumulated knowledge but also on the ability to

recognize patterns and identify meaningful connections. Both factors combined create the basis for the development of ideas.

- **Curiosity:** Individuals with curiosity are more likely to seek out new experiences and ideas, leading to a greater likelihood of making creative connections between apparently unrelated concepts. [5]

However, the innovation generated by individuals cannot thrive if it is not sustained by a larger infrastructure that provides them with enough tools to develop their innovations. Companies are responsible for providing this support while also harvesting creativity of their own. To achieve this goal, companies must ensure the following factors:

- **Organizational structure:** Creating an open structure with creativity and communication at the center of the workspace is vital to generate innovations. Flat hierarchies and cross-functional teams are tools that facilitate the sharing of ideas and knowledge across departments and individuals.
- **Resources:** Companies that invest in research and development, provide training and development opportunities, and encourage experimentation are more likely to produce innovative products and services.
- **Leadership:** Strong leadership that fosters a culture of innovation is essential to driving creativity at the corporate level. Leaders who encourage risk-taking, experimentation, and collaboration while not punishing failures have a greater likelihood of inspiring their employees to think creatively. [6]

Lastly, industries play a vital role in fostering creativity through a combination of factors by uniting all the participants and allowing collaboration:

- **Competition:** The need for companies to differentiate themselves in a highly competitive market forces them to continuously innovate to remain relevant. Competitors also have the power to influence companies to invest in research and development and to provide better products and services.
- **Government support:** Public policies and funding provide resources for research and development, training programs, and creative projects, helping to foster a supportive environment for creativity and innovation.

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[5] Information and factors provided by Heagelaar (2018)
[6] Information and factors provided by Smith, Busi, Ball, and van der Meer (2008)

- **Collaboration:** Collaboration between different companies has the potential to lead to new creative ideas by bringing together different skills, perspectives, and expertise, leading to more innovative and holistic solutions.
- **Intellectual property:** Favorable regulations regarding copyright and intellectual property conservation drive innovation by incentivizing creators to invest time, effort, and resources into creating original works by protecting their rights and ensuring they are properly compensated for their work.
- **Education and training:** The easy accessibility to professional training, such as university degrees, helps to create more skillful and resourceful individuals capable of thriving in the creative industries. Education and training programs can also foster a culture of creativity and innovation, by encouraging experimentation, risk-taking, and critical thinking.[7]

2.4 Importance on the Broader Economy

One of the most important aspects of the study of the creative industries is the effect that the sector plays in the wider economy. Since the creative industries are based around innovation and creativity, they have the capability of influencing the rest of the industries with their innovative approaches and findings. Tom Fleming Creative Consultancy in their 2015 referred to these influences as spillovers since they originate in the creative industries before overflowing to the rest of the economy. This influence surges through the sharing of ideas, skills, concepts, knowledge, and capital, and its effects have the potential to reach national and international spheres, affecting them with positive and negative results.[8]

According to Tom Fleming Creative Consultancy these spillovers can be classified into three main categories:

• **Industry spillovers:** This typology of spillovers is present when the creative industries trigger a transformation in the supply chain.

• **Knowledge spillovers**: These spillovers surge when the ideas originated in the creative industries overflow to other sectors, incentivizing innovation, and the absorption of new concepts.
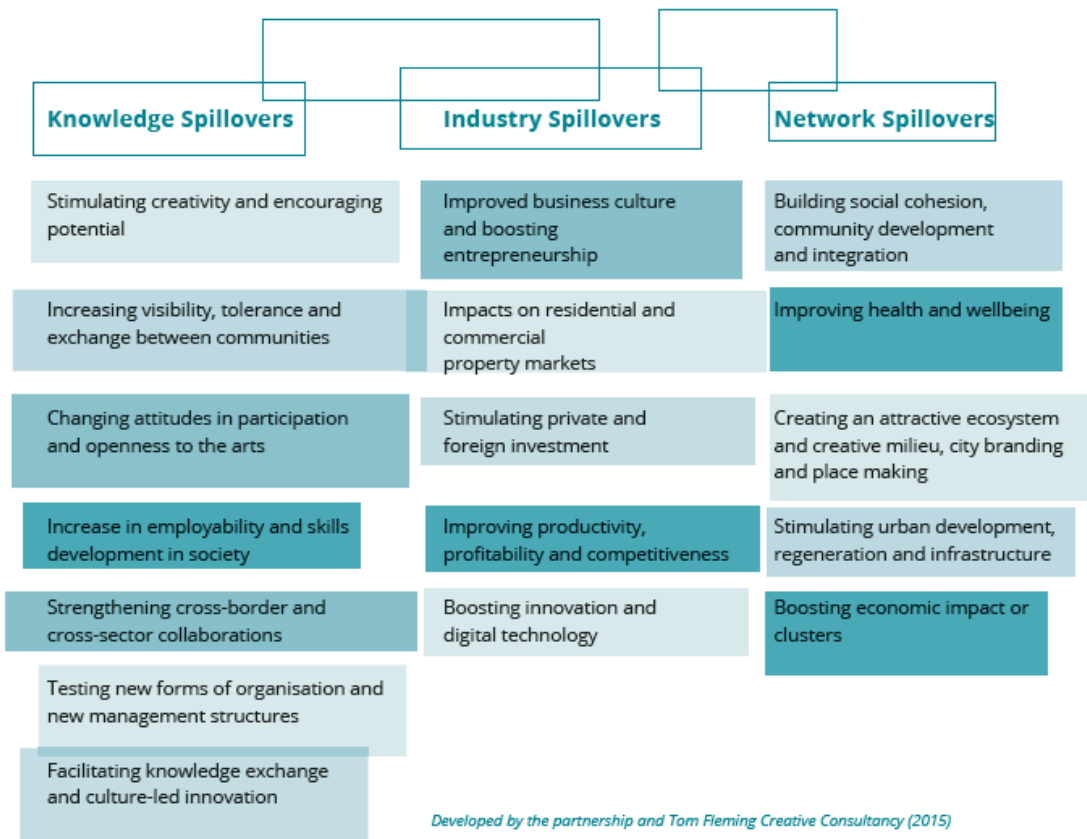
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[7] Information and factors provided by OECD and European Union (2018)
[8] Categorization provided by Tom Fleming Creative Consultancy (2015)

• **Network spillovers**: Refers to the spillovers that form when the positive performance of the creative industries generates a subsequent effect on the rest of the economy.

The following table, elaborated by the European Center for Creative Economy, introduces some of the most relevant spillovers.

Table 3: Spillover of the Creative Industries

Knowledge Spillovers	Industry Spillovers	Network Spillovers
Stimulating creativity and encouraging potential	Improved business culture and boosting entrepreneurship	Building social cohesion, community development and integration
Increasing visibility, tolerance and exchange between communities	Impacts on residential and commercial property markets	Improving health and wellbeing
Changing attitudes in participation and openness to the arts	Stimulating private and foreign investment	Creating an attractive ecosystem and creative milieu, city branding and place making
Increase in employability and skills development in society	Improving productivity, profitability and competitiveness	Stimulating urban development, regeneration and infrastructure
Strengthening cross-border and cross-sector collaborations	Boosting innovation and digital technology	Boosting economic impact or clusters
Testing new forms of organisation and new management structures		
Facilitating knowledge exchange and culture-led innovation		

Developed by the partnership and Tom Fleming Creative Consultancy (2015)

Source: Cultural and Creative Spillovers in Europe (2015)

Aside from the aforementioned spillover, the creative industries generate two more effects: the supply-side effect and the innovation effect. The latter refers to the capacity of the creative industries to function as innovation leaders, facilitating the introduction of new products and processes into the market.

The supply-side effect refers to the capacity of the creative industries to attract highly skilled workers, which creates a chain effect, attracting more skilled workers to the area where creative industries are located and therefore improving the job market for the rest of the economy. A study developed by the PEC discovered that in the United Kingdom from the year 1998 until 2018, the creation of each job related to the creative industries generated the creation of 1.9 jobs in other non-creative related industries. Additionally,

said study also concluded that the creation of creative jobs was significantly higher in the regions where creative industries were already located, further proving the chain effect that the sector creates in the job market.[9]

2.5 Contribution to Culture and Society

The spillovers generated by the creative industries are not limited to the economy; instead, the effects can be felt in all aspects of society. The creative industries hold a strong power when it comes to shaping cultures, redefining social attitudes, and even shaping the social view of minorities and oppressed groups. The benefits the sector brings to society are immeasurable; however, several pieces of research have proven the vital impact that the industries have had in strengthening communities and improving the wellbeing of their participants.

The main contribution to society is the preservation and spread of culture. The creative industries and local culture are tied to their core. Unlike other sectors that produce goods that are standardized and commonly out of touch with their place of origin, the outputs generated by the creative industries combine culture, history, and ideals of the communities they belong to. This effect is easily exemplified by traditional creative sectors such as architecture and music. Said industries can be found in all cultures and regions of the world; however, the way each of them operates, and most importantly, the outputs they generate are different in each region. This creates a close cycle in which the creative industries enrich the culture with their production while at the same time feeding from that same culture. Therefore, the creative industries can be said to be a vital piece of culture preservation that enhancement the connection between communities, culture, and the business world.

The creative industries are also notorious for their inclusivity. This is apparent when talking about the inclusion of women in the workforce. A study made by UNESCO in 2015 concluded that while in Europe, women only represent an average of 45% of the active population; more than half of the workers employed by the creative industries were females. The paper emphasizes the vital role that women play in the sector, especially in the developing world, where women are commonly in charge of the elaboration pf creative products. This is exemplified by the carpet industry in countries like Turkey or Southeast Asia, where females are commonly in charge of designing and elaborating the products. Indeed, this close relation between the creative industries and the female labor

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[9] Data provided by Gutierrez Posada Kitsos, Nathan, and Massimiliano (2021)

has plenty of historical precedents due to most cultures associating creativity with the female mind. This has turned the creative industries into a historical refuge for women across the world in a trend that persists until this day.

Diversity is also reflected in the creative industries through the inclusion of other vulnerable groups, namely migrants, people from religious and racial minorities, and LGBTQ+ individuals. While the cultural sector still has a long way to go to become fully inclusive, numerous studies demonstrate that the sector is taking the lead in this department. A 2019 survey conducted on diversity in the creative industries in the United Kingdom revealed that the inclusion of Black, Asian, and other racial minorities in creative sectors like IT and computer science was relatively higher than in other highly skilled sectors. These numbers were not only high, but they also represented an increase from previous years. However, it is important to mention that this trend did not translate to other creative sectors such as libraries and galleries where the numbers were notably lower and had been stagnant for several consecutive years.[10] The following graph represents the number of BAME employees in the creative sector of the United Kingdom.

Figure 4: BAME share in creative industries in the United Kingdom
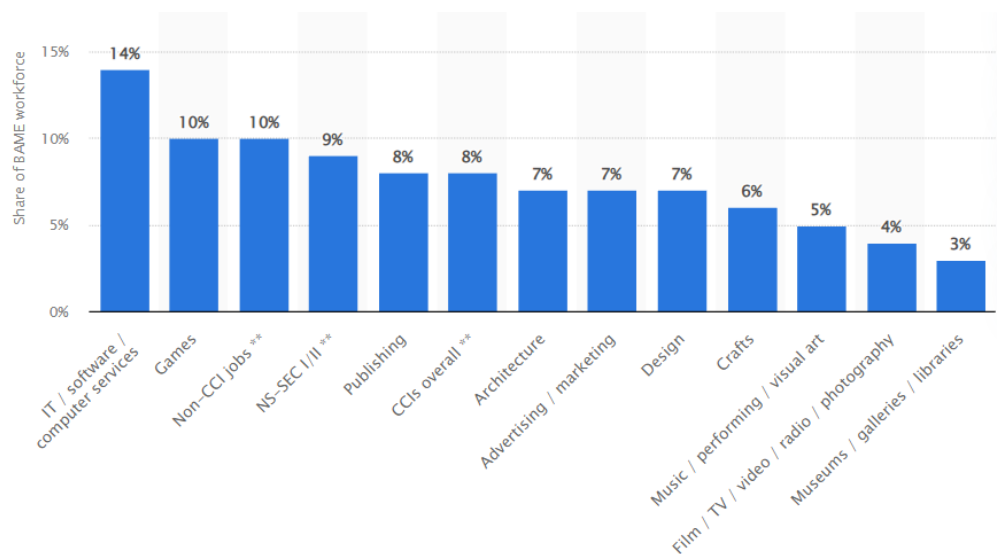
Source: BAME share in creative industries in the United Kingdom (UK) in 2019, by sector

The last major contribution of the creative industries to society is the impact they generate on the environment. Traditionally, the creative sector has not been known for its green practices. However, with the expansion of environmental awareness, the industries are rapidly shifting towards more eco-friendly practices. This transformation is necessary to reduce pollution and meet the net zero target that several countries in the

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[10] Information provided by Guttmann (2021)

developed world have imposed. Several studies have determined that design is a key element in reducing pollution, with some stating that the design phase might determine up to 80 percent of the environmental impact that will be generated during production. [11] Therefore, the inclusion of the creative industries in environmental agreements is essential to reduce their negative impact. UNESCO is one of the international organizations that has raised awareness of the potential of the creative industries for environmental causes with its program "The International Year of Creative Economy for Sustainable Development," completed in 2021.

2.6 Challenges Ahead

The economic and social paradigms are currently undergoing a period of intense economic and political change, motivated by the globalization of the economy, the digitalization of industries, the changing social paradigms, the shift of the political center to Asia, and global events such as the COVID19 pandemic and the Ukrainian war. This complex and unstable scenario presents a series of challenges for the creative industries, forcing them to constantly evolve to maintain their relevance in the market.

The first challenge that the creative industries are facing is the **growth challenge**. Unlike other sectors, the creative sector has traditionally been constituted mainly by small players, with a reduced number of large corporations dominating the market, which has long limited the sector's capacity to expand globally. To change this trend, some of the larger companies have initiated a wave of mergers to face weak global economic growth and digital disruption. A study conducted by EY in 2015 regarding the Media & Entertainment Capital Confidence Barometer revealed that half of the creative companies analyzed were planning to pursue acquisitions in the following 12 months, which doubled the numbers obtained by the same researcher two years prior. The companies studied pointed out the protection of revenue and the desire to gain more market share as the main causes for the acquisitions. [12] However, this technique is reserved for big corporations with large funds, while small companies have been forced to pursue other routes to obtain investment. Some of the most used financial tools in the sector are crowdfunding and co-production, which enable companies to share costs and initiate new projects.

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[11] Information provided by Bartkowski (2021)
[12] Information provided by EY (2015)

Another problem faced by the creative industry is the **challenge of globalization**. Globalization is inherently difficult for the creative industries due to the connection the sector has with the area where it is located and its culture. Therefore, when selecting the destinations where to invest, being aware of the risks and potential rewards is vital for the success of the globalization strategies. Historically, some of the most attractive destinations for the cultural industries have been developed countries such as the United States, Australia, and European countries like Germany, the United Kingdom, or the Netherlands due to their seemingly economic and political stability, consolidated and robust economies, and easy access to investment. However, lately, some emerging countries such as China and India have emerged as some of the most popular destinations for the sector. Nevertheless, the creative industries are facing several adversities when trying to penetrate these developing nations due to the lack of infrastructure, restrictions to foreign companies, and overly low prices set by local competitors. The way the creative industries are going to tackle this challenge might be one of the main determinants of their global significance in the following decades.

During the early days of the technological revolution, many creative companies made the strategic decision of providing free unlimited online content such as newspapers, music, or videos to generate revenue through advertising and product placement. This early move has led the sector to one of its main challenges today, the **online monetization challenge**. To reverse the mistakes committed by these strategies, the creative sector is undergoing a process of customer re-education to change their habits. High-quality and value-added content have turned into the main technique to convince customers to pay for content they are used to consuming for free. However, the success of these strategies has been overly diverse, both at an industry and market level. On the one hand, industries like the movie industry that did not rely on free content during their digitalization process have had a relatively smooth transition to online paid content, while the industries that used to offer free unlimited content like newspapers and radio are mainly still incapable of fully monetizing their online content. On the other hand, the success of content monetization is also tied to the market where the product is offered. The following graph created by EY about the penetration of free content in different markets show the value of cultural differences and consumer behavior and how they impact the capacity to monetize creative content in the main global economies.

Figure 5: Average penetration free online activities
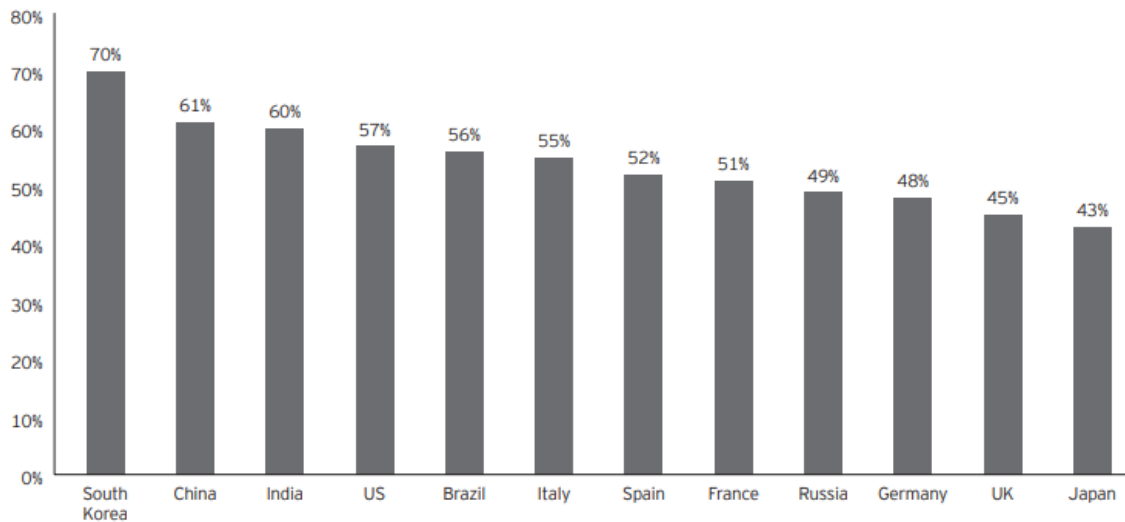
Source: Cultural times: The first global map of cultural and creative industries. 85.

Another effect of the free to access unlimited online content is the **copyright protection challenge**. The creative content offered online at no cost presents a threat to the creative industries since it creates direct competition with the professional products that the sector creates. Additionally, the difficulty of traceability of online postings has made it easier to repost protected content on free-to-access sites, thereby violating the ownership rights of the creators. If not addressed properly, this problem has the potential to significantly reduce the revenue generated by creative companies and individuals, forcing them to stop production. Collective management of rights might be an interesting approach that could allow creators to focus on their craft, knowing that their productions can be traced and compensated. However, this is far from the only potential solution, and it will require initiative and effort to ensure ownership protection. Tackling this problem is vital to ensure the survival of the creative sector and to prevent hindrances to creative growth generated by the unfair use of content.

Talent is at the heart of the creative sector, and therefore, the **challenge of generating talent** is one of the most urgent problems facing the industries. The creative industries have been struggling to attract talented individuals due to their scarcity and the intense competition presented by non-creative sectors. Universities and other higher education entities are regarded as key players in tackling this problem. While the main purpose of universities might be to foster innovation, these entities perform other crucial roles for the sector, namely acting as creativity hubs and linking different disciplines in shared facilities, facilitating the sharing of ideas and processes. Due to this unique position that universities hold, they can impact the entire creative economy by creating talent,

fostering tolerance, attracting skilled individuals, generating novelty, and offering support to creative activities that are commonly ignored by non-educational entities.

The last main challenge that the creative industries must face is the **challenge of adapting to new business models**. The rapid-changing economic reality, paired with digitalization, globalization, and a shift in consumer preferences, is forcing the creative sector to adopt new business models to face the new reality. The main principle that the creative economies have adopted is the hybridization of their funding and revenue sources. Hybridization refers to the multiplicity of investment and revenue generation. By multiplying the economic models within a particular creative sector, the revenue sources are expanded. An example of hybridization in a creative industry is the gaming industry. Said industry currently has six economic models functioning in parallel: physical or digital payment, subscription, free-to-play including Paymium, advertising, and micropayment. The diversification of economic models has allowed the gaming industry to adapt to the new era while maintaining its relevance and base principles. However, this transformation has not occurred in all industries. The book industry is a prime example of industry stagnation, where the new principles are ignored in favor of the old ones, which has come to the detriment of the industry and its revenue.

Table 4 Hybridization of economic models

	Video games	Music	Movies	Books
Digitalization rate	72%	50%	30%	15%
Hybridization index	80	41	56	23

Source: Cultural times: The first global map of cultural and creative industries. 89.

To overcome these challenges, several strategies are required, which may vary from one industry to another. Nonetheless, what is common among all industries is the significance of the approach taken to confront these challenges since it has the potential to determine their level of success and notoriety in the coming years. For instance, industries that are more successful in adapting to digitalization may find themselves in a better position than those that fail to do so. Therefore, the approach taken by each industry to tackle these challenges can have a significant impact on its prospects, and it is crucial to develop effective strategies to ensure long-term sustainability and growth.

3. ARTIFICIAL INTELLIGENCE

3.1 Concept of AI

The term "artificial intelligence" has recently become a trend in economic and social spheres due to its novelty and the prospect of single-handedly transforming the world in countless ways. Artificial Intelligence (AI) could be described as the capacity of a machine or robot under the control of a computer to conduct activities typically linked to intelligent beings. This definition, although short, outlines the basis of the technology. When using the term AI, what is being referred is a collection of sophisticated software that has been trained to perform diverse tasks commonly attributed to human beings, such as reasoning, learning from experiences, and analyzing data.

The actual goal that AI should aim for, and therefore the manner in which the technology should be developed, is highly disputed. In one of the leading textbooks regarding AI developed by Russell, S. and Norvig, P., the authors identify two different branches of thought regarding AI: the human and the ideal approach. The human approach is to create software able to emulate the human brain to perform tasks in an identical manner to how a human would endure them through its own intellectual process and without the need for external help. On the contrary, the ideal approach defends that AI should not try to emulate human intelligence. Instead, it should aim to create a fully rational intelligence capable of performing tasks without the human biases.

Table 5: AI aproches

	HUMAN APPROACH	IDEAL APPROACH
THINKING	AI that thinks like a human	AI that thinks rationally
ACTING	AI that acts like a human	AI that acts rationally

Source: Own elaboration

Regardless of its newfound popularity, the concept of AI is not exactly brand-new. It traces all the way back to 1940 and the development of the first digital computer. Since their beginning, computers have been capable of performing tasks on their own, and thus it could be argued that AI has existed since the creation of the first computer, although in different degrees of sophistication. Since then, the more "creative" side of computers has been trained and developed, a process that is surely going to continue soon. The following figure represents the timeline of AI development from its beginning until the current era.

Figure 6: Timeline of AI development

1961.First Industrial robot replaced humans at assembly line.
1964.Pioneering chatbot named ELIZA was developed at MIT
1966. A general purpose mobile robot developed at Stanford

1997. IBM's Deep Blue defeated Garry Kasparov in chess Competition
1998. An emotionally intelligent robot KISMAT was developed
1999. Sony launched pet robot dog named AIBO

2011. Apple's SIRI and IBM's Watson were developed
2014.EUGENE, a chatbot passed Turing test; Amazon launched Alexa, a voice enabled intelligent virtual assistant.
2017.Google's AlphaGO beat the world's best GO player Ke Jie.

1961-1970   1991-2000   2011-2020
                                                    2021

1950-1960   1971-1990   2001-2010
                                                    2020

1950. Turing Test by Alan Turing
1956. Term of AI was coined

AI Winter

2002. iRobot launched autonomous vacuum cleaner robot in bulk.
2009.Google built first self driving car for urban conditions

- **Moxie:** A Social-Emotional Companion for kids is developed by Embodied.
- Earth's first autonomous **beehive** is developed by beewise
- **TrialJectory** is an AI enabled service to look for clinical trials.
- **BrainBox AI** is an AI system to predict a building's thermal conditions.
- Refined business process, more personalized recommendations, human like conversational skills

Source: AI timeline. Connectjaya

However, despite the enormous development that AI has experienced in recent years, the technology is still far from reaching its goal. The main reason behind for this is the complexity of emulating creativity and all its nuances, which creates a challenge for developers to imitate. Psychologists generally argue that human intelligence is composed of five main traits that allow creativity, namely: learning, reasoning, problem-solving, perception, and language usage. Currently, the success of adapting AI to each of these traits has been different for each of them.

3.2 How AI functions

To understand how AI works, it is necessary to introduce a new term: Machine Learning. Machine learning is described as the area of research that empowers computers to learn without requiring explicit programming. This definition exemplifies the difference in nature between the traditional manner of writing programs, which mainly consists of creating a set of specific rules that the machine must follow. AI is intrinsically more complex to develop than traditional programs, and thus the old approach of developing them is neither cost nor time-effective, and in most cases, even impossible to materialize. This is where the innovative system of machine learning comes into play, by letting the programs learn by themselves solely based on the experiences they are exposed to.

The machine learning process starts with the collection of relevant data for the program that wants to be developed. For instance, if a group of programmers is trying to develop a music creating program, they would gather samples of several types of songs. Once

the archive of data has been collected, this information would feed to the program, which immediately starts to analyze and gather information about similar patterns repeated throughout the archive and develop a set of predictions based on said findings. However, a small part of the sample is usually kept apart to be used as evaluation data to determine if the algorithm is effectively managing the introduction of new data.[13]

Due to the nature of machine learning, the larger the amount of data the program is exposed to, the more accurate the model will end up being. If successfully conducted, the process of machine learning can develop a model that capable of being retrofitted in the future to be exposed to new sets of data to either improve its performance or even learn to endure new tasks. There are three main subcategories of machine learning:

- **Supervised:** The models are exposed to datasets that have been previously labeled. An example of this method would be providing a labeled set of photos including human portraits and other images to an image recognition model so it can extract the common traits and learn to identify human portraits even when they are not labeled. This is currently the most employed system since it generates the most accurate algorithms over time.

- **Unsupervised**: Similar to the supervised system, however, with the sets being unlabeled. This system has the advantage that allows the machine to recognize trends and patterns that might be unrecognized by humans.

- **Reinforcement**: This model is based on a trial-and-error basis with a system of rewards to let the machine capture the best actions. This is the system that is currently being used for self-driving cars.

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[13] Information provided by Brown (2021)

The following diagram exemplifies which system is most suited to each type of AI based on the desired results.

Figure 7: What do you want the machine learning systems to do?
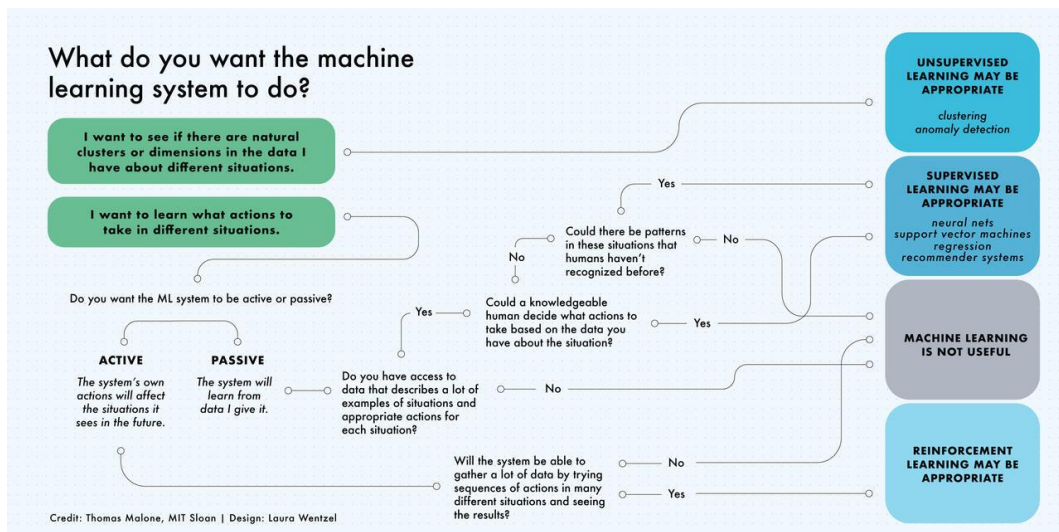
Source: Artificial Intelligence and the Future of Work (2020)

While machine learning is the main method used for AI learning, it is also associated with several subfields, the most important of which are:

- **Natural language processing**: This system consists of allowing AI models to learn written and spoken language in a similar way that humans do, without the need for data and numbers. The advantage of this method is that it allows the models to recognize, understand, and respond to language, as well as generate new text and translations. Natural language processing is used by chatbots such as Siri from Apple or Alexa from Microsoft.

- **Neural networks**: This system imitates the human brain by creating a complex net of interconnected processing nodes that are organized in layers similar to human cells. The data moves through the net, allowing each node to perform a different activity to produce the desired output.

- **Deep learning**: The deep learning system is another neural system and, as such, it maintains the human brain-like structure of interconnected nodes but with the difference of being deeply layered. The extensive amount of layers allows the model to process substantial amounts of data to determine the relevance of each of the nodes. Deep learning is used to power several machine learning uses such as medical diagnostics and self-driving cars. However, concerns are raised regarding its economic and environmental costs due to the large amount of power these systems require to properly function.

3.3 Current State of AI Technology

To establish the current state of AI, it is necessary to determine its success in emulating the distinct aspects that characterize human intelligence. In it 2023 study 'Artificial Intelligence' Copeland identifies five major aspects of human intelligence:

- **Learning:** There are two separate ways in which an AI can learn. The first one, and the simplest to implement, is learning by a process of trial and error. This method consists of letting the machine repeat a process several times until it reaches a satisfactory result that it will later memorize to be performed in similar occasions afterwards. The second method is called generalization and consists of teaching a program to develop its own results based on previous experiences. The main difference resides in that to perform an action in the first method, the AI has to have been exposed to that exact action previously while in the latter method, the AI is able to effectuate the action based on similar previous experiences. The first method has been successfully implemented in AI, while the generalization method is still in development, having been completely implemented for some tasks but not all of them.
- **Reasoning**: This presents one of the hardest challenges for AI developers. While the success that AI has achieved in deductive reasoning (mathematic and logic tasks) is considerable nowadays, the technology is still struggling in inductive reasoning (scientific tasks) due to its incapacity to distinguish relevant inferences when solving a task.
- **Problem solving**: It refers to the capacity of searching through a range of possibilities to find a predefined solution to the task being performed. This is one of the traits in which AI has succeeded the most, as can be shown for its capability to play board games that require a sequence of moves.
- **Perception**: It refers to the capability of AI to perceive objects that can be found in the environment and identifying them. This trait presents several challenges mainly related to the influences of environmental factors such as illumination or angle that modify the object being perceived. Regardless of these challenges, AI has generally been successful at perceiving objects in the environment, such as human faces or car plates.
- **Language**: The last trait is also the hardest to establish its success. On the one hand, AI is nowadays perfectly capable of producing works that reach a human-like level of proficiency, and in some instances, might be undistinguishable from a work produced by a person. On the other hand, AI is currently incapable of

really understanding human language, regardless of its command, and it is debated if that is a trait that it will ever be able to develop.[14]

In view of the previous analysis, it can be argued that AI has been successful emulating parts of human intelligence, while at the same time, it is incapable of mastering all traits. Therefore, it can be argued that while being able to produce its own work, AI is still far from achieving human intelligence, and therefore, its work cannot currently be equated with that of a human.

3.4 Adoption and Success

Despite its limitations and the technology still not being fully fleshed out, AI models are attracting huge interest both among research and development teams and companies due to their tentative potential. This interest is currently on the rise, and it translates into investment and adoption numbers rising every year.

The study 'The state of AI in 2022 - A Decade and a Half in Review,' developed by McKinsey, shows interesting numbers obtained through several surveys. The study demonstrates that between the period from 2017 to 2022, the adoption of AI in the surveyed companies has doubled. However, the same study shows that the number of new adopters seems to have plateaued since the numbers have remained stagnant since 2019 when they peaked as seen in the following graph:

Figure 8: Percentage of companies that have adopted AI
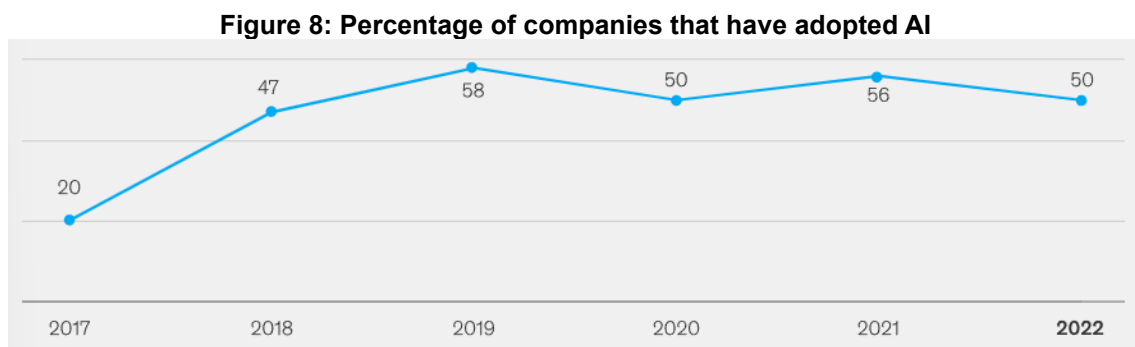
Source: The state of AI in 22 – and half decade in review

A similar trend has happened in the number of AI capabilities used by organizations going from 1.9 in 2018 to 3.8 in 2022. The main usage given by companies to AI models is said to be optimization of service operations. Figure 9 shows to most relevant usages:

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[14] Information provided by Copeland (2023)

Figure 9: Most adopted AI use cases by percentage
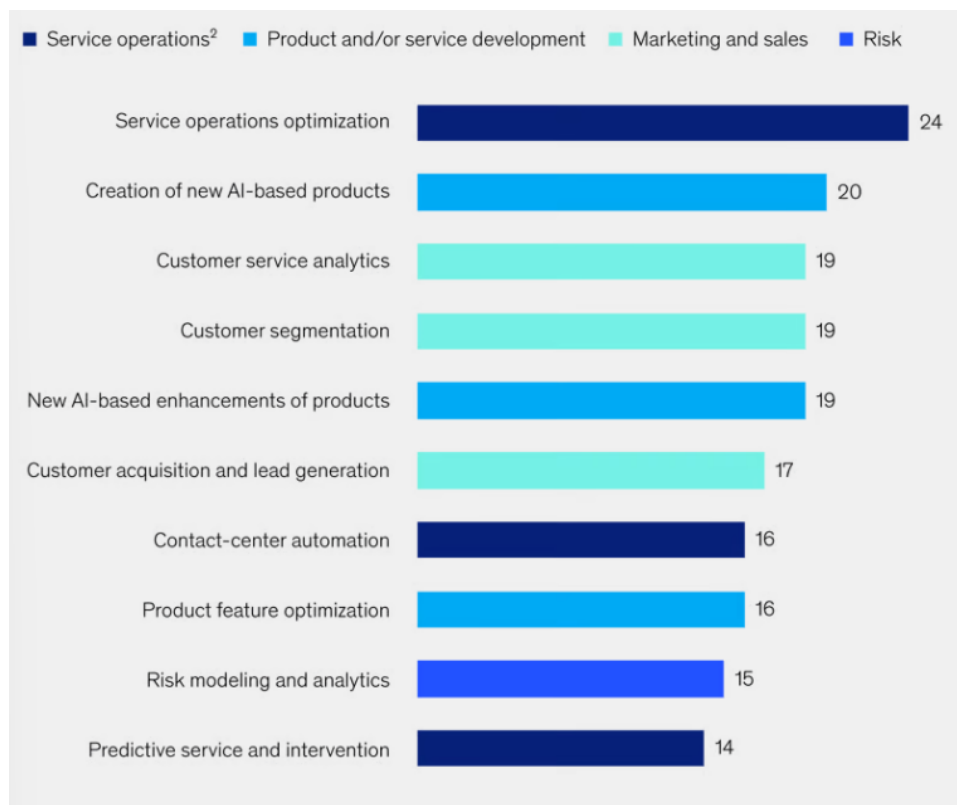
Source: The state of AI in 22 – and half decade in review

The increase of AI adoption also coincides with an increase in investment in the technology. The percentage of the digital budget that companies deploy in AI has risen from 40% in 2018 to 52% in 2022. These numbers are expected to keep growing in the following three years until reaching 63%. This continuous rise in AI investment can be attributed to a shift in perception by most investing companies. While in 2018, manufacturing and risk were regarded as the most fitting areas for AI usage by most companies, nowadays corporations have realized the potential of the technology in other areas such as marketing and sales, product and service development, strategy and corporate finance, and supply chain management. This diversification of the usage of the technology has a significant impact on the number of investors and adopters willing to prioritize AI models. Additionally, the decrease in the cost of adopting AI in comparison to the benefits has also enhanced the attractiveness of the technology, even though it is still regarded as having a substantial risk by most investors.[15]

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[15] Data provided by Chui (2022)

3.5 Concerns and Ethical Dilemmas

The rise in popularity and adoption of AI technology is said to provide countless benefits to companies and society, but this may come at a cost. Since its early days, AI has been surrounded by controversy and fear. While some apprehension toward the technology comes from misconceptions, there are several real concerns that must be addressed when discussing AI, its wide adoption, and its regulation by states.

The first concern that must be addressed is bias. While there are different methods of AI training, all of them require the introduction of a set of data to develop the model. Then, the model makes its own conclusions based on the data it has been fed. This system is effective in training models; however, it presents the concerning problem of generating biases. These biases generated by past experiences have the potential to affect the future outcomes of the system, making them highly dangerous. A consequence of biases in a model might be a security system that, due to negative past experiences with individuals of a certain race, starts targeting other individuals who belong to that specific group because the model relates them to the negative encounters. This problem with biases is common among human beings; however, their effects might be of the same or greater scale in AI models due to their tendency to confer scientific credibility to its experiences and therefore making the prediction seem objective, which could help to further spread discrimination.

Another concern regarding AI is the implications the technology might have on privacy. As previously stated, to be trained, models require to be fed with copious amounts of data. This data originates from diverse sources that are commonly untraceable. Therefore, the practice of using data whose owners have not given personal consent for that purpose is relatively common. This has resulted in different models being criticized or even banned due to the illegal usage of unconsented data in the training process. Additionally, the pattern recognition characteristics of AI raise concerns about its potential usage for surveillance and repression, which raises further fears about its wide implementation in society.

AI has the potential to damage information accuracy. Many of the most popular AI models nowadays are targeted to content production, namely audio, image, and mainly text production. Aside from the biases and problems with data privacy that said tools present, they also raise concerns about the spread of false information. For instance, image-generating models can be used to produce highly realistic images of individuals in order

to alter the perception of them to a certain level of detail that is indistinguishable from authentic images.

The aforementioned models also represent a threat to novelty. The usage of self-dependent tools that can perform creative activities by themselves might have a catastrophic impact on novelty by damaging the capacity of individuals to produce their own outcomes in favor of the products produced by AI. This concern is already present in educational institutions and the rise of AI-generated papers created by students, which can potentially damage their capacity to create their own papers.

Finally, AI models also raise an ethical question about responsibility. The aforementioned concerns have the potential to generate catastrophic results for society as a whole, and therefore the question of who should be responsible for said outcomes is important to consider. However, the answer to this question is complicated. While developers might be the ones creating the models, their power to control the usage of said models is limited. Additionally, while individuals and entities might be the ones utilizing the models, the level of automatization that they present makes blaming them for the outcomes complicated. Therefore, similar to an accident caused by a self-driven car, the one who holds the entire responsibility for the fatality would be the AI itself. This generates the risk of AI models being used with damaging intentions but with the incapacity of the penal system to hold anyone accountable for the effects it generates.

4. AI AND THE CREATIVE INDUSTRIES

4.1 AI in the Creative Industries

In recent years, numerous industries have begun experimenting with different AI tools to evaluate the viability and potential advantages they could provide to their respective sectors. Among these industries are the economic, engineering, physics, education, and social sciences. However, the creative industries have been the primary targets and among the early adopters of AI-generated programs.

This early adoption is not surprising, considering that the creative industries are characterized by constant change and the search for new tools that can facilitate material production and enhance its content. Since AI has undoubtedly become the most significant technology under development, this relationship emerges naturally.

Several industries, including film, music, literature, art, and design, have already embraced some form of AI technology. These industries have primarily utilized AI models to automate mechanical activities such as image editing, sound mixing, and video post-production. AI technology is also employed for data analysis, with certain models capable of analyzing large sets of data to make suggestions and identify preferences and trends.

However, despite the significant role that AI plays in the aforementioned activities, the most commonly associated creative activity with this technology is content creation. Numerous AI models have been launched for the creative industries, serving various purposes. One example of such a program is Lensa, a platform that can generate art pieces featuring an individual by inputting a relatively small sample of photos into the algorithm. Lensa is just one example among an extensive list of AI platforms currently revolutionizing the creative industries, including AudioLM, a model that transforms text into audio, and AlphaTensor, a program that creates algorithms.

Among the successful cases, it is essential to highlight OpenAI, a company founded in 2015 that has developed some of the most significant models to date. At the core of this company lies ChatGPT, a sophisticated software capable of providing detailed and elaborate responses to user prompts through a dialogue format. These responses can take various forms, ranging from elaborating on original texts to converting quotes into code or summarizing entire papers. Other notable models developed by OpenAI include DALL-E, a text-to-image model that can create photos from text prompts, and Jukebox, a model that generates beats in different styles. Additionally, it is worth noting that all

these models are freely accessible to users, which has contributed to the widespread use of AI among the public.

The following illustration depicts the most important AI models at the time of authoring this paper, categorized according to their purposes:

Figure 10: Most prolific AI models
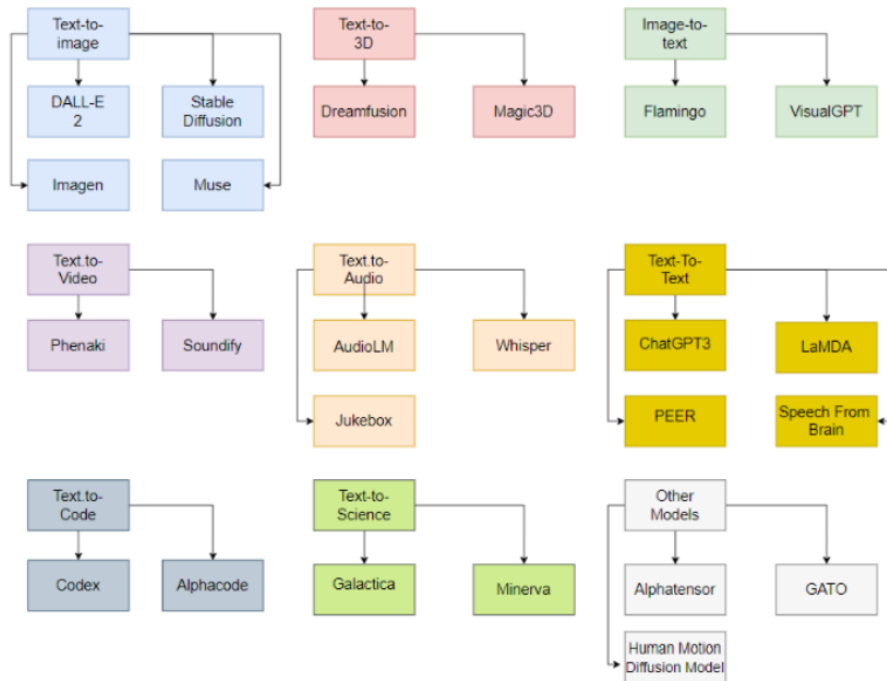
Source: Chat GPT is not all you need. A State-of-the-Art Review of large generative AI models. (2023) Pag. 3

By analyzing the previous image, several conclusions can be drawn. Firstly, the table highlights the extensive range of AI technology that is already capable of performing essential activities across nearly all creative industries. Secondly, it demonstrates a clear correlation between the creative industries and AI technology. This correlation is evident in the fact that the majority of developed and ongoing AI models are designed to facilitate creative activities. It can be argued that while AI is expected to revolutionize the creative industries, these industries also play a crucial role in driving the development of the technology itself.

4.2 Areas of Application

Despite AI being commonly associated with content creation, this technology is multifaceted and can be utilized in various stages of the creative process. The tasks performed by AI in the industry can be classified into three major areas based on the desired outcome: content creation, content enhancement, and content distribution.

In the **content creation** area, AI technology serves as a tool to generate new content across different creative fields. For example, an AI model trained on a vast collection of paintings could be used to create new pieces based on specific descriptions in a text-to-image model. AI can also be employed to create music, architectural plans, original stories, clothing designs, and more.

Within the creation area, AI models can serve different purposes. They can generate entirely new and original content or create content that resembles existing works. These models can also be used for inspiration, allowing AI to formulate ideas that can then be developed by humans.

The **content enhancement** area involves the use of AI models to edit or modify existing pieces to improve their quality. For instance, some AI models have been trained to detect background noise in audio recordings, enabling them to separate and extract the noise, resulting in a higher-quality track.

In the enhancement area, AI models primarily focus on replacing human work. Given that many tasks involving editing and post-production are repetitive and mechanical, there is a significant potential for automation in this area. AI can also analyze existing content to make suggestions for improvement or replacement.

Lastly, the **content distribution** area pertains to how AI can alter the way customers interact with finished products. A common application of AI in distribution, already experienced on numerous platforms, is recommendation algorithms. These AI models predict user preferences by analyzing their past actions on the platform, browsing history, location, and other parameters to offer a personalized experience to each user.

In conclusion, the broad scope of AI technology holds immense promise for the creative industries as it has the potential to transform every step of the content creation process, from inception to final consumption.

4.3 The Role of AI

As AI becomes increasingly involved in the creative industries, a debate has emerged regarding the role this innovative technology should play. The 2022 study 'Redefining Creativity in the Era of AI?' distinguishes two main perspectives based on the perception of the technology, trust in its capabilities, and willingness to rely on AI models. These perspectives are referred to as "independently creative AI" and "co-creative AI."

Image 1: Independently creative AI vs Co-creative AI
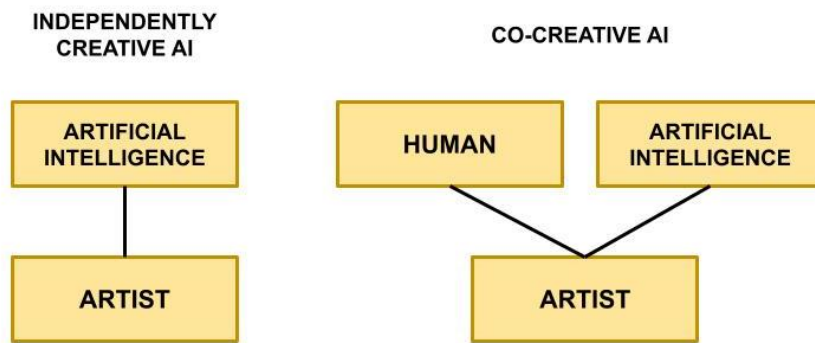
Source: Own elaboration

The supporters of the first perspective claim that the industries should fully embrace AI technology and allow it to become a self-managed creative entity capable of autonomously performing creative activities. According to this group, AI should evolve with the aim of imitating the human brain to the extent that it can eventually produce its own original creations without human guidance. An example of independently creative AI would be a tool capable of generating a video by itself, encompassing all the activities involved in the process, such as writing the script, recording, and editing, without the need for human assistance. Therefore, this group equates AI to artists, giving the same credit and value to the creative outcomes regardless of whether they are produced by a human or a model.

On the other side, supporters of the "co-creative AI" perspective argue that AI's role should be restricted to assisting human beings. This perspective views AI technology as a mere tool that humans can employ to complement their work by performing mechanical activities that do not require a creative mind. In this scenario, AI is not attributed full creativity but instead seen as a semi-creative entity capable of supporting human creativity with apparent limitations. This perspective is supported by research that has shown AI models can serve as inspiration to humans by providing innovative ideas. An example of this perspective would be a tool capable of editing imperfections out of videos, such as removing background noise or improving lighting, to enhance the original work created by a director. As a result, this group argues that AI should never become the main creative force behind a creative process but rather serve as an assistant to facilitate the work of humans. Therefore, co-creative AI is not viewed as an artist but as a creative partner under the supervision of an authentic human artist.

These two schools of thought can be found across all creative industries, with the co-creative perspective currently being dominating. Understanding these two perspectives

is crucial for this paper, as the predominant perspective will deeply influence how the creative industries approach AI in the future. However, despite the current dominance of the co-creative perspective, the new models being developed seem to lean towards the independently creative AI approach. Since the AI revolution is still in its initial stages, it is impossible to predict which perspective will ultimately prevail.[16]

4.4 The Scope of AI in the Creative Industries

The introduction of AI technology in the creative industries at a mass scale is fairly recent however it is growing at an impressive speed. The AI related market in media and entertainment was said to have reached $10.87 billion in 2021. This numbers are expected to grow at an annual rate of approximately 26.9% from 2022 to 2030 translating in $99.48 billion. Geographically this increased has been located mainly in the developed countries with the North America region accounting for 38% of the overall revenue related to AI models. This impressive raise in popularity can be highly attributed largely to the unique abilities of the technology namely virtual creation of media, composition of high-definition graphics and formation of real-time virtual worlds.

The area that has led this astronomic raise has been the service area. In 2021 services accounted for 59.2% of the AI market in the creative industries and this trend is said to continue with services expected to experience the fastest growth of AI usage in the sector. This trend can be attributed to the current lack of professionals specialized in the technology which forces corporations to hire external companies to fulfill their AI needs. Alongside with the service sector the hardware sector is experiencing the greatest expand in AI usage. This increase of AI in the segment is mainly motivated by the movie and TV sectors and the increasing complexity of their needs that require additional aid to be fulfilled. In this area AI is being implemented in motion capture workstation, virtual camera systems, simulation cameras, among others.[17]

Regarding the application, the sales and marketing areas dominated the sector in 2021, accounting for 21.7% of the revenue. The primary uses for this application include design, advertisement, and promotion. In addition to marketing and sales, the personalization segment has experienced significant growth in recent years, and this trend is expected to continue due to its relevance in content distribution and consumption in industries such

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[16] Information provided by Wingström, Hautala, and Lundman (2022)
[17] Data provided by Grand View Research (2021)

as music and on-demand TV content. Other prominent applications of AI include video production, automated spot production, and computer-generated graphics.

In the field of video production, AI is being utilized as a tool to automate repetitive tasks such as script breakdown, storyboarding, and scheduling, resulting in a substantial reduction of production costs. In the realm of automated sports production, the popularity of AI can be attributed to its high efficiency in live streaming, broadcasting, and analytical services. Finally, computer-generated graphics are being employed for cost and administrative purposes across several industries. Figure 11 depicts the main application for AI in 2021.

Figure 11: AI in the media and entertainment market
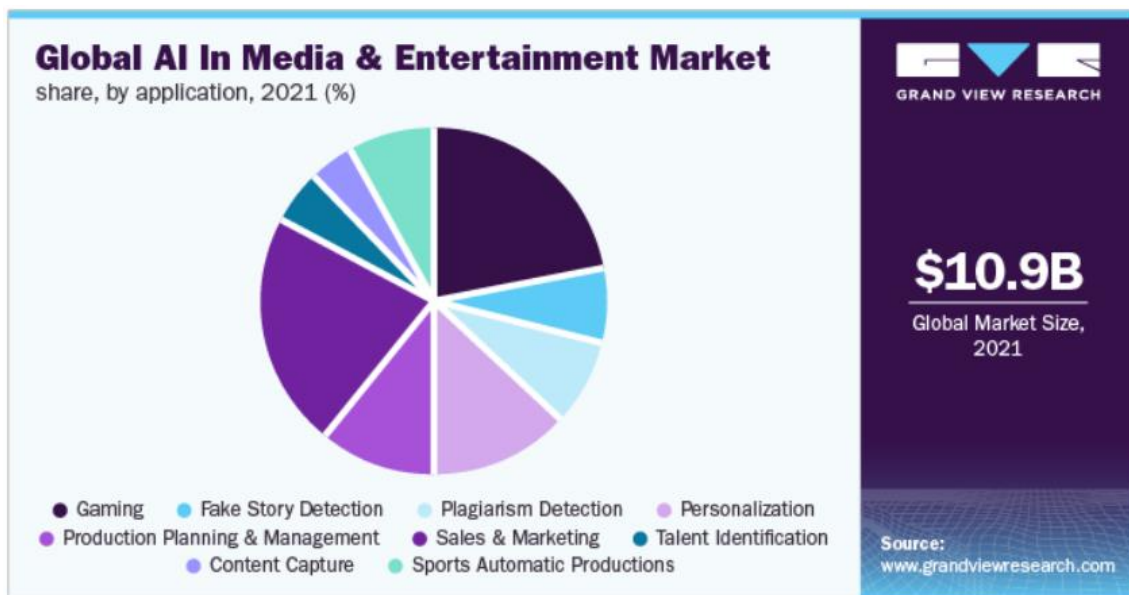
Source: AI In Media & Entertainment Market Size, Share & Trends Analysis Report By Solution (Hardware/Equipment, Services), By Application (Gaming, Personalization), And Segment Forecasts, 2022 – 2030. Grand View Research (2021)

## 4.5 AI Projects in the Creative Industries

In this section of the paper, several examples of AI projects developed by companies in various creative industries will be presented. The aim of this segment is to illustrate the diverse ways in which technology can be utilized by creative industries and the outcomes that such usage has produced for the companies.

One company that has embraced AI technology since its initial stages is Starbucks. The coffee corporation announced a strategic plan related to the use of AI in its operations

as early as 2016. The motivation behind adopting this technology was to enhance the company's ability to offer personalized content to its customers, a core aspect of Starbucks since its inception. The technology has been incorporated into the company's mobile app and loyalty card systems. By leveraging AI, the company has been able to collect and analyze customer data, including information such as the products purchased, the time of purchase, and the specific store where the transaction occurred.

Using this data and the predictive capabilities of AI, Starbucks can present personalized promotions to its customers based on their previous purchases, the time of day, and even their physical location. This allows for exclusive offers to be made when individuals are in proximity to one of their establishments. Additionally, AI technology serves as a virtual assistant in the Starbucks app, facilitating the placement of online orders. While specific numbers have not been disclosed, these combined actions are reported to have increased sales and provided valuable data for recommending new store locations.

Image 2: Services offered by Starbuck's AI powered app
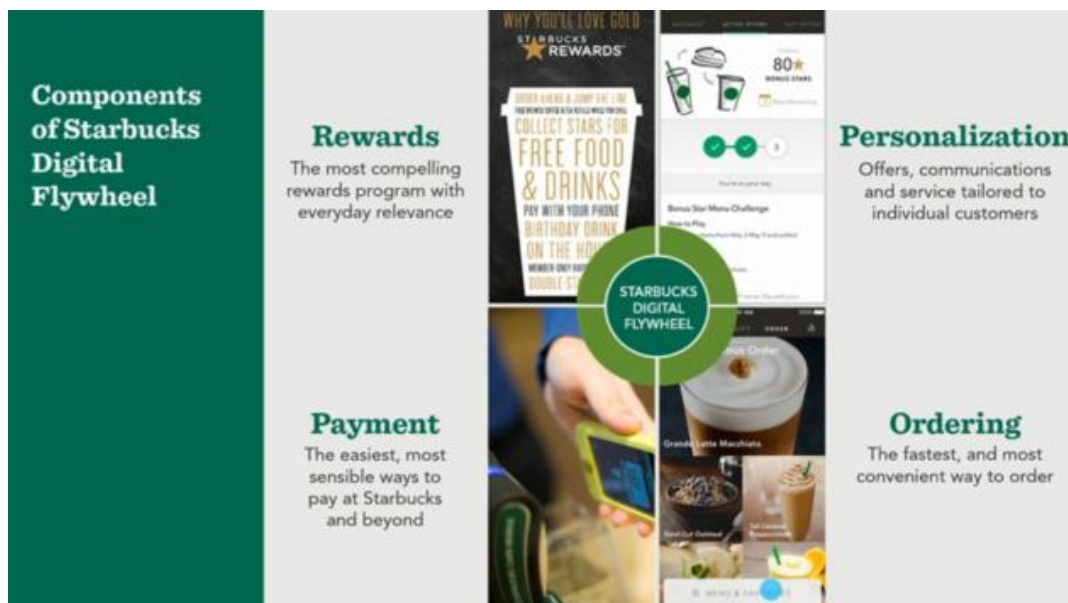
Sources: How Starbucks is using artificial intelligence to connect with customers and boost sales. GeekWire (2016)

Another company that decided to utilize AI technology to personalize their content is Nutella. In 2017, the company announced their project called 'Nutella Unica.' This project involved the use of an image generating model to create unique designs for each jar of Nutella. By employing AI, the company was able to generate no less than seven million different versions of their iconic jar throughout the project's duration.

The Nutella Unica project was a resounding success. Nutella disclosed that the project generated over three million social media posts and 10,000 customer-created videos.

Within the month that the project was active, Nutella sold approximately seven million jars. Overall, the project garnered significant attention for the brand and revitalized its image among customers. This project exemplifies how the integration of AI in a creative manner can greatly benefit a company. In this case, a project of such scale could never be achieved by a traditional design team due to time and physical limitations. However, unlike human employees, the AI model can produce countless packaging designs following a set of predefined rules without compromising creativity[18].

It is worth noting that the AI model did not operate fully autonomously; it worked under the guidance of a qualified design team who oversaw the quality and appropriateness of the artwork.

Image 3: Sample of Nutella jars created by an AI

Source: Nutella's Unique Product Now Comes in 7 Million Unique Jars. Adweek.

Another industry that has wholeheartedly embraced AI technology is the architecture industry, and one company that exemplifies this embrace is the renowned Zaha Hadid Architects studio. Patrik Schumacher, the principal of the studio, has openly discussed the use and integration of AI models within the company. Schumacher specifically highlighted text-to-image models such as DALL-E2 and Midjourney. According to his statements, the company actively encourages its employees to utilize these models for gathering inspiration and outlining the foundations of new projects.

While not all current projects of the company have been developed using AI technology, the number of projects employing such technology is increasing and already represents

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[18] Data and inforamation provided by Ogilvy Italia (2017)

the majority. One notable project that specifically utilized AI for its development is the design of the planned city, Neom, intended to be constructed in Saudi Arabia. The city is envisioned as a contemporary model for future cities, featuring modern and abstract architecture. To align with the futuristic vision of the city the studio created several renders using AI technology. Approximately 15 percent of these renders were selected to be further developed into potential future buildings. The initial renderings were also presented in their raw form to the project's promoters before any alterations were made by the architects. While the outcome of this specific project is yet to be seen, the studio claims to have already constructed several successful buildings using this technique, albeit with the input and corrections from their employees.[19]

The company also commended the capacity of these models to generate designs that resemble a certain style, enabling the company to maintain its unique visual identity by producing results that harmonize with their previous works.

Image 4: Footage of the model DALL-E presented by Zaha Hadid Architects
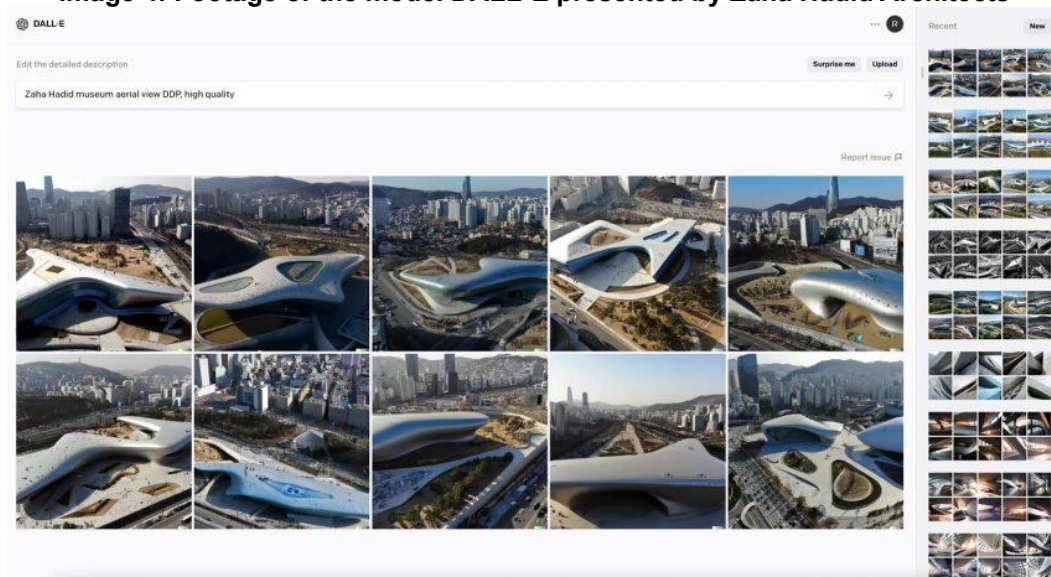
Source: HA developing "most" projects using AI-generated images says Patrik Schumacher. Dezeen. (2023)

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[19] Data and information provided by Barker (2023)

5. CASE STUDY: AI IN THE MUSIC INDUSTRY

5.1 Overview of the Music Industry

The music industry is a broad term that encompasses all the companies and businesses whose main aim is to create, record, produce, and distribute music. This industry is complex and dynamic, including a wide range of activities such as music publishing, record labels, live music events, and merchandising. Given the variety of roles encountered in the music industry, it could be argued that the term serves as an umbrella to unite several sub-industries that differ in nature but are united by their focus on music. Some of the sub-industries within the sector include recording, digital music distribution, music streaming, live performances and touring, licensing and synchronization, artist management, music publishing, and radio industries, among others.

The roots of the formal music industry can be traced back to the late 1800s with the establishment of the first music labels, Columbia and Victor, and the invention of the phonograph and records. These innovations allowed music to be recorded and played for the first time without the need for live performances. Over the years, the music sector has evolved to adapt to new trends and technologies to maintain its relevance. Since its foundation, the industry has continued to grow, transforming into one of the most significant and widespread creative industries monetary and cultural terms.

Throughout its existence, the industry has experimented with various formats, including vinyl, cassette tapes, CDs, digital downloads, and on-demand streaming. Currently, streaming dominates the sector, accounting for approximately 65% of global music revenue. Specifically, 47.7% of the revenue comes from subscription audio streams, 17.7% from ad-supported streams, and 19.2% from physical sales. These figures exemplify the profound changes that the industry has undergone since its origins when physical sales accounted for most of the revenue generated by companies and artists.[20]

During the 20th century, the music industry experienced almost continuous growth, with only brief interruptions caused by the world wars. However, the trend shifted with the onset of the 21st century, as technological advancements emerged that ended up harming the sector. Total music revenue declined from $24.4 billion in 2021 to $14.8 billion in 2011, primarily due to changing consumer preferences and the rise of piracy facilitated by the widespread use of computers.

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[20] Data provided by McCain (2023)

Despite the decline experienced in the first decade of the century, the industry managed to recover and has since surpassed the revenue figures recorded in 2001. Although it is challenging to provide exact numbers, it is projected that in 2022, the music industry reached a total worth of USD $26.2 billion. These numbers are expected to experience a compound annual growth rate of 8.5% during the period between 2021 and 2026. [21] The following graph exemplifies the revenue flow during the last decades:

Figure 12: Global recorded music revenue from 1999 to 2018, billion U.S. dollars
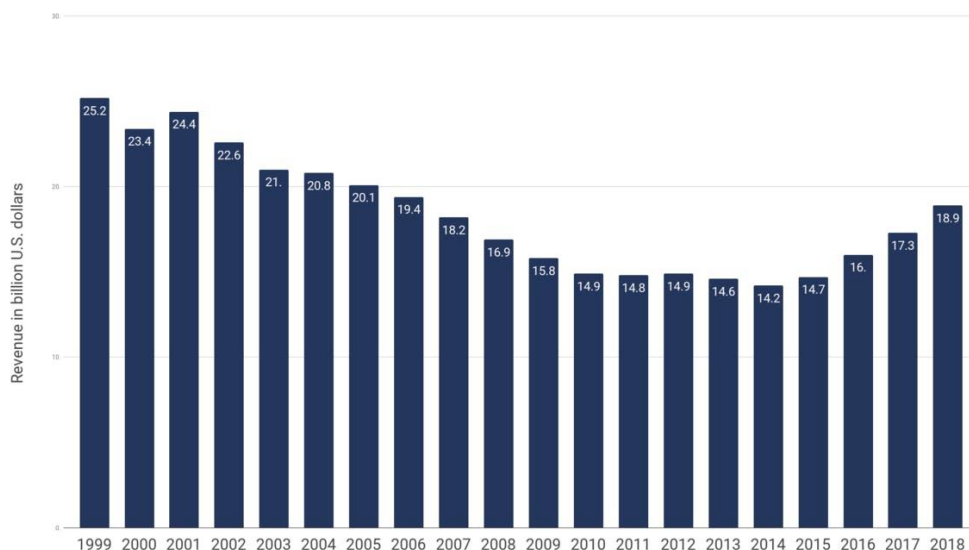
Source: How Does the Music Industry Work? Introducing the Mechanics: A 10 Part Series (2019)

The music industry can be divided into three main groups. Firstly, there are the singers, songwriters, and producers who participate in the creation and performance of the music. The second group consists of customer-facing roles, which include streaming platforms, venues, and public platforms such as radio stations. Lastly, there are labels, managers, publicists, Performing Rights Organizations, distributors, and booking agents, among others, who perform business activities and function as a connection between the aforementioned groups.

The current state of instability, driven by rapid changes in customers' needs and the introduction of revolutionary technologies like AI, is forcing the industry to evolve at an unprecedented pace. Despite the challenges it faces, the sector has demonstrated resilience in the past, which provides a positive outlook for the future. However, the success the industry will achieve in the coming years will ultimately be determined by how it approaches this new era and all the changes it entails.

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[21] Data provided by Patsukhov (2019)

5.2 AI in the Music Industry

Many industries are currently experiencing the initial impacts of the adoption of AI, and the music industry is no exception. In fact, the music industry has had a long-standing relationship with this technology. One notable example is autotune, a software that allows producers to modify musical pieces. While autotune may not qualify as an AI model due to its limited decision-making capabilities, it does employ certain degrees of automation and machine learning algorithms, making it an early precursor to this technology. The utilization of such models has paved the way for the music industry to be an early adopter of AI. Despite this connection, the use of newer and more sophisticated AI models is predicted to completely revolutionize the music production process.

Developing AI models specifically tailored to the music industry has proven to be a challenging endeavor. One of the most significant challenges faced by developers in creating such models is managing high temporal resolution and long-term structures. Overcoming this complexity has required leveraging the knowledge gained from developing software for other fields, such as speech and language processing. Despite the challenges, notable progress has been made in the development of models related to music production, editing, distribution, consumption, and copyright protection.

Content production

When it comes to production, the process of creating a model capable of producing music starts with compiling a dataset of different audio files, all belonging to a certain style or artist, so that the software can analyze them. The underlying idea is that by feeding similar music to the algorithm, it will be able to recognize common patterns such as chord progressions, melodies, and rhythms. This process of recognition would be significantly more difficult if each of the entries fed to the AI belonged to different genres.

The main method used for music creation is called GAN, which stands for Generative Adversarial Networks. This method employs two networks: the generator and the discriminator, in different steps of the process. With the information compiled from the samples, the generator can generate an estimate of how these pieces are composed to replicate the pattern in newly created compositions. Once the piece is generated, it is handed to the discriminator, which determines if the creation is similar enough to the original database. While this technology is not inherently recent, it has not been until

recently that the models have reached a sufficient level of sophistication to be used in music production, in part due to the changing view of the music industry towards AI.[22]

Another approach of these models is melody generation. This maintains the need for large databases; however, the distinction is that the AI generates new melodies instead of fully fleshed tracks. These models have proven to be capable of generating unique melodies; however, since the outcomes they offer are not complete tracks, they require the usage of composers to fully finish the products. As a result, these models are currently being employed as sources of inspiration instead of fully automated creators.

Music models have also taken inspiration from models created for other fields, particularly style transfer models currently used in the visual industries. These models use already existing works of art and transform them to match a different style. While the new creation cannot be considered completely novel since it retains attributes of the original source, the level of differentiation from the original makes it be perceived as one. An example of the application of these models in the music industry would be the transformation of orchestral tracks into rock songs or jazz melodies into R&B pieces.[23]

These mainly generative models have proven successful when creating temporally structured music and orchestration. However, more research is needed regarding emulating more complex aspects of music, such as timbre. Currently, the available models are greatly dependent on sampling to generate their new pieces. Several models have already been developed that can generate new tracks without the usage of sampling; however, the success achieved by each of them has been varied.

Image 5: Sampling methods used by the model Jukebox

Encode using CNNs
(convolutional neural
networks)
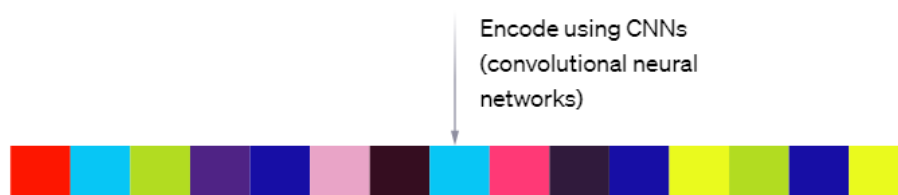
Compressed audio 344 samples per second, where each sample is 1 of 2048 possible vocab tokens

Source: Open AI. *Jukebox* (2020)

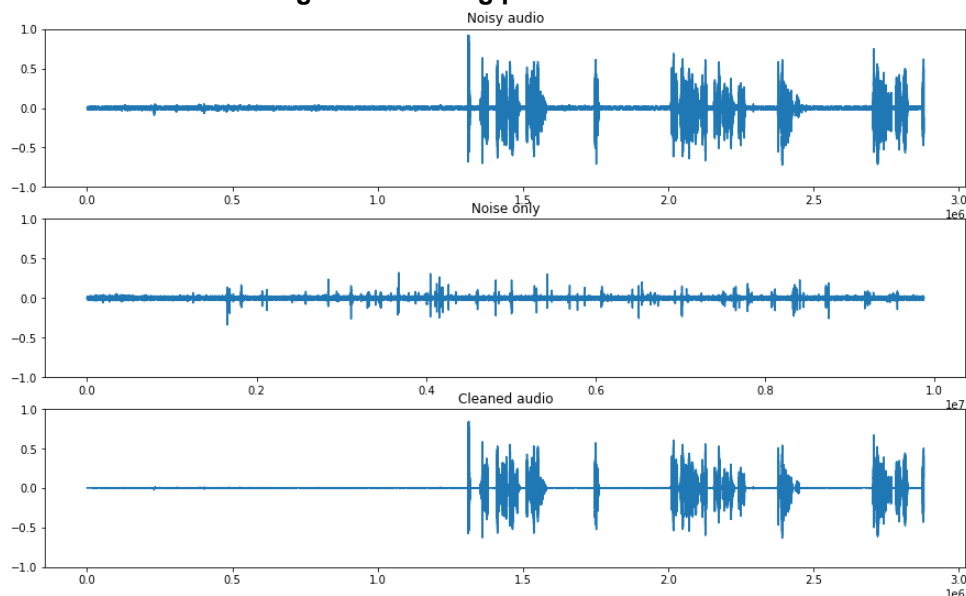[22] Information provided by Gross (2022)
[23] Information provided by Wiggers, and Silberling (2022)

Content enhancement

While AI is still a minor part of the content creation aspect of the industry, the technology has already proven handy in the enhancement department. One of the main utilities found for AI in the industry is none other than the repurposing of old tracks. As recording technology has improved over the years, so has the quality of recordings. Producers have long tried to salvage old audio recordings, mainly from the 20th century, which are often noisy, band-limited, and only available as mono tracks due to the outdated technology used for their production. AI technology, such as demixing, can be used to enhance the quality of these audios and make them as appealing and professional sounding as their modern counterparts. This technology involves separating the tracks into different audio components so that individual sounds can be used in new recordings. Researchers have been investigating this problem for over twenty years, and AI demixing technology has been able to provide a solution.[24]

Audio mastering and noise reduction are other applications where AI is used. Audio mastering involves the final processing of a music track to improve its overall sound quality. Several AI models can analyze the frequency response and dynamics of a track to optimize it for different playback environments. Regarding noise reduction, AI models are capable of separating and processing the different elements present in a track. As a result, they can discern and eliminate unwanted noises that decrease the audio quality.

Image 6*: Denoising process of a track*

Source: Audio Denoiser: A Speech Enhancement Deep Learning Model (2022)

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[24] Information provided by Amato, Behrmann, Bimbot, Caramiaux, Falchi, Garcia. and Vincent

AI models also have the potential to revolutionize the way music is recorded in studios. Until recently, to obtain high-quality recordings, musicians had to record their parts individually in the studio to mitigate the acoustic interference produced during the recording process. While this technique was effective in reducing interferences, it greatly hampered the creativity that arises during recording. AI, with its signal recognition capabilities, is said to reverse this trend by allowing musicians to record all the pieces that make up a track simultaneously, enabling the processing of several signals at once. This would significantly reduce the time needed to record a track and, consequently, reduce the generally high costs associated with this activity. Additionally, it would simplify the editing process by eliminating the need to mix different tracks.

Overall, AI technology has the potential to simplify the way tracks are mixed and edited. Thanks to its ability to recognize patterns, AI is capable of interpreting audio signals and making suggestions for appropriate methods of mastering and mixing the tracks. By doing this, AI could potentially automate the post-production process, which is currently the most labor-intensive and time-consuming aspect of the industry. This would allow artists to focus exclusively on the more creative activities.

Content distribution and consumption

AI technology has also been highly integrated into the distribution and consumption aspect of the music industry. In fact, it could be argued that this area is where AI has achieved the most significant advancements. This claim stems from the successful incorporation of AI into the recommendation systems of various online music stores and streaming sites, such as Spotify, Tidal, and Apple, among others. While recommendation systems capable of suggesting content to users based on their previous selections already existed before the inclusion of AI on these platforms, they were limited to handcrafted methods. Now, AI has automated and expanded these systems. However, acquiring users' information and preferences still poses a challenge in moving beyond implicit mechanisms.

Another area of music consumption where AI has been implemented is in new intelligent speakers. These devices, despite resembling their traditional counterparts, are equipped with AI technology that enables them to perform special features that traditional speakers could never achieve. Most of these features allow the user to have unprecedented control over the audio, such as activating user-specific passive noise cancelling. While still limited in their real-time performance capabilities, new features for this type of technology could potentially be developed, such as incorporating the aforementioned

demixing technology to allow users to mute the vocals in a song and turn it into a karaoke experience.[25]

Content Protection

Lastly, one of the areas of the music industry where the use of AI has been highly beneficial is in content protection. Due to its pattern recognition capabilities, AI is widely implemented to identify and flag unauthorized usage of copyrighted content. Algorithms in music streaming services analyze audio signals to detect the source material and compare it to a database of copyrighted content to search for similarities. If the analyzed audio coincides with a registered track, the models can flag the content and inform the affected parties about the misuse.

The same models used by streaming services can also be utilized for different purposes, such as detecting the distribution of illegal content by scanning different networks and searching for copyrighted content being shared without permission. This is done through a process called watermarking. A watermark is a unique identifier added to the digital signal of an audio that allows it to be tracked, enabling the detection of any unauthorized use. The AI models can extract the watermark from the audio and provide a comprehensive record of its usage. The outcomes of these processes can range from the removal of unauthorized content to the initiation of legal measures to protect the revenue and rights of the artists.[26]

Additionally, some AI models have been developed to automate the process of royalty collection. Royalties are the revenues generated by songs and other artistic works through their consumption, and they are often the main source of income for artists. The usage of AI models, combined with data provided from authorized usage of the content, help calculate and collect the necessary payments. The introduction of AI in the royalty collection process reduces time and costs while eliminating human error, making the process more efficient and reliable.

As a final remark, it is important to mention that while AI can generate positive effects for artists by protecting their rights and sources of income, it also has the potential to be misused and cause harm to the same artists. An example of this paradox is observed in the visual arts industry, where several models are being developed to track the wrongful usage of watermarked content, while other models aim to remove the watermark to make

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[25] Information provided by Anantrasirichai, and Bull (2022)
[26] Information provided by Robinson (2022)

the stolen content unidentifiable. Therefore, the final impact of AI on the protection of artists and their rights will be determined by the way the technology is applied.

5.3 AI Models for the Music Industry

The list of AI models targeting the music industry is rapidly expanding. This section will present several of the most influential and successful models that target the industry.

Regarding music creation, the most prolific AI model is Jukebox, created by OpenAI. Jukebox is a neural network developed to produce music in a range of genres and styles, including rudimentary singing. Unlike most text-to-audio models that generate symbolic audio in the form of a piano-roll, Jukebox challenges this approach by directly composing audio as sound waves, eliminating the need for further processing or manipulation. This feature allows Jukebox to shift from a sample-based method to a signal-based one.

To train the AI, over 1.2 million songs were fed into the model. In addition to the songs, the developers provided lyrics and metadata such as the artist, album genre, year of composition, and keywords. This additional information provides the model with a deeper understanding of the audio. Currently, Jukebox can create music in several styles, including rock, jazz, hip-hop, reggae, country, soundtrack, R&B, pop, classical, blues, and soul. The AI allows users to generate unique music that does not resemble any previous work, as well as music that imitates the style and genre of already published songs and artists. [27]

Image 7: Jukebox Sample Explorer

Source: Open AI. Jukebox (2020)

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[27] Information extracted from Open AI (2020)

Despite its early success, the Jukebox model still presents noticeable gaps when compared to human-composed music. Firstly, the model's database mainly consists of Western songs with English lyrics. As a result, Jukebox is only capable of composing lyrics in English, and the songs it creates have an overwhelmingly Western flavor. Additionally, the model is unable to recreate the natural structure of a song, lacking distinctive parts such as choruses that commonly repeat several times throughout a song. Lastly, the model is not time-efficient, taking an average of 9 hours to create a minute of novel content.

Google is another prominent corporation that has also entered the text-to-audio trend by developing two different models: AudioLM and MusicLM. The company's goal with these models is to generate long-term, consistent, high-quality audio. Google takes a unique approach by mapping the input audio into a sequence of discrete tokens and casting audio generation as a language modeling task in this representation space, which sets it apart from its competitors. AudioLM was trained on a large corpus of raw audio waveforms and can generate natural and coherent audio continuations by receiving short prompts. The model combines recent advancements in self-supervised representation learning, audio compression, and language modeling to produce high-quality audio that exhibits consistency. Originally conceived to generate human-like speech, this approach has been successfully expanded to generate piano music, even though the algorithm was not trained using music as an input.[28]

On the other hand, MusicLM was trained on over 280,000 hours of sourced music from the MuLan database alongside a public accessibility that allowed internet users to contribute by uploading short music clips. As of early 2023, Google had received over 5,500 clips. The model has succeeded in creating 5-minute-long audio clips that match the original source in a mere 1%, making them novel compositions. However, despite experts regarding its instrumental creations as high-quality, the company is still struggling to emulate the human voice. The vocals that MusicLM currently produces are described as low quality and barely intelligible. Additionally, similar to Jukebox, the model faces challenges in replicating traditional song structures.[29]

Recently, a study was conducted to assess the effectiveness of AudioLM in creating audio that closely resembles authentic human speech. The study involved exposing short audio samples to over one thousand individuals who had to determining whether each sample was created by humans or by AudioLM. The results of the study indicated

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[28] Information provided by Borsos, and Zeghidour (2022)
[29] Data extracted from Houser (2023)

a success rate of 51.2%. It is important to note that this rate is statistically similar to the expected success rate of 50%, which would be achieved by randomly assigning responses. Consequently, the study concluded that AudioLM does produce high-quality audio that is challenging to differentiate for the average listener.[30]

Another example of successful music-generating AI is Flow Machines, a model developed by Sony. This model works similarly to Jukebox; it utilizes a large database of songs from the same genre to extract patterns and generate new tracks that adhere to these patterns. Notably, the model was developed by engineers in collaboration with actual musicians, resulting in a design that perfectly caters to the needs of its target audience. The outcome of this partnership is a model that functions more like an AI assistant for musicians rather than an individual creator. The model's main appeal lies in its ability to compose eight-bar melodies based on the preferred chord progressions and basslines of the musicians. Additionally, the model incorporates adjustable parameters such as note duration and melodic complexity, allowing it to adapt to the artists' demands. The audio can be regenerated and modified as many times as necessary to establish a foundation upon which the artists can build. Sony envisioned the assistant to feel like a fellow co-writer, and to achieve this, they endowed Flow Machines with an individual persona capable of reasoning and communicating with the artist, emulating the sensation of co-writing with a colleague. The model's layout and design are simple and intuitive, facilitating workflow and easing the onboarding process for new musicians. What sets Flow Machines apart from other models is its ability to combine genres and generate unique tracks.

While quality in a track is not solely achieved during the composition stage, AI models have been developed to simplify the post-editing and enhancement process. One such algorithm is LANDR, a mastering software that can analyze an audio file within minutes and apply a series of mastering techniques to enhance its quality. The model employs machine learning to recreate the editing process performed by mastering engineers on raw audio. LANDR incorporates software that listens to music and responds by making subtle, frame-by-frame adjustments using micro-genre detection. It utilizes various tools including multi-band compression, EQ, stereo enhancement, limiting, and harmonic saturation, tailoring adjustments based on the unique characteristics of the track. Additionally, LANDR includes a mode where users can upload the track they wish to master, along with a maximum of three polished tracks, to extract the editing characteristics and apply them to the raw track. Currently, the model is capable of

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[30] Data provided by Borsos, and Zeghidour (2022)

handling various music genres, ranging from soft acoustics to electric EDM, as well as voice-based content such as audiobooks and podcasts. Although it cannot fully emulate professional mixing, the model has garnered praise for its performance. It is particularly renowned among small and independent artists, providing them with an affordable and easily controllable tool for producing high-quality tracks without relying on expensive mixing engineer teams.

AI technology is not only advancing in content creation and production but also in other areas of the music industry, such as managerial roles. The ability to produce high-quality music does not guarantee success in the industry, as factors like music trends and customer behavior often have a greater impact than the product itself. HITLAB, a data processing company, aims to address these factors with its innovative model. Developed through machine learning, their model analyzes songs to detect their potential to become hits. It assesses each song using eighty-four different mathematical parameters that purportedly predict the track's success. These parameters are derived from historical databases that include both successful and unsuccessful songs released after 2007, allowing for the extraction of common patterns. The model is continuously updated with new charts to align with current trends and trained on datasets from different regions to predict the track's success potential in various markets. While the accuracy of the predictions is still debated, the company has demonstrated its ability to provide significantly accurate results.[31]

Despite the notable cases of success, AI technology in the music industry is still in its infancy. This can be attributed to the inherent complexity of music, which is highly structured, as well as the limited availability of extensive archives to feed into the algorithms. Developers are currently working to address these challenges with the aim of creating a model that can potentially generate music autonomously, reducing the reliance on extensive sampling.

5.4 Music Projects Involving AI

This section of the paper focuses on presenting real examples of how various companies in the music industry implement AI technology in their operations.

One prominent company that has been integrating AI into its operations is the popular music streaming platform, Spotify. The company initially introduced AI technology in 2013

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[31] Information provided by Moore (2022)

when it acquired Tunigo to enhance its music recommendation algorithms. Since then, Spotify has continued acquiring AI-related companies, including Echo Nest (a music intelligence company), Seed Scientific (a data science corporation), Sonalytic (specializing in machine learning for audio detection and recommendation), Niland (an AI startup with a music search algorithm), and Sonantic (a text-to-speech model). With these AI companies under its umbrella, Spotify has made AI a cornerstone of its operations, influencing various aspects of the platform.

One area where the impact of AI is most evident is content recommendation. Spotify leverages user data from listening history, playlist creation, and overall platform interactions to generate personalized recommendations. The goal is to continuously enhance user satisfaction and engagement, encouraging users to return to the app regularly and fostering loyalty. These recommendations manifest as hyper-personalized playlists that are tailored to each user and change daily. While other music streaming companies also utilize AI technology for recommendations, Spotify's proficiency and sophistication in its implementation have set it apart from its competitors, making AI-powered recommendations its main competitive advantage. The company emphasizes this by asserting that there is not just one Spotify, but 433 million versions, each exclusively accessible to one individual customer.

In addition to recommendations, Spotify employs AI in its search engine. The platform currently utilizes AI-powered natural language processing (NLP) to deliver accurate search results to users. What distinguishes this technology from its predecessors is its ability to comprehend the semantic correlation between words, including synonyms and paraphrases. This enables the platform to provide accurate results even when the search query does not precisely match the desired outcome. Furthermore, Spotify employs AI audio detection capabilities, allowing users to identify songs that are playing and add them to their playlists.[32]

Another company that has achieved significant success with the use of AI is the Luxembourgish start-up, AIVA. The project was initially announced in 2016 with the objective of developing a composition tool and has received financial support from the EU since its inception as seen in Figure 13. This backing from the European institution has enabled AIVA to conduct a feasibility study involving game developers. The study involved gathering and analyzing market data, as well as tracking usage analytics of their existing product, to further enhance its development.

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[32] Information provided by Kaput (2022)

Figure 13: EU investment in AIVA

Source: AI composers create music for video games (2020)

The AIVA model was trained using over 30,000 pieces of classical music composed by history's greatest composers. By analyzing this input, the model deduced a series of mathematical rules that are employed to generate unique compositions. This system has proven to be time-efficient and capable of producing tracks on a large scale. Currently, the model can generate one piece of music in just a few minutes, facilitating the mass production of tracks. Additionally, the system operates at a relatively low cost, presenting a competitive alternative to traditional soundtrack production teams. These teams often require up to six months to produce a full set of tracks, with costs typically exceeding 500,000 euros.

With its original approach, AIVA has already completed several successful projects. The first project that the company launched to the public was the release of the song "Genesis." This classical-inspired track garnered countless praises for its high quality and originality, helping to establish a foundation for future projects. The first major project undertaken by AIVA was the production of a piece for the National Day celebration in Luxembourg in 2017. The track, named "Letz Make It Happen", was performed by live orchestras and choirs on the festive day. However, despite the praise received from the public, it also generated discomfort among the country's musicians. Despite the controversy, the company unveiled its second project in the same year, this time being a collaborative song for the city of Dubai. The 18th century-inspired track "Ode to Dubai" was first presented at the Future Technology Week, becoming the first AI-composed theme song for a city. After this series of successful projects, the company has become a major name in soundtrack production, being utilized by Nvidia, TED, Animo Television, and several Netflix shows, among others. The company has also recorded songs in renowned places such as the Newman Scoring Stage in Los Angeles. [33]

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[33] Information extracted from CORDIS (2020)

AIVA is also renowned for being the first AI to be officially recognized as a composer by SACEM, the French and Luxembourgish society for authors' rights, in 2017. This significant milestone means that AIVA is capable of releasing music under its own name and receiving protection for its compositions, thus being treated as a genuine author.

AI usage is not restricted to large corporations; indeed, the technology has found great support among independent artists. Taryn Southern is an example of a smaller artist who has used AI-generated music with remarkable success. In 2018, Southern released her album named "I AM AI," becoming the first album composed and produced with AI released by a solo artist. The album consists of eight tracks in which the artist explores the existing relationship between humans and machines and the future it entails. Several models were used during the process, including IBM's Watson Beat, AIVA, and Google Magenta for notation, and Amper for instrumentation. The outputs of these models were combined with Southern's lyricism, as well as mixing and mastering by professional editors. The project achieved significant accomplishments for the artist, including four million streams for the main single "Break Free," peaking at number 48 on the Mediabase Indicator radio chart in 2018, and receiving positive reviews from critics who described the project as a fascinating experiment. [34]

The list of projects developed using AI in the industry is much more extensive and includes numerous cases of success. However, the projects created with the technology in the broader industry are still relatively scarce compared to the massive scale of the global music industry. The aforementioned projects provide a glimpse of what the music industry could potentially become if AI technology were fully incorporated into its operations. The impact could extend beyond music composition to encompass fully automated artists capable of producing, editing, releasing, and promoting their tracks. While several virtual artists have been created for this purpose, none of them currently operate without significant human intervention. Nonetheless, the increasing number of AI projects within the industry may signify that the presence of AI-generated content in the sector is poised to expand.

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[34] Information provided by Southern (2018)

5.5 Impact and Future of AI in the Music Industry

As demonstrated in this thesis, AI models targeting the music industry are still in their infancy, presenting numerous challenges that developers must overcome for the technology to become a staple in the sector. Although developers are actively addressing most of these problems, the complexity of music production poses a significant hurdle.

Despite these challenges, developers are currently on a promising path towards solving most of these issues, making the possibility of an AI-dominated industry more likely than ever. Naturally, the consequences of large-scale AI implementation remain unknown, but by utilizing the information presented in previous sections, some speculation can be formulated on both the positive impact and drawbacks it may bring to the industry.

Beginning with the positive aspects, AI is expected to enhance the overall efficiency of the industry. This efficiency improvement could be observed throughout various stages of the production process. Firstly, intelligent models have already demonstrated their utility in audio editing. Some already developed models can enhance track quality by removing background noises, adjusting signals, or modifying recording tones. Although these systems are not fully developed and require some degree of human assistance to perform their tasks effectively, the rapid evolution of these models makes the automation of the costly and labor-intensive post-production process plausible, resulting in cost and time savings.

The efficiency effect could also extend to the creative department. AI models can generate new sounds from scratch, providing inspiration for artists and expediting the composition process. Moreover, these models can produce innovative sounds by blending different styles. This has the potential to revolutionize the industry by showcasing new styles and completely altering consumer preferences. It is understood that this could enhance the overall industry by making it more diverse and personalized.

AI technology can also be applied to the managerial side of the sector. For example, specific sound identification models could serve as copyright detectors, scanning the internet to identify unauthorized usage of copyrighted content. By doing so, these models could save significant revenue for companies and artists by reducing and preventing piracy.[35]

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[35] Information provided by Scambler (2023)

Behavioral prediction models can be utilized to detect market trends. The same models used to provide recommendations to users on streaming services can be employed by artists and companies to gather information about market fluctuations. This data can be used to identify popular styles, predict future trends, and determine the type of music that companies should produce to maximize profit. These models can also analyze the success of marketing strategies and offer recommendations, such as identifying the less active times of the day to avoid when releasing new music. Additionally, these tools can aid marketing campaigns for live events by predicting ticket demand, identifying the areas with the highest demand, and determining peak periods. This information can assist music companies in planning their live performances and tours more effectively by selecting appropriate venues in profitable locations with optimal capacity.

By utilizing the aforementioned tools, companies have the potential to significantly reduce costs. However, it is indie artists who could benefit the most from these advantages. As mentioned in the introduction of this section, the music industry is currently dominated by big corporations which creates an imbalance of opportunities between artists signed to music labels and those operating independently. The implementation of AI has the potential to radically change the industry's model by making it more accessible to indie artists. With the use of AI, independent musicians could access to production, marketing, and protection strategies of equivalent quality to those provided by music labels, but without incurring enormous costs. AI models, which are potentially more affordable than traditional methods, can help the indie scene flourish and fundamentally transform the foundations of the industry.

Furthermore, while this section primarily focuses on audio-related AI models, the music industry can also benefit from models focused on different art forms. For example, image generation models can be used to create album cover illustrations, fashion design models can design personalized outfits for live events, video generation models can be employed to produce music videos (which are known for their high costs), and design models can create distinct aesthetics with specific colors, visuals, and logos for marketing and promotion strategies to differentiate artists. [36]

These are just a few notable potential benefits that AI technology presents for the music industry. Collectively, they have the potential to make the industry more diverse and accessible than ever before. However, despite these advantages, concerns about the

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[36] Information provided by Macaulay (2021)

use of AI models within the industry are increasing. This can be attributed to the high cost associated with AI and the fear that the drawbacks may outweigh its positive impact.

One major concern regarding the implementation of AI is its effect on creativity. Music has been an integral part of human culture for approximately 3,400 years. Throughout history, music has been used to convey stories, evoke emotions, and foster cultural unity. Therefore, entrusting such a creatively human activity to technology raises concerns about its potential impact not only on the music industry but also on society. This fear is amplified by the knowledge that AI often exhibits biases. The training systems used for these models can cause algorithms to favor the styles they have been predominantly trained on, leading to AI-produced content that aligns with those genres' patterns and tropes. If developers are unable to mitigate the bias in these models, it could result in a highly standardized music scene where AI-generated and edited content sounds similar, ultimately eroding the inherent diversity of music.

Concerns also arise regarding the quality of AI-generated pieces. While several models have already been developed, the quality of their creations is highly debated, with a sizable portion of the industry arguing that they lack "soul" or do not feel like real music.[37] It is undeniable that current technology still needs to evolve to fully replicate human creations. Whether developers can achieve a level of humanity in their models remains to be seen. If this perspective continues to gain traction, it could lead to the rejection of the technology within the industry, potentially slowing its adoption.

Another crucial point to address is the impact of AI technology on employment in the music industry. Whether AI adopts a co-creative or independently creative perspective, the consequences for employment could be devastating. Automating activities such as content editing and protection using AI could lead to significant job displacement, resulting in the elimination of numerous positions across the industry. While this reduction in costs may be advantageous for companies, it would also lead to a human crisis. Moreover, the remaining employees would need to undergo a challenging process of adapting to the new industry paradigm.

Additionally, to fully collect the benefits mentioned earlier, the industry would need to undergo a comprehensive and costly transformation. While AI could potentially reduce operating costs in the long term, companies would initially face high costs associated

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[37] Information provided by Ricci (2020)

with adapting their current operational techniques, including training employees in the use of AI technology, and adjusting existing facilities.

As evident, the inclusion of AI in the music industry would have diverse effects. Consequently, compelling arguments can be made both in favor of and against the introduction of this technology. However, with the continuous improvement of AI models and the growing interest of the public in this technology, the usage of AI is expected to significantly increase in the coming years. This is supported by the recent popularity of models like Jukebox and the constant pressure that the market exerts on companies and artists to innovate and deliver new, original content.

The overall impact of this phenomenon will primarily depend on how companies choose to incorporate AI, public perception and acceptance, regulatory measures implemented by authorities, and the capabilities of developers. The future will ultimately reveal whether the music industry can harness the potential benefits presented by AI technology or if the drawbacks will result in a less original and impersonal industry.

6. THE CREATIVE INDUSTRIES IN THE ERA OF AI

6.1 Opportunities that AI Brings to the Creative Industries

The creative industries are currently facing a critical moment in relation to their process of digitalization due to the struggles of finding ways to monetize their content and reach digital-minded and digital-native audiences. The pandemic and its subsequent lockdowns served as an accelerator for the digitalization process due to the severe damage it caused to the industries, especially those based on in-site activities. This has exacerbated the existing problems of the industries by forcing them to digitize at a rapid pace that has not allowed them to comfortably adapt to the new paradigm. However, the current advancements in AI development might be a solution for these problems.

Although the overall impact of AI technology on the creative industries remains unknown, the technology presents a series of opportunities that can potentially address the current challenges the sector is facing. The list of opportunities that AI presents to the sector is vast. For easier research, it can be classified into four main categories: cost and efficiency, decision making, audience engagement and discovery, and inspiring creativity.

Firstly, AI technology has the potential to **reduce costs and increase the efficiency**. As exemplified in the dive of the music industry, AI offers the possibility to increase business efficiency in content creation, development, and distribution areas, as well as enabling the production of generative content. The improvement can be attributed to the automation of repetitive and low-skilled activities found mainly in the production and post-production stages of content generation. Automation reduces the time required to produce content, enabling companies to produce a greater volume of content while reducing average costs, with the added benefit of allowing standardization. Additionally, it has the potential to improve the morale and motivation of the workforce by eliminating the most tedious elements of the process, allowing them to focus on the creative and more complex aspects of their work. Besides content creation, the technology also simplifies support activities, namely data security, data processing and treatment, and customer support.

Each of the creative industries employs the technology in a way that better suits its activities. Here are some examples of creative industries using AI to reduce costs and augment efficiency:

- **Book publishing:** AI is used to generate automated translations. The technology allows publishers to significantly reduce the amount of time required to translate

a book prior to its release, thereby increasing profits by allowing the publication of more books. It also reduces the need for paid professional translators, further reducing costs.

- **News media industry:** AI is utilized as a research tool capable of filtering information and discerning reliable sources from those that feature questionable content. This results in a considerable reduction in research time, enabling journalists to produce more content while ensuring the reliability and accuracy of their sources.

- **Video game industry:** In addition to its editing capabilities, AI and machine learning can be employed in the automation of game testing. By simplifying this task, game developers can accelerate the release of new games.

AI technology is significant for its capacity to analyze large-scale data and obtain relevant patterns that, if interpreted correctly, can be utilized by companies to **facilitate decision-making**. Companies across the creative industries can leverage these capabilities to collect relevant information related to their previous content, such as engagement and diffusion. This information can be used to predict future revenues, develop marketing campaigns, enhance the quality of their service, and improve customer relationships, among other benefits. In certain industries, this information can be utilized to anticipate new trends in the market and serve as a guide for identifying the most potentially profitable projects to invest in. This has the additional benefit of encouraging companies to invest their capital, explore new business models, and expand their reach to previously untapped target groups since the predictions made by AI reduce the uncertainty associated with engaging in riskier business activities.

Here are some examples of creative industries utilizing AI for decision-making:

- **Performing arts:** The industry employs AI's capabilities to process and analyze information to assist in making marketing decisions and forecasting attendance rates and ticket sales. This allows producers to discern which kinds of shows will receive the best response from the public to make informed investments.

- **Fashion and design:** AI-generated forecasts are employed to predict future trends, enabling businesses to anticipate changes in customer needs. The information is also used to optimize the supply chain, minimizing the amount of product that ultimately goes to waste.

- **Museums and heritage:** AI is used to personalize the visitor experience, allowing each individual to experience collections in a unique way that captures their interest more effectively.

The creative industries are in need of attracting the new digital generations, commonly referred to as the digital-minded and digital-native generations. These generations consume content in a different manner compared to older generations, thereby forcing the industries to adapt to their new needs. AI technology provides several tools to facilitate this transition and help the creative industries **enhance content engagement and discovery**.

One major factor that distinguishes the digital and traditional generations, apart from the means of communication, is their approach to the content they consume. The digital generations have access to countless amounts of content, which has led them to develop more curated tastes, demanding more specific and unique content. AI enables companies to fulfill this desire by allowing the creation of hyper-personalized content. The characteristics of AI technology enable consumers to become co-creators of the content they consume by providing access to features that can be selected and customized to better adapt to their needs. The technology is also extensively used for content curation and recommendation. By utilizing technologies such as collaborative filtering, audio analysis, and natural language processing, industries can target their products exclusively to customers who are potentially more interested in consuming them. Personalized content not only enhances customer satisfaction but also increases engagement and thus generates more revenue. Additionally, these technologies have the potential to make content consumption more accessible by providing altered versions of the content that can be consumed by people with disabilities.

Here are some examples of industries using AI for this purpose:

- **News media industry:** AI and machine learning are employed for data collection and analysis, allowing companies to better understand their customers' needs and desires. This information can be used to classify customers into different subcategories based on their preferences, enabling the production and promotion of content that better aligns with their needs, thereby increasing engagement.
- **Fashion and design industry:** AI technology is widely implemented in shopping assistant tools. Online platforms often combine human recommendations with datasets created by consumers' interactions on the website, offering the most suitable products for each individual.
- **Video game industry:** The usage of AI allows creators to develop adaptive games capable of changing the course of events depending on the player's engagement, offering a unique experience.

- **Visual arts:** AI's notable contribution to the field is enabling the consumption of visual content by people with disabilities. For example, the technology can be used to transform originally visually based content into text-based formats, allowing visually impaired audiences to access the content.

Lastly, while AI is often perceived as a direct competitor to artists, in reality its key role in content creation is serving as a **source of inspiration** for human artists. AI has the potential to improve cultural outputs and attract larger audiences through innovative ideas that result from the collaboration of human knowledge and AI's capacity to provide unexpected propositions. Therefore, the inclusion of AI can potentially make the creative industries more diverse in their operations and the outputs they produce.

AI is currently serving as a source of inspiration in several industries, such as:

- **Architecture industry:** AI tools allow individuals without previous knowledge or resources to produce high-quality renders and sketches that can be utilized by professionals to produce creative outcomes that adjust to specific needs in a relatively brief period.
- **Book publishing industry:** AI can serve as a generator of base ideas that are later developed by actual authors, enabling the creation of unique content. Similar tools can be utilized in other industries like the film and media industry.
- **Performing arts:** AI models can be employed to present innovative ideas for setting design and choreography, pushing the boundaries of creativity in the performing arts.
- **Museums and heritage:** AI can be used as an aid for the restoration of artworks. AI models can present original ideas to complete a broken piece by recreating the style of the original artists in terms of composition, coloring, stroke, carving, and modeling, among other aspects.

Additionally, apart from the individual benefits that AI technology provides to specific industries, it also presents opportunities for collaboration and integration within the creative industries, as well as the emergence of new industries in the sector. The creative industries have traditionally operated independently due to the distinct ecosystems in each of them. However, the evolution of AI models offers a potential bridge to reconcile some of these differences:

- The media industry often collaborates with other industries such as photography and video creation to enhance its content. AI has the potential to bring these industries closer through the introduction of AI-generated photorealistic content.
- AI technology establishes a bridge between the architecture and video game industries. The video game industry can utilize architectural plans as a basis for creating environments and scenery, while architecture studies can benefit from the special effects and rendering capabilities of video game models to create more realistic and visually appealing representations of their projects.
- The movie industry can benefit from the museum and heritage industry by utilizing collections of images as a foundation for constructing movie scenery. Simultaneously, museums can incorporate the special effects used in movie production to enhance the visitor experience and create unique interactive exhibitions.

These arguments demonstrate that the inclusion of AI technology has the potential to expand the creative industries and enhance their outputs and customer relations. However, it is important to mention that, thus far, these benefits are largely speculative. The ultimate impact of the technology in the aforementioned areas will depend on how it is incorporated into the sector and the receptiveness of artists and stakeholders to allow the technology to deeply transform the industries.

6.2 Risks and Concerns of AI in the Creative Industries

While the list of benefits that AI can potentially bring to the industry is extensive, it comes with some costs and significant drawbacks. The mass-scale introduction of AI in the creative industries presents serious ethical dilemmas and a range of risks, the long and short-term effects of which are still unknown.

While the long-term impacts are difficult to predict, some early effects can already be observed in data access, skills, collaboration, and funding accessibility. The consequences of these effects can lead to increased inequality among artists and the standardization of content. It is important to note that the negative consequences cannot be directly attributed to the technology itself but rather to the way systems, relationships, and processes are established surrounding the technology. Therefore, the ultimate impact of the following drawbacks of AI technology on the sector mainly depends on the industries themselves and the way they utilize the technology.

The first risk associated with the introduction of AI in the creative industries is the significant transformation it brings to the sector by **challenging the status of value chains**. While the introduction of AI is perceived as positive for consumers as it improves their experiences and engagement with creative content while easing access, the effects on the actual participants in the sector are more diverse. As a disruptive technology, AI challenges the traditional industry models, providing both new and established players with opportunities to enter an industry that was previously inaccessible to them or to further extend and consolidate their power in the sector. However, these opportunities are not evenly distributed among all participants, leaving smaller and slower-to-adapt players out of the market, thereby shifting the balance with an uncertain outcome in terms of industry fairness. The concentration of power also carries the risk of creating asymmetries between the participants, potentially damaging the diversity and quality of consumers' experiences. The introduction of this technology can enhance the value created by the industries, but if not properly regulated, it might disrupt competition in the sector, ultimately having a negative effect on consumers. For instance, AI technology might facilitate the rise of new monopolies in the industries, ultimately damaging content diversity and impeding the establishment of start-ups that play a vital role in the generation of innovative systems.

AI models, especially AI recommendation systems, function on a reward basis, which translates into the models recommending specific content to users based on their past interactions and feedback. This approach helps increase consumer satisfaction by providing them with tailored recommendations of content that may potentially meet their needs. However, while effectively targeting consumers' needs, it presents the risk of **monoculturalization** and the subsequent limitation of their perspectives. By exclusively recommending content based on past experiences, consumers are trapped in a bubble where they are only exposed to content that already aligns with their tastes and opinions, limiting their capacity to discover and hindering their exposure to content with different perspectives. This effect has the potential to exacerbate damaging behaviors and movements by reinforcing harmful ideologies. Ultimately, this may impact the industries by limiting the success of new content and forcing artists to exclusively produce content that suits the recommendation models.

Monoculturalization and its negative effects are intensified by the presence of **biases**. For AI models to function properly, they need to be fed with information to process and generate novel outputs. However, this system has the drawback of perpetuating existing human biases. Biases can also emerge as a result of consumer intervention through the

inclusion of non-transparent user preferences. The extent of this risk depends highly on the specific industry being discussed, as biases in architecture models might be less damaging than biases present in models used in the media sector. The main challenge with these biases lies in identifying and addressing them. Therefore, the most effective way to reduce biases is to ensure that AI models are trained using extensive and diverse datasets that include important considerations such as diversity of opinion and cultural and historical heritage to guarantee neutrality.

Another serious risk associated with the widespread use of AI technology is the **spread of misinformation**. Currently, AI models are not capable of discerning legitimate and trustworthy information from manipulated data. This is because AI models acquire information from datasets that often include questionable or uncorroborated data. As a result, AI models may unknowingly spread and recommend false information to users who, due to the misperception of the technology's capabilities, might perceive it as reliable. AI can also be intentionally used to propagate inauthentic information by employing models that generate stories based on false information and rewrite articles, altering viewpoints and data while maintaining a formal and professional aesthetic and style. An example of the spread of misinformation is the use of deepfake and voice-altering models with malicious intent, such as damaging reputations, framing individuals, or making threats.

To provide personalized recommendations, AI models need to gather information from users. Ideally, this information would be used solely to deliver high-quality recommendations and enhance customers' experiences. However, if not responsibly managed could produce the **misuse of personal information**. AI models can be trained to collect diverse types of information, including sensitive topics such as political views, personal preferences, and health conditions. This information can then be used to manipulate customers' behaviors in malicious ways. This problem is exacerbated by the fact that most users are unaware of the information they are providing and the potential uses of it, thus creating a basis for digital crime and infringing on people's right to privacy.

Lastly, a major concern in the creative industries regarding the widespread introduction of AI technology is the **potential negative impact on the workforce and job prospects for professionals**. While it is not expected that AI models will replace human labor, at least in the short term, they will undoubtedly change the operational systems for professionals such as journalists, reporters, technicians, architects, and market research specialists. Therefore, while in the short term AI may not eliminate job positions, it will compel professionals to adapt to the new paradigms and perform new tasks, while some

of the more technical activities become automated. However, while AI does not directly damage the job market, it may lead some employees, particularly from older generations, to resign from their positions if they are unable to properly adapt to the new requirements.

Table 6 presents a list of creative professions alongside with their traditional activities and the substitutions that AI might originate:

Table 6: Tasks impacted by AI technology.

| Occupations	New Tasks	Tasks disappearing
Producers, Architects and Designers	Handling AI based tools for design	Handcraft design and traditional digital design
Editors and Producers	Calibrating AI models to perform autonomous editing based on their needs	Editing
Translators	Revising and enhancing AI made translations	Translating
Technicians and Recording Engineers	Developing AI algorithms	Technical tasks

Source: Own elaboration.

Despite the mild early impact of AI technology on jobs compared to its benefits, the true long-term impact it will have remains unknown. Currently, AI models are unable to fully replace human labor and thus heavily rely on human input and correction to perform their tasks. However, with the rapid advancement of technology, a future where AI could substitute some of the more repetitive tasks in the industries may eventually arise. The outcome of such a scenario would be concerning if the market is not adequately prepared.

To prevent this scenario from becoming a reality, industries should approach the technology differently by promoting education and training in the field and implementing long-term employment measures. Additionally, policymakers need to address this issue to effectively manage the potential short-term structural unemployment that may arise from the integration of AI technology. It is crucial to proactively prepare for these potential changes to mitigate any negative consequences and ensure a smooth transition in the job market.

6.3 Challenges of AI in the Creative Industries

AI technology is gradually permeating the creative industries, and this trend is expected to intensify in the coming years. However, despite the optimistic projections, the adoption process will not be seamless, and as such early adopters will encounter various challenges in their quest to succeed in the industry. As seen in Figure 14 these challenges encompass multiple levels and are not solely confined to model development. To fully embrace this technology, companies, as well as the entire industries, will need to devise new business models that can adapt to the emerging market. Additionally, they must invest in developing the human talent and skills necessary for commanding and advancing the technology. Furthermore, a shift in attitude towards the technology and its characteristics is imperative.

Figure 14: Challenges to overcome in the creative industries regarding AI
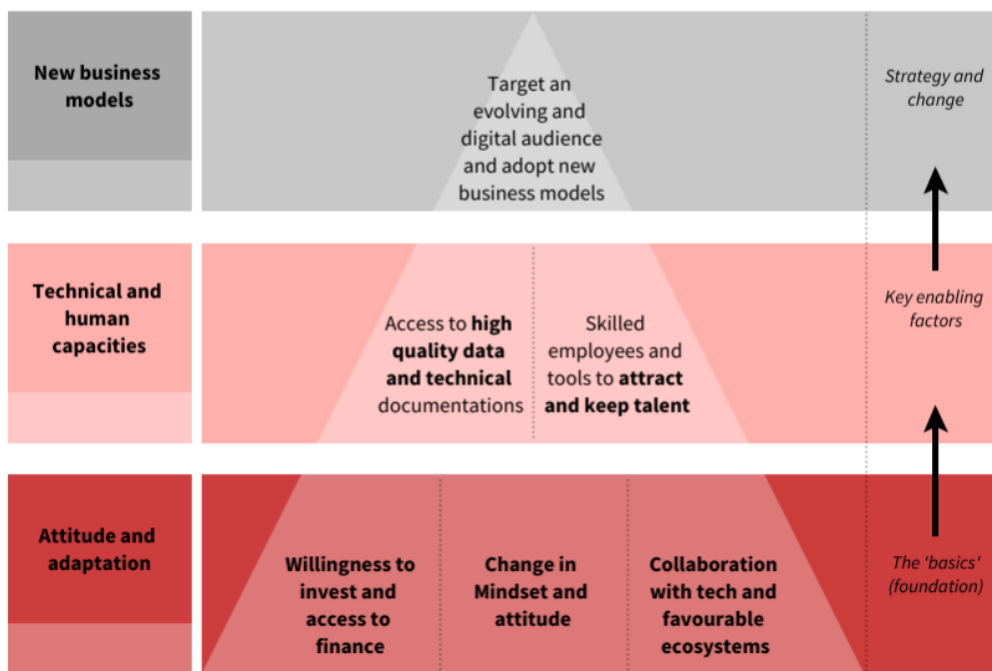
Source: Opportunities and challenges of Artificial Intelligence Technology for the Cultural and Creative Sectors (2022)

The first level of change that the creative industries must confront pertains to a **shift in attitude and adaptation to the technology**. Due to the risks and ethical dilemmas posed by the rise of AI, many companies in the creative industries have chosen to maintain a conservative stance towards the technology. This perspective is particularly pronounced in inherently traditional creative sectors, such as museums and heritage industries, which generally exercise caution when incorporating AI into their operations. While this position may be understandable given the novelty of the technology, its perpetuation within the creative industries has the potential to detrimentally impact the

sector in the long run. The primary risk is being overtaken by more daring sectors, such as the technology industry, resulting in a loss of relevance and market share for the more reticent creative industries.

To prevent this scenario from unfolding, a comprehensive change in perspective towards the technology is necessary. The perception of AI as a threat to employment and direct competition with artists must be reframed into a more positive outlook, wherein the technology, when controlled and regulated, is embraced as a powerful tool that enhances content production and improves customer satisfaction. This shift in perspective should be accompanied by increased investment in AI. While some AI models pertaining to the creative industries have already been developed, their accuracy and capabilities still lag behind models in banking and computational industries. Therefore, the creative industries must boost their investment in research and development of models that directly benefit them. Additionally, the change in attitude should extend to the relationships established with other sectors, particularly the technology sector. While certain creative industries have collaborated with the technology sector in the past, strengthening these alliances is vital to create an environment where AI can thrive and eventually become integral to different industries.

Once the fundamental challenges of attitude and adoption have been overcome, the sector will need to address the challenges related to **fostering technological and human capabilities**. The first challenge revolves around the collection of high-quality data that is accurate, reliable, relevant, and comprehensive. The nature of the required data varies depending on the specific industry, as does its accessibility. For instance, the publishing industry possesses abundant information about market attitudes and trends due to their direct involvement in book production and distribution, as well as access to public information such as bestseller lists. This facilitates the training of AI models tailored to the industry using reliable and accurate data. On the other hand, the news media industry's capacity to gather information is limited to the data extracted from their own websites. Therefore, without strategic partnerships, companies are unable to acquire sufficient contextual data to develop accurate AI models. Regardless of the data characteristics, acquiring high-quality information is vital to ensure the optimal performance of AI models and mitigate issues such as biases. Therefore, securing reliable data acquisition is a crucial step in fully leveraging the opportunities offered by AI. This process may involve collecting and storing relevant data, cleaning, and preprocessing data to ensure accuracy and completeness, and adhering to ethical practices to avoid biases while safeguarding data privacy and security.

In addition to data gathering, the creative industries also need to **foster skills and proficiency** in AI technology among their professionals. The introduction of AI poses a challenge for industry professionals to adapt to the new models and tasks required by the technology. While user-friendly models already exist, the most complex models that yield professional outcomes still demand extensive knowledge to utilize effectively. Hence, investing in fostering AI knowledge is vital for the sector to thrive in the new paradigm. Some of the key abilities required by the creative industries include data management, differentiation, innovation, coding, and change management. Furthermore, each industry requires its own unique and specialized expertise. Additionally, the industries must be capable of attracting skilled professionals from other sectors, such as cybersecurity professionals, to facilitate the transition to an AI-dominated industry. By attracting skilled professionals with a strong command of AI models, the creative industries can enhance their innovative capabilities, competitiveness, efficiency, and productivity while promoting multidisciplinary collaboration. In a context where highly skilled individuals are scarce, the industries that succeed in attracting and retaining professionals will have a significant advantage over the rest of the sector.

The final step is for the industries to **develop new plans with a focus on AI technology**. The current business models of the creative industries are based on traditional systems and early technologies, impeding the integration of new systems. The funds that the creative industries are currently investing in AI technology are limited, and thus understanding how to allocate them effectively is crucial. Developing long-term projects involving AI technology is the foundation for changing this trend, as it demonstrates that investing in the technology has the potential to generate revenue. By orienting business models toward AI-related activities, the creative industries could better serve their growing digital audiences and reap the benefits provided by the technology.

Lastly, although not directly featured in the main pyramid, the creative industries as a whole face another significant obstacle: **the difficulty of obtaining the necessary funding**. The development and integration of AI in the industries require a substantial upfront investment. The lack of needed funding can primarily be attributed to investors' reluctance to fully trust the technology and the scarcity of public funds and initiatives to support the transition. While the lack of investment is not solely attributed to the industries themselves, without overcoming this challenge, the sector will be unable to advance in the AI race, falling behind more adaptable industries with consistent funding and support.

7. CONCLUSSION

The concluding part of this paper will provide a summary of the main ideas explored through the study of theory, research, and the case study conducted. It will also include a comprehensive conclusion and recommendations. Additionally, a section addressing the limitations of the research and the need for further study will be provided at the end.

7.1 Main Ideas and Conclusions

AI's role in the industry

Despite the limited instances of AI adoption in the creative industries, a pattern regarding its role in the sector is already emerging. Most industries are hesitant to embrace AI as a fully independent creator, primarily due to the risks involved and the technology's early stage of development. However, AI has shown promise as a collaborative co-creator. While it is not yet capable of functioning as a fully autonomous creative entity within the industries, its capabilities in automating repetitive and mundane tasks, as well as serving as a source of inspiration, make it an ideal tool for revitalizing the sector in the fast-paced post-COVID era. The concept of a fully independent AI functioning within the creative industries may eventually materialize in the future as the technology advances and the associated risks are mitigated. However, given the current state of both the technology and the industries, this idea remains distant in terms of practical implementation.

Misperception of the technology as the major obstacle

AI technology has proven successful in enhancing creative content, relieving workloads for creators, reducing costs and production time, and improving efficiency in industries. However, despite these benefits, some creative industries, and many companies within them are still hesitant or completely opposed to its introduction. The primary obstacle to widespread adoption of AI technology and the reason for its controversy in the creative industries lies in a misunderstanding of the technology itself. AI is often perceived as a direct competitor that will lead to job loss and the erosion of creative identity. While these concerns are not unfounded, they stem from a lack of understanding regarding the technology and its capabilities. As mentioned earlier, the current state of AI limits its use as an auxiliary tool, meaning that even with its adoption, artists and creative individuals will retain control over the creative process. A change in mindset and approach toward the technology is necessary for its proper implementation in these industries to fully leverage its potential.

The adoption is inevitable

The adoption of AI in the creative sector is still limited, but its implementation is rapidly accelerating. The creative industries are reaching a point where the use of AI is becoming a widespread practice. This is highly significant because once the technology has established itself in the sector and companies recognize its potential, there will be no turning back. AI is also being integrated into other sectors, often with a more favorable reception, which further intensifies the pressure on the creative industries to adopt it. Overall, AI is expected to have a profound impact on the entire market, permeating all imaginable sectors, and even though its ultimate success may face challenges, it is unlikely to be reversible.

Necessity of collaboration with policymakers

While the list of potential benefits of AI is extensive, so are its risks and ethical dilemmas, such as biases and content protection. To mitigate the existing drawbacks of AI technology, the creative industries need to collaborate with governments and policymakers to establish codes of conduct and limitations. For instance, many countries lack adequate protection laws concerning the use of copyrighted content in training AI models, which can lead to the improper use of protected material and a violation of artists' rights. The establishment of laws and regulations governing the use of AI, its development, responsibility for misconduct, and ownership of generated content is essential for fostering a healthy and sustainable relationship between the technology and the industries. Achieving this requires the involvement of relevant authorities.

Necessity of collaboration between industries

Aside from collaborating with policymakers, the creative industries also need to further extend their collaboration among each other regarding technology sharing. The nature of AI is such that its models are not limited to a single industry but can be compatible with several. For example, an image generative model can be employed by graphic designers to enhance their designs, by music artists to create album covers and promotional posters, by architects to visualize their projects, and by clothing designers to develop graphics and patterns for their garments, among other applications. This multifaceted characteristic of AI necessitates deep collaboration between industries to develop improved models. Otherwise, if each industry limits its sharing to itself, it will not only impede technological advancements but also create asymmetries within the sector. Furthermore, the creative sector needs to collaborate with the technological industry to

gain a better understanding of the technology and ensure that the created models operate in favor of the creative industries rather than against them.

The reluctance to adapt will have unwanted consequences

As mentioned earlier, the adoption of AI varies widely across the creative industries. While the music and movie industry are currently at the forefront of AI usage, setting the trends for its wider implementation, some industries have barely begun to address it. The inherent differences between the creative industries result in highly diverse opportunities that AI brings to each of them. However, despite AI's widespread integration into both creative and non-creative sectors such as manufacturing and banking, certain industries remain reluctant to adopt it. This unwillingness to embrace the new reality carries several consequences, including the risk of falling behind competitors, decreased comparative efficiency and productivity, and reduced profits. As AI becomes increasingly integrated into various industries, those who fail to adopt it may struggle to keep pace with innovation and find themselves at a competitive disadvantage.

Furthermore, as AI technology advances, it is likely to play an increasingly significant role in decision-making and strategic planning processes. Therefore, the reluctance to adopt this technology may limit industries' long-term capacity to make well-informed decisions based on data-driven insights. Lastly, as the job market shifts towards roles that require advanced technological skills, industries that fail to adopt AI may face challenges in attracting and retaining talented employees who seek opportunities to work with innovative technologies. This talent drain could further diminish the industries' ability to compete effectively in the long term.

7.2 Limitations and Further Research

As a conclusion to the paper, it is important to acknowledge the limitations and constraints of this study and emphasize the need for further research on the topic.

Firstly, the novelty of the technology and its limited implementation on real life cases hinders the collection of useful and relevant data surrounding the topic. AI is a relatively recent technology and therefore the amount of studies developed addressing its implication in the creative industries is still scarce and bare bones. A similar situation is encountered in the real cases of AI implementation. While some successful projects have been conducted by creative companies with the usage of AI, this are still limited and so recent that discerning its overall effects on the long term is not possible yet.

Additionally, the fast pace of technology evolution and implementation presents another obstacle to studying AI's effects. Studies quickly become outdated, and even recent ones may not provide up-to-date information and statistics. This issue will persist until the technology reaches a sufficient level of maturity.

Moreover, the rapid development of AI technology affects the longevity of the study. The fast pace at which AI is being incorporated into the creative industries hinders the ability to provide long-term definitive answers. Recommendations and ideas presented in the paper should be understood as speculations rather than reliable predictions, as they may lose relevance or be proven wrong in the near future.

Furthermore, the study's reach is limited to an overall review of the creative industries due to time and data constraints. While the findings apply to the sector as a whole, they may not be relevant to individual industry cases. In-depth analysis of each industry, similar to the case study of the music industry, would be necessary to provide tailored recommendations. Unfortunately, this is not feasible given the aforementioned constraints.

To overcome these limitations, further research conducted by professionals is needed.

- Firstly, independent studies targeting each of the main creative industries is needed to fully capture and understand the specifics of their relationship with AI and the unique opportunities, drawbacks and risks that said relation entails.
- Secondly, further studies must register the progress and evolution of AI oriented projects in the industry to assess the success, durability, and nuances in the long term. While the projects analyzed have proven successful so far this might differ in the long term and therefore that information must be recorded.
- Lastly, a deeper analysis of the risks and drawback of the technology in the creative sector is needed to try to minimize the potential negative effects it might originate.

By addressing these research gaps, a more comprehensive understanding of AI's impact on the creative industries can be achieved, enabling the development of effective strategies, and mitigating potential risks.

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