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EXECUTIVE SUMMARY OF THE THESIS

Implementing Sci-fi methodologies for Innovation in companies: Unveiling how institutional and rational factors foster knowledge generation and sharing

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

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1. Contextualization and purpose of the study

The business world has changed dramatically in the last 20 years, with innovation and change accelerating and taking unpredictable paths. The dynamics of this environment in which organizations are embedded and operate can be labeled VUCA, an acronym for volatility, uncertainty, complexity, and ambiguity. The traditional approaches used so far relying on past and current data, such as classical strategy formulation, were suitable for a relatively stable environment and linear change. Many organizations are employing new approaches to adopt a proactive attitude toward the future and increase the time horizon of their strategies, such as future studies and foresight. Foresight is a methodology based on techniques for exploring possible futures, in order to go beyond what is already known and anticipate change by developing more informed business strategies in the present.

Researchers and organizations are investigating a new additional tool for introducing a future-oriented approach to support business activities: science fiction. Science fiction or (sci-fi) is a genre that belongs to speculative fiction and deals with possible or imagined future developments in science and technology. Sci-fi has specific characteristics that may help organizations by exploring fictional futures that would have been unthinkable otherwise, addressing the challenges of the present context. The relationship between foresight and science fiction was defined in 2010 with the pioneer and greatest representative of the subject Brian David Johnson, former futurist at Intel. Today, numerous corporate organizations, including Google, Microsoft and Apple are hiring sci-fi writers to help them envisioning the future and explore worlds generated by innovative technologies, such as quantum computing, machine learning and artificial intelligence. Also organizations in the public and military sectors, including NATO and the U.S. Army, use sci-fi to envision upcoming threats. In the last years, the topic has raised academic attention and in 2022 a call for paper by Michaud and Appio solicited

research to study its development and encourage its wider dissemination [1].
This study aims to explore what actions and efforts organizations can take to effectively introduce science fiction-based approaches into their processes. This was achieved by designing and testing a theoretical model that explores factors driving employees' participation in sci-fi activities.

2. Extant studies

Part of this dissertation was dedicated to the systematic review of past studies and research on the use of science fiction in business contexts.
The analysis of the studies revealed two dimensions to cluster the uses of science fiction in organizations: the methodologies through which science fiction is employed to support companies' objectives, which we will refer to as the sci-fi based approaches, and the different organizational processes on which the methodologies are applied.

The first dimension identifies the existence in the literature of two possible sci-fi based approaches: the analysis of existing sci-fi landscape and the design of ad-hoc sci-fi stories. Both approaches share the following characteristics: the start from scientific research and technological trends; the adoption of a speculative approach to explore transformative futures; the interplay between technology, society and individuals; the exploitation of the power of story-telling and vivid representation of future scenarios.

The analysis of the sci-fi landscape consists in the analysis of existing science fiction content in the cultural landscape, in its different artistic forms, including books, movies, TV shows, comics or video games. It can be performed through the following steps: source identification, sample selection and analysis of the content. The process is aimed at extracting valuable information from the story in order to take inspiration from a transformative portrayal of the future. The use of this approach allows organizations to:

- Draw from the rich *sci-fi imaginary* of utopic and dystopic futures, innovative technologies, risks and warning signals.
- Align with the *society imaginary* about the future.
- Perform a *society sentiment analysis*, as sci-fi stories embed society expectations, aspirations and fears towards the future.

As for the second approach, the literature brought out the existence of several design practices aimed at the production of sci-fi stories to explore futures for organizational purposes. The two most relevant and diffused methodologies to design sci-fi stories are the following:

- *Design Fiction*: a design practice that starts from current trends and uses speculation to create disruptive scenarios of the future.
- *Science Fiction Prototyping* (SFP): the creation of short fictions on a particular technology, that starts from current scientific knowledge, created for the purpose of acting as prototype for people to explore the implications, effects, or ramifications of the technology [2].

By creating sci-fi stories, organizations are able to promote:

- *Creativity and imagination* in the definition of a preferable future.
- *Co-creation* of a shared vision of the future among people from different backgrounds.
- *Problem-solving* and *critical thinking* on long-term developments.

The second dimension distinguishes between the application of sci-fi approaches within innovation process or scenario planning to achieve specific goals.

Sci-fi can support different phases of the innovation process with the following objectives:

- *Idea generation* at the front-end of innovation, through the extraction of innovative ideas from the analysis of existing sci-fi or the generative potential of designing stories.
- *Testing the innovation*, developing a science fiction prototype that places the technology in its future context.
- *Drive organizational change*, by using the SFP to motivate, inspire and align the company's members towards the same vision.

Finally, sci-fi can support scenario planning in the following activities:

- *Detection of weak signals*, by analyzing the sci-fi landscape.

- *Creation of scenario(s)*, by extracting transformative scenarios of the future from existing sci-fi.
- *Communication of scenario(s)* to a broader audience, through the creation of a sci-fi story which offers a concrete view of the future scenario(s), allowing better comprehension and raising awareness.

3. Research model

Extant studies have indicated that the use of sci-fi based approaches within organizational context is aimed at achieving two main goals: generating new knowledge related to the future and sharing this knowledge within the organization. For this reason, in order to study the employees' participation and engagement in activities that use science fiction-based approaches, two behaviors were assessed in the research model: the generation and the sharing of future-oriented knowledge.

The developed research model aims at investigating the organizational factors that influence the generation and sharing of knowledge on the future, when using sci-fi based approaches. In order to describe the worker's behavior, constructs from three theories were introduced in the model. The Institutional Theory is used to explore the influence of organizational structures on the non-rational individual behavior towards the usage of science fiction in the company. Three constructs were retrieved: regulative pillar (RP), normative pillar (NP) and cultural pillar (CP) [3]. From TAM, which aims at explaining the individual rational assessment of the usefulness of the innovative methodology, the perceived usefulness (PU) was retrieved [4]. Finally, the Knowledge Management Theory provides the constructs of knowledge generation (KG) and knowledge sharing (KS) [5].

Once defined the constructs, the configuration of the model was formalized, and the hypotheses were stated as follows.

The model describes the influence of institutional pillars on knowledge generation and sharing, both directly and indirectly through the individuals' Perceived Usefulness as a mediating factor. As a results, twelve positive influences were tested.

The regulative pillar is expected to influence KG and KS, by imposing the workers' participation to the activities. The normative pillar can impact KG and KS, as the worker may be influenced by the opinions of colleagues on an innovative methodology based on science fiction. The cultural pillar is expected to influence KG and KS, through an organizational culture that fosters the need for innovation and for change.

The regulative pillar may also influence the PU, by linking the worker's participation to organizational targets. The PU can be impacted by the normative pillar, by seeing the benefits obtained by colleagues. The cultural pillar is expected to have a positive influence on the disposition of individuals to feel that the sci-fi approach is useful (PU).

PU is expected to positively impact KG and KS, as a determinant of the engagement is the personal belief that expected benefits will outweigh costs. KG may influence KS thanks to the motivation to see the idea implemented.

From the literature and considering the context, thirteen control variables were included in the model to see if knowledge generation and sharing were influenced from other factors. The control variables are the following: gender, age, nationality, level of education, company size, company products and services, seniority, job role, sci-fi employment in the company, individual frequency of engagement in sci-fi, individual interest in sci-fi, psychological safety and environmental dynamism.

4. Materials and Methods

The research methodology involved the development of a survey composed of 37 questions. The first part of the questionnaire includes 19 questions concerning personal and socio-demographic information of the respondents, the characteristics of the companies in which they work, their relationship with sci-fi, psychological safety and environmental dynamism. The second part brings together 18 questions, and it allowed to measure the constructs of the model through the items selected from the relevant literature. The survey was distributed exclusively online and was self-administered by respondents. Workers in companies or in research, specifically with at least 2 years of experience in their current organization, were selected as the target group. This choice was to ensure that they

had some level of knowledge about their current work context.
Once the data was collected, a preliminary analysis was performed on the control variables, in order to investigate the characteristics of the sample population. Thereafter, the analysis of the constructs of the research model has been performed, using the statistical software STATA 17. Each construct has been tested by collecting results on multiple items, allowing a better accuracy in the measurement. The first step of the process was to use the Kaiser-Meyer-Olkin (KMO) test, to assess if the dataset collected from the questionnaire was suitable for performing a factor analysis. After having obtained a positive result, an Exploratory Factor Analysis (EFA) was performed to have a preliminary assessment of the model's latent variables, through the Principal Component Analysis (PCA) and the evaluation of the Cronbach's alpha. Then, the Structural Equation Modeling (SEM) was used to test the hypotheses of the model. The Confirmatory Factor Analysis (CFA) was carried out to test the validity and consistency of the constructs. Additionally, two indicators were computed to assess the validity of construct convergence: Composite Reliability (CR) and Average Variance Extracted (AVE). Finally, the overall goodness of fit of the model was assessed, by analyzing continuous measures of model-data correspondence, through the following indexes: square error of approximation (RMSEA), standardized root mean residual (SRMR), comparative fit index (CFI) and Tucker-Lewis index (TLI).

5. Descriptive Analysis

The survey collected a total number of 480 responses, of which 269 with a completion rate of 100%. After excluding respondents with less than 2 years of experience in their current organization, the final number of answers analyzed was 194. The sample is characterized by 63% men and the average age is 42, with 30% of individuals falling in the 31-40 age group followed by 27% in the 51-60 age group. In addition, 88% have a bachelor's degree or higher. 52% of respondents work in large organizations and 49% provide complex services. In addition, it was found that the sample was characterized by individuals interested in the science fiction genre, as 38% and 32% respectively strongly agreed and agreed with the statement "I like science fiction." A similar percentage responded positively to the question regarding the fruition of sci-fi-related content.

6. Results

The analysis started with the KMO test on the sample, showing that the factor analysis was worthwhile. The results of the EFA showed that the item CP1 had a factor loading below the acceptability threshold, so it was removed from the proposed model. Then, as a result of the CFA, the item NP1 was removed from the model, as its factor loading was below the cut-off value for excellent goodness of the model. Both EFA and CFA confirmed the validity of the relation between all the other items and latent variables.
Subsequently, the SEM validated the model tested. Specifically, the relations between the RP and KG, KS and PU were found to be not significative. NP had a positive significant influence on KG and PU, while its impact on KS was not verified. CP was found to positively influence KS, while its impact on KG and PU was not supported. The relation between PU and KG was found to be strongly significant, while PU had no impact on KS. Finally, the correlation between KG and KS was confirmed. The most interesting control variables, i.e., company products and services, company size, and seniority, were chosen to test their influence on KG and KS. The results showed a significative impact of SEN, PES and SIZ on KS, while INT had an influence on KG. All the goodness of fit indexes were shown to be inside the acceptability threshold, as presented in Table 1.

Indicator	Threshold	Value
RMSEA	< 0.08	0.053
SRMR	< 0.08	0.069
CFI	> 0.9	0.957
TLI	> 0.9	0.945

Table 1: Goodness of Fit indexes

7. Theoretical and managerial contribution

This study offers two main theoretical contributions to current literature.

First, the findings of this research provide a theoretical contribution to science fiction studies

and knowledge management literature, by proposing sci-fi as a tool to manage future-oriented knowledge within organizations. Specifically, the study identified two sci-fi based approaches, science fiction content analysis and the creation of science fiction stories, that are aimed at supporting the generation and sharing of new knowledge related to the future within the organization.

Moreover, new theoretical considerations were developed on the influence of institutional and individual rational factors on the employee's generation and sharing of future-oriented knowledge, through science fiction. It was confirmed that generating knowledge leads to sharing it. The individual belief of utility of innovative methodology is the main driver of worker's generation of knowledge. Regulatory actions do not incentivize active participation in sci-fi activities. Peer opinions, behaviors and experience with the approach influence the willingness to generate knowledge with sci-fi and the perceived individual benefits. Organizational culture that fosters the need for change incentivizes employees to share resulting ideas and intuitions.

Some insightful managerial considerations were deduced by the interpretation of the results. By introducing activities based on sci-fi, companies can improve their ability to innovate, explore future scenarios and drive organizational change. If a company wants to adopt sci-fi approaches, it should design proper levers to promote the participation of workers in these activities. The research reveals a concern on the opinion that peers have towards an approach that is far from traditional procedures and the working sphere. Thus, supervision from experienced mentors and training with specialists is relevant to communicate the validity and potential of the method; the activities should be organized in groups, to foster interaction among colleagues, including also sci-fi authors and consultants. The sci-fi based approach is able to generate desired results even if adopted in experimental forms by companies, as proceduralization does not influence engagement. Finally, organizations should make an effort to share the idea that it is important to innovate, think outside the box and have a long-term orientation, in order to achieve sharing behaviors.

8. Limitations

The findings also disclosed some limitations in the research, that are useful to discuss in order to inform future research on the topic. The first limitation is the small number of answers analyzed, as only 194 answers were retrieved. Further research could carry out the presented analyses on a higher number of responses Moreover the sample was broadened as much as possible to every type of organization, industry and business area. More accurate and useful results could be obtained by limiting the sample and conducting the analysis on a specific type of organization.

Finally, the survey introduces the respondents to a hypothetical scenario in which their company organizes a workshop to experiment with sci-fi activities. For this reason, future research can contribute to the validation of the results and developments of the topic by repeating the analysis after the worker's actual participation in the sci-fi activities, once introduced within the company.

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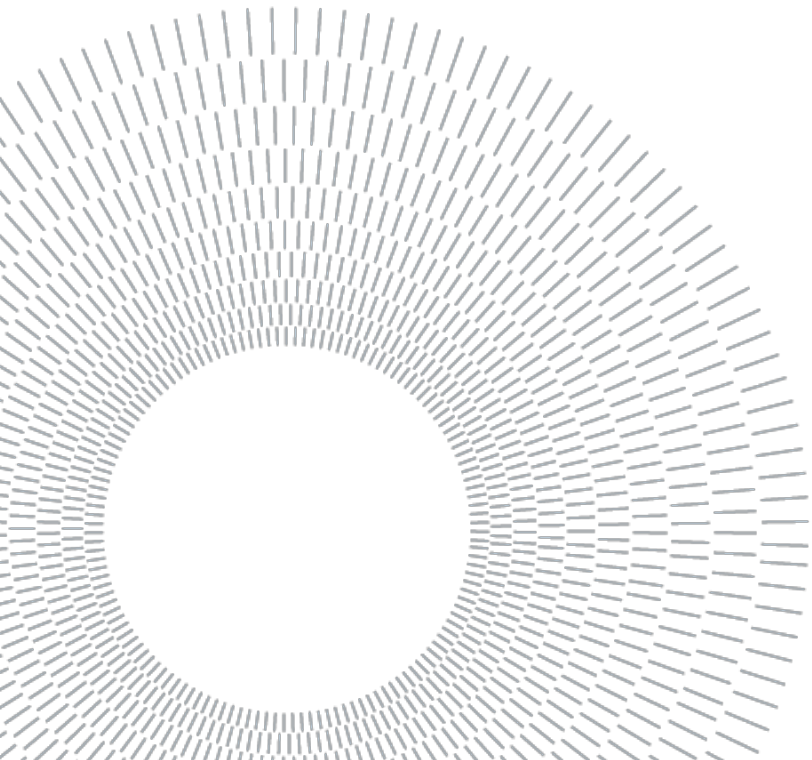

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Implementing Sci-fi methodologies for Innovation in companies: Unveiling how institutional and rational factors foster knowledge generation and sharing

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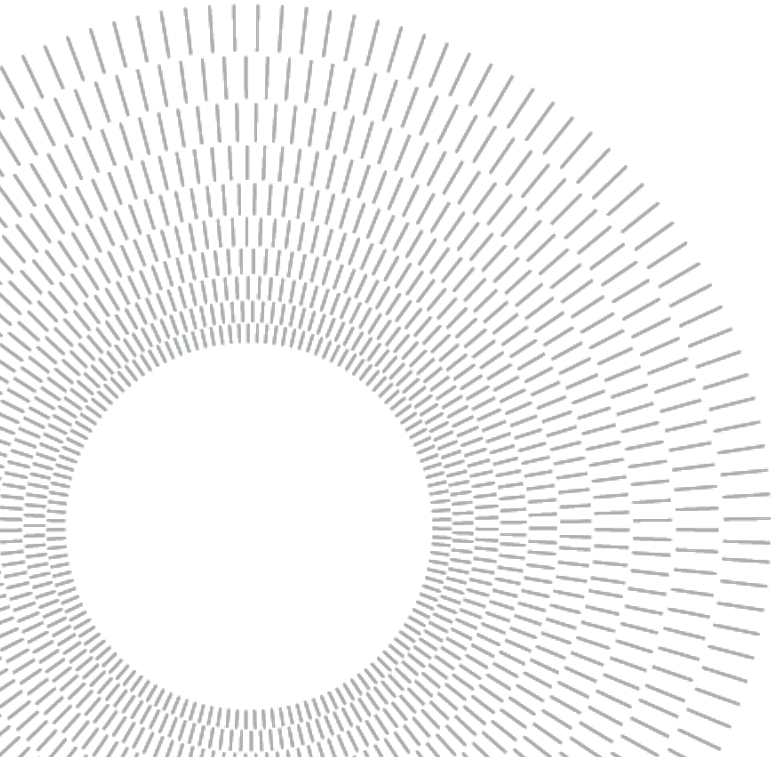


Abstract

In a context where innovation and change have taken unpredictable trajectories, companies operate in an environment characterized by dynamics referred as VUCA, an acronym for Volatility, Uncertainty, Complexity and Ambiguity. To meet the needs of the context, researchers and organizations are investigating a new tool in the field of *future studies* and *foresight* to introduce a future-oriented approach into business activities: science fiction, a genre that can help explore otherwise unthinkable futures.

The goal of this study is to identify actions that organizations can take to effectively introduce science fiction approaches into their processes. For this purpose, a theoretical model was created and tested to analyze factors driving workers' participation in science fiction activities, aimed at the generation and sharing of future-oriented knowledge. The research model integrates organizational mechanisms, derived from Institutional Theory, and rational factors, derived from the Technology Acceptance Model, that can both explain knowledge generation and sharing, according to Knowledge Management Theory.

To test the model, an online survey was administered to individuals working in business or research. Structural Equation Modelling was used to study the hypothesized relationships among the constructs. From the analyses, the positive influence of Knowledge Generation on Knowledge Sharing was confirmed. Perceived Usefulness has an impact only on Knowledge Generation. Among the institutional factors, investigated as antecedents, the Normative Pillar influences Knowledge Generation and Perceived Usefulness, while the Cultural Pillar influences Knowledge Sharing. No significant impact emerged from the Regulative Pillar. The results also provided managerial contributions by suggesting levers on which organizations can act to effectively introduce sci-fi initiatives. The limitations of the study allowed observations for future investigation.

Keywords: Science fiction, Innovation, Foresight, Future, TAM, Institutional Theory, Knowledge Management.

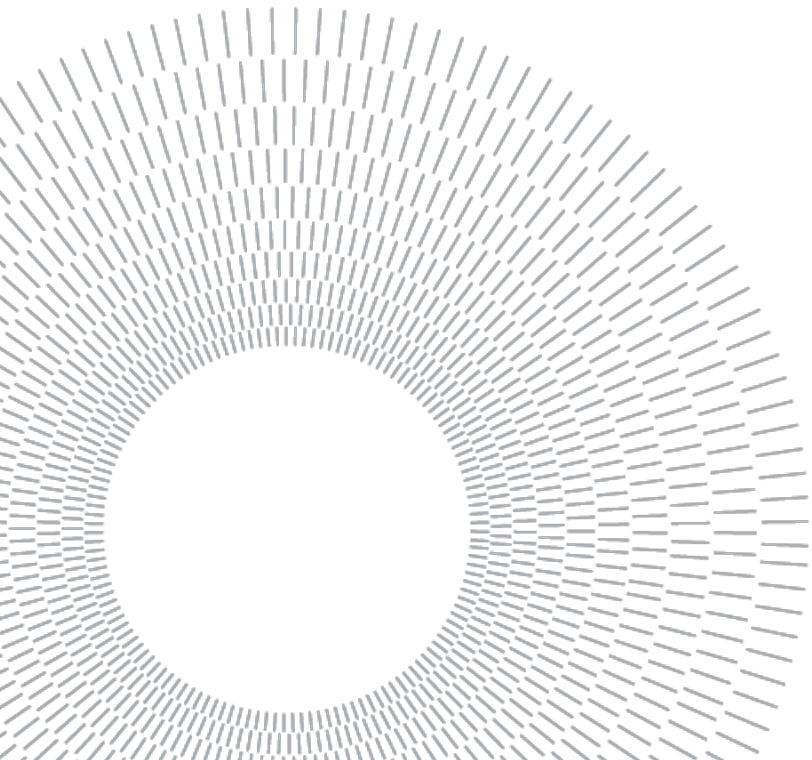
Abstract in italiano

In un contesto in cui l'innovazione e il cambiamento hanno preso delle traiettorie imprevedibili, le aziende operano in un ambiente caratterizzato da dinamiche definite VUCA, acronimo per Volatilità, Incertezza, Complessità e Ambiguità. Per rispondere alle necessità del contesto, i ricercatori e le organizzazioni stanno studiando un nuovo strumento nell'ambito dei *future studies* e del *foresight* per introdurre un approccio orientato al futuro nelle attività aziendali: la fantascienza, genere che può aiutare a esplorare futuri altrimenti impensabili.

L'obiettivo di questa ricerca è quello di identificare le azioni che le organizzazioni possono intraprendere per introdurre efficacemente approcci di fantascienza nei propri processi. Per farlo è stato creato e testato un modello teorico che analizza i fattori che determinano la partecipazione dei lavoratori ad attività di fantascienza, orientate alla generazione e condivisione di conoscenza relativa al futuro. Questo modello di ricerca integra meccanismi organizzativi, derivati dalla Teoria Istituzionale, e fattori razionali, derivati dal Technology Acceptance Model, che possono spiegare la generazione e condivisione di conoscenza, secondo la teoria del Knowledge Management.

Per testare il modello, è stato somministrato un questionario online rivolto agli individui che lavorano in azienda o nella ricerca. La Structural Equation Modelling è stata impiegata per studiare le relazioni ipotizzate tra i costrutti. I risultati confermano l'influenza positiva del Knowledge Generation sul Knowledge Sharing. La Perceived Usefulness ha impatto solo sulla Knowledge Generation. Tra i fattori istituzionali, indagati come antecedenti, il Normative Pillar influenza la Knowledge Generation e la Perceived Usefulness, mentre il Cultural Pillar influenza il Knowledge Sharing. Nessun impatto significativo è emerso da parte del Regulative Pillar. I risultati hanno inoltre fornito un contribuito manageriale suggerendo le leve su cui le organizzazioni possono agire per introdurre efficacemente iniziative di sci-fi. Le limitazioni dello studio hanno permesso di formulare delle osservazioni per indagini future.

Parole chiave: Fantascienza, Innovazione, Foresight, Futuro, TAM, Teoria Istituzionale, Knowledge Management.



Contents

Introduction

The VUCA environment

The business world has changed dramatically in recent decades, with innovation and change accelerating and taking unpredictable paths. The advent of artificial intelligence, the increasing presence of the Internet and social media in everyday life, or events such as the COVID pandemic or the conflict in Ukraine have increased the sense of living in a turbulent and unpredictable environment. The old belief of living in a stable and controllable environment has given way to the feeling of being in a constant state of change. The dynamics of this environment in which organizations are embedded and operate can be labeled VUCA, an acronym for volatility, uncertainty, complexity, and ambiguity (Bennet & Lemoine, 2014). Specifically, volatility refers to an unstable situation in which changes occur rapidly and frequently. This does not mean not knowing about possible scenarios and trends because of the complexity one is dealing with, but rather their recurrent change. Uncertainty, on the other hand, differs from volatility in that it refers to a lack of knowledge about a particular phenomenon and its cause-and-effect relationships. Uncertainty can be resolved structurally by devoting more resources to cross-boundary activities: going beyond existing networks, data sources, and analysis processes to gather information from new partners and look at it differently (Bennet & Lemoine, 2014). Complexity, on the other hand, is due to a context characterized by a large number of interacting elements and factors that must be dealt with simultaneously. The main problem due to complexity is the difficulty of figuring out which factors to act on in order to achieve the desired result, since changing one of these factors may lead to other changes that were not anticipated. Finally, ambiguity refers to the lack of a clear understanding of cause and effect relationships in a given situation. It is not necessarily related to a situation of volatility or uncertainty, as there may not necessarily be frequent or unpredictable change. According to Bennet & Lemoine (2014), an ambiguous situation typically revolves around a wholly new product, market, innovation, or opportunity. This implies that, unlike uncertainty, where, one can try to make a prediction if enough information is acquired, in an ambiguous situation it is even more difficult to predict what the possible outcomes will be.

Given the VUCA context just shown, companies are challenged to adapt quickly to change to avoid finding themselves unprepared and becoming obsolete. In light of this

need, however, organizations struggle to look to the long term and respond appropriately to the changing environment. In particular, looking at radical innovations, companies face a wide range of barriers. These, according to Sandberg & Aarikka-Stenroos (2014), can be summarized in two macro categories: external and internal barriers. External barriers include those due to resistance from specific actors, such as customers, governments or competitors, and those dictated by the external environment such as an underdeveloped ecosystem, technological turbulence or lack of complementary services. Internal barriers, on the other hand, can be summarized in four areas: restrictive mindset, due to resistance from employees, as radical innovations bring changes that imply serious challenges to their extant skills and job security (Wolfe et al., 2006); lack of skills, including those of discovery, incubation, acceleration and commercialization of innovation opportunities; insufficient resources; and lack of support from the organizational structure. This context is also compounded by the use of traditional methodologies for doing innovation, which allow to only look at the short term. To overcome these barriers and to see into the future with a broader time horizon, many organizations are employing new methodologies, including future studies and foresight, which are discussed in detail below.

Strategic Foresight

Definition

Strategic foresight is a methodology which falls under the field of foresight and is based on techniques for exploring possible futures, in order to anticipate change by developing more informed business strategies in the present. It has a clear link to strategic management and should be "understood as the processes that assist decision makers in charting the firms' future course of action" (Iden et al., 2017; Vecchiato, 2012). Through the performance of specific exercises, the practice of foresight enables the development of an informed and consistently interpretable view of possible futures in order to adopt a proactive attitude toward the future.

Strategic foresight enables us to provide answers to three fundamental questions, namely:

- What alternative scenarios does an organization must be prepared for in the future?
- Based on these possible future scenarios, what actions should the organization take to maintain and/or achieve its goals?
- How should the organization proceed so that it creates the best conditions for realizing the most desirable future scenarios?

Foresight is carried out in the larger context of future studies (Fergnani, 2019). They are based on the fundamental assumption of the unpredictability of the future, implying that it cannot be predicted (Dator, 1998; Voros, 2007). Future studies are characterized by 3 main components. First, possible, probable, or desirable futures are made visible by analyzing existing trends and the impact of so-called "wild cards," i.e., unpredictable events that could change the course of events. Second, futures studies develop a holistic approach based on careful analysis of social, technological, economic, environmental, and political factors from a wide range of disciplines. Third, that such studies break away from the prevailing vision of the future by challenging its basic assumptions.

In connection with this last point, history is permeated with predictions that did not come to pass, sometimes leading to fatal errors. This is precisely because such predictions were made in the certainty that the present context would not fundamentally change in the future, in other words, the basic assumptions about the representation of the future given at the time were not questioned. Strategic foresight precisely serves this purpose, namely, to go beyond what is already known and to think about the possibilities that lurk in the future and that we cannot readily see in the present.

Rapidity of change

The conventional approaches used so far, such as classical strategy formulation, were suitable for a relatively stable environment and linear change: thanks to data from the past, one could make assumptions about the future with some certainty. However, if we look at the last 20 years, change has taken on a speed never seen before in human history. It follows that traditional methods to look at the future, such as strategy formulation, are no longer sufficient if companies don't want to be unprepared or to quickly become obsolete. It must be complemented by other tools such as strategic foresight and future thinking. Through their disruptive vision of the future compared to the current state of affairs, they offer more adequate support for a reality increasingly permeated by volatility, uncertainty, complexity and ambiguity. Foresight systems basically consist in explorative approaches that aim to position the firm so as to take maximum benefit from these changes in the business environment (Vecchiato & Roveda, 2010).

On this point, too, the breakthrough in Foresight is that it positions itself at the opposite end of the spectrum from forecasting. Indeed, the latter aims to predict the future with certainty thanks to historical data that can be drawn upon in the present. It follows that the value of prediction is greater in the very short and short term, but the more advanced the development, the shorter its time horizon will be. In contrast, future thinking and especially foresight, on the other hand, allow projection onto possible alternatives that can be dealt with in order to forecast change.

Main features and techniques

Strategic foresight, as mentioned earlier, is primarily characterized by a systemic approach. Following the logic of STEEP, i.e., incorporating social, technological, environmental, and political factors, it examines how they interact in visualizing future scenarios. Indeed, in a long-term view, it is essential to take into account all macroscopic variables that may influence the course of events.

Second, strategic foresight is characterized by a long-term view, where long-term means a time frame of at least 10 years. Indeed, the goal of foresight is not to figure out what will happen overnight, but to understand how we want to shape our future. Therefore, a time horizon of at least 10 years allows us to step out of the present and open up the possibility to act. Indeed, the possibility of acting tomorrow is relatively limited by the fact that the course of events seems to be "already written," while looking at the long term allows for a much greater impact. In addition, strategic foresight differs from other typologies of foresight in that it focuses primarily on the use of strategic methods and tools, such as scenario planning, which will be discussed in more detail below (Heger & Rohrbeck, 2012).

Strategic foresight uses a variety of techniques, including analysis of emerging trends, weak signals and wild cards, horizon scanning, backcasting, and the most important for this study: as anticipated, scenario planning. This is an actual narrative about a possible future. Its purpose is not to describe a future that might actually occur, but to enable the organization to understand what actions to take and how to organize in that specific situation. It differs from future prediction in that the latter uses simulation as a tool to facilitate understanding. In scenario planning, on the other hand, simulation is an effective tool for understanding what the consequences of a particular decision are for the future, both from a macroscopic point of view - e.g. STEEP factors - and from a microscopic point of view in terms of the direct consequences for the organization in question.

In addition to the techniques just described, researchers are investigating the use of science fiction. Indeed, science fiction is a genre that belongs to speculative fiction and deals with possible or imagined future developments in science and technology. Within organizations, it can be a useful tool for introducing a future-oriented approach to support various business activities, similar to that which characterizes foresight activities. In fact, the use of this genre is investigated to support various organizational processes that may have to deal with the future and long-term orientation, as it has specific characteristics that may assist product managers and engineers in addressing the above mentioned challenges of the present context (Michaud & Appio, 2022). In particular, the study aims to investigate how science fiction tools can be applied in the innovation process, scenario planning and strategic decision making.

Research Objectives

Given the need for companies to innovate and think long-term, and the support science fiction can provide in achieving these goals, this study aims to explore what actions and efforts organizations can take to effectively introduce science fiction-based approaches into their processes. Specifically, the study aims to identify factors that drive employee engagement in activities that use science fiction approaches.

This study started from a theoretical background on science fiction and conducted a literature review to identify the main patterns and benefits of using science fiction in a business context. It was found that science fiction approaches involve two main behaviors, namely the generation and sharing of future-oriented knowledge (Michaud & Appio, 2022).

To test the effectiveness of individuals' participation in these initiatives, knowledge management theory has been employed as an evaluation method (Davenport & Prusak, 1998). In fact, it makes possible to assess the worker's ability to innovate and explore the future by observing two behaviors, the generation and sharing of future-oriented knowledge. Therefore, the purpose of this study is to design and test a theoretical model that describes the factors that influence these two behaviors in the context of using sci-fi-based approaches in business processes.

To examine the motivational forces that drive a particular behavior in organizations, Szulanski (1996) suggests the relevance of two dimensions: employees' personal belief structures and institutional structures, i.e., values, norms, and accepted practices (Bock et al., 2005). The most commonly used theory to explain individual rational assessment toward an innovation is the Technology Acceptance Model (TAM) by Davis (1989). On the other hand, individuals' behavior in the organizational context is considered to be the result of a combination of regulations, social norms, and cultural systems (Butler, 2011). In order to investigate institutional factors driving worker's behavior, the Institutional Theory by Scott (1995, 2001) is used to explore the non-rational individual behavior related to the use of science fiction in the organization.

This innovative combination allows to generate interesting practical insights on the actions and levers that the organization should implement to introduce Sci-Fi based approaches into its practices in an effective manner, that is, in a way that fosters innovation and long-term thinking. In this way, this research also contributes to the call for papers issued by Michaud and Appio (2022) on the usage of science fiction within organizations.

Table 0.1 provides an overview of the key supporting models along with their respective reference constructs.

Theory	Author and year	Constructs explaining effective participation
Knowledge Management	Davenport & Prusak, 1998	Knowledge Generation
		Knowledge Sharing
TAM	Davis, 1989	Perceived Usefulness
Institutional Theory	Scott, 1995, 2001	Regulative Pillar
		Normative Pillar
		Cultural Pillar

Table 0.1: Theoretical models and relative constructs

Organization of the work

The present study has been divided into 8 parts, representing in order the activities carried out in order to create the theoretical model, to test it, and to analyze the final results.

- Chapter 1 provides an overview of the genre of science fiction, its relevance and impact on individuals and innovation, and its integration into foresight.
- Chapter 2 reports the systematic literature review on the topic of how the science fiction genre can be used to support foresight practices in organizations. Several papers were analyzed and clustered according to the key insights they provide. Based on these findings and the gaps they contain, it was possible to define the research area to be investigated in the empirical part.
- Chapter 3 presents the model, the associated hypotheses, the constructs, the control variables, and the theoretical framework that was employed to construct it.
- Chapter 4 shows the materials and methods, to test the proposed model. Having used a survey as the method of collecting information, the structure of the questionnaire was described, on what channels and how it was distributed. In addition, the questions have been reported in detail and the methods by which the analysis of the results was performed.
- Chapter 5 contains the descriptive analysis of the sample that responded to the questionnaire to show any trends in the characteristics of the respondents.
- Chapter 6 provides the analysis of the empirical and statistical results of the proposed model. In particular, the goodness of fit of the model, the validity of

the hypotheses proposed in the previous chapters, and the effects of the control variables were tested.

- Chapter 7 shows the contribution that the obtained results can make, both at the theoretical and managerial levels.
- Chapter 8 contains the conclusions as well as the limitations of the study and possibilities for further research.

1 Science fiction: description and relevance

The aim of this section is to observe the evolution of the science fiction as a narrative genre and identify its relevance, with the aim of determining the points of interest for the present research, studying the motivations and meanings of science fiction in contemporary times and its relationship to the concept of technological progress. In this sense, after an initial descriptive introduction on science fiction, the relevance of the genre is considered below, reporting statistics on its popularity, the motivations that lead consumers to enjoy this genre and finally the causes of this success - commercial and cultural.

1.1. Definition and history

Science fiction is a genre that belongs to speculative fiction and deals with possible or imagined future developments in science and technology. It encompasses a wide range of concepts and themes such as advanced technologies and science, parallel worlds, extra-terrestrial life forms, time and space travel, and parallel universes. It is an ancient and enduring form of fiction (Menadue and Cheer, 2017) that has been part of what has been defined as our 'cultural wallpaper' since the origins of recorded history (Aldiss, 1986). In fact, it is commonly known that science fiction grew from a more or less plausible scientific focus in the early 20th century to adopt more sociological and cultural factors over time. In the 1960s and 1970s, science fiction reflected the dramatic changes in contemporary culture, particularly the political aspects of gender, conflict and freedom of expression. It follows that science fiction, as both a literary and audio-visual genre, has undergone mutations, conditioned by the world's cultural, political and social evolutions and transformations. The science fiction of the Golden Age (1930-1960) was a positivist science fiction, permeated by the sense of wonder towards science and technology, thanks to which man would be able to know and control the world without fear of side effects. Within it, however, there were already the prodromes of a more critical approach to the relationship between society and progress. The sociological and pessimistic current of science fiction thus

took over, moving from the New Wave (1960-1980) of Moorcock, Ballard and Le Guin to the cyberpunk of Gibson and Sterling. Until today, where dystopian and post-apocalyptic elements have become predominant.

Science fiction has grown to be a massive genre in the last 150 years, with a particularly strong presence in books, film and television: because of its connection to reality, it can be considered a highly exciting and mind-bending genre for audiences. Like other literary genres, science fiction evolves in the contexts in which authors are born, study, work and live. Different worlds and cultures thus lead to different approaches to science fiction. The western one has been a dominant model in this field but now narratives from other realities are emerging. However, the common denominator remains the same: the use of fiction as a tool to imagine different worlds and possible evolutions of the current situation. It is therefore possible to talk about the future in order to represent the present, either from a pessimistic point of view or by expressing an optimism that wants to be a drive for improvement. Two different ways of looking at tomorrow, which arise from drives inherent in society, science and politics of different cultures. In other words, as shown by recent studies, science fiction is a genre that focuses on imagined technology and is often about imagining possible futures or alternative presents (Michaud & Appio, 2022). Science fiction questions the role, relevance, costs, and benefits of current and future technologies, and presents ideas that can influence public opinion. Science fiction could determine the worldview of individuals, by the modification of attitudes to the significance of current and future science and technology – i.e. innovation and progress. In fact, in its relationship with science, science fiction has an impact on the vision of technology, and the directions in which humans pursue scientific progress.

1.2. Relevance

Before investigating and delving into the existing and identified relationship between science fiction and progress, it is necessary to highlight the motivations that drive the consumption of such fictional texts and the subsequent success of the genre. In order to better observe the dissemination and success - both critical and commercial - of science fiction, data collected from multiple institutes over the past five years is shown in Table 1.1[(1)(2)]:

[1] https://wordsrated.com/science-fiction-book-sales-statistics/#:~:text=Science%20fiction%20books%2C%20combined%20with,in%202021%20compared%20to

[2] https://www.boxofficemojo.com/showdown/sd2034169348

	Title	Year of publication	Author / Director	Copies sold (books) / Grossing (movies)
Books	*DUNE*	1986	Frank Herbert	Over 20 million copies
	The Hitchhiker's Guide to the Galaxy	1979	Douglas Adams	15 million copies
	1984	1949	George Orwell	Over 9 million copies
	Foundation Series	1942-1993	Isaac Asimov	8 million copies
	Ender's Game	1985	Orson Scott Card	7 million copies
	The Time Machine	1895	H.G. Wells	Between 5 and 6 million copies
	Cat's Cradle	1963	Kurt Vonnegut	4 million copies
	The Martian	2011	Andy Weir	3 million copies
	2001: A Space Odyssey	1968	Arthur C. Clarke	3 million copies
	Ready Player One	2011	Ernest Cline	1.7 million copies
Movies & TV Shows	*Avatar*	2009	James Cameron	$2,922,917,914
	Avatar: The Way of Water	2022	James Cameron	$2,217,479,262
	Star Wars: The Force Awakens	2015	J. J. Abrams	$2,068,223,624
	Jurassic World	2015	Colin Trevorrow	$1,670,516,444
	Star Wars: The Last Jedi	2017	Rian Johnson	$1,332,539,889
	Jurassic World: Fallen Kingdom	2018	J. A. Bayona	$1,308,467,944
	Transformers: Dark of the Moon	2011	Michael Bay	$1,123,794,079
	Transformers: Age of Extinction	2014	Michael Bay	$1,104,054,072
	Star Wars: The Rise of Skywalker	2019	J. J. Abrams	$1,074,144,248
	Rogue One: A Star Wars Story	2016	Gareth Edwards	$1,056,057,273

Table 1.1: Most successful literary and audio-visual sci-fi narratives

Looking at the data collected[3] over, in the literary context alone, it can be observed that the profits - economic and cultural - of the science fiction genre have set unprecedented records. Science fiction books generated $590.2 million in revenue in the United States. Within comic books, science fiction sales grew by 8.3% in 2021 compared to 2020. In the United Kingdom, science fiction sales in 2021 were 23% higher compared to 2020. Science fiction books in Australia sold 9% more copies in 2021 than in 2020. During the first half of 2018, the science fiction genre sold 2,679,000 copies, 18% higher than in 2017, with "Ready Player One" by Ernest Chile selling 430,000 copies alone. In the juvenile category, the science fiction genre combined with fantasy sold over 20.3 million copies during the first half of 2018. Along with fantasy, the science fiction genre ranks no.8 on Amazon's most competitive categories list. Finally, in audiobooks, science fiction with fantasy holds the largest share of sales among all audiobook categories, generating over $1.6 billion in revenue in 2021.

In short, it can be stated that science fiction transforms true scientific hypotheses into full-fledged stories about what is feasible and/or imaginable: science fiction is capable of investigating society and humanity through the lens of the 'future'. All the best works of science fiction create worlds that could very well be real and analyse the workings of human society. These possible futures - whether utopian or dystopian - are therefore fascinating and invite reflection. A second reason lies in the fascination that man has always had for what he does not know, the mystery of the universe in which the human being is placed as a tiny dot and in which everything is possible. Moreover, like the fantasy genre, it allows the imagination to travel and 'visit' new worlds, having as an advantage over fantasy (at least for me) a pseudo-scientific basis that makes it all more rigorous, logical and less random. Many stories employ scientific facts and realities, in order to suggest what might happen in the future; investigate what may happen if particular events or situations occurred or advocate the implications of technology and scientific progress and innovation.

Among the main motivations for readers and viewers to read and watch content related to the science fiction genre (Menadue et. al., 2020), it is possible to discuss: escapism – reading science fiction is the best way to forget about actual reality –, warnings – utopian stories educate the audience on what they should do, whilst dystopian novels tell what they should not do –, expansion – sci-fi incorporates new aspects, innovative settings, and technologies –, and "*what if*" – sci-fi narrative delves into ways in which life could be different, starting with individual choices.

[3] See note 1

1.3. Impact on individuals

Looking at the impact that science fiction has had on individuals and their career choices, the most affected areas have been astronomy and space science, as their relationship with sci-fi is perhaps the strongest, "since both typically involve the envisaging and exploration of aspects of the universe which lie outside our everyday experience" (Stanway, 2022). The author observes how many leading STEM enthusiasts credit sci-fi for piquing their interest in science, technology, engineering and math: the impact of science fiction on perceptions of science is also recognised in areas which include public engagement, science education and, in particular, the field of exoplanet, habitability and extra-terrestrial life research has found its deep roots in fictional imaginaries of benefit for framing public science discourses.

The last of the above fields lends itself to an in-depth case study that, for research purposes, offers a point of entry into the relationship between science fiction and STEM careers: this is the so-called 'Scully Effect'. In the late 1990s, one name was synonymous with a medical doctor-turned-paranormal detective: Dana Scully. Played by actor Gillian Anderson, Dr. Dana Scully made her mark on the television Show The X-Files, a hit science-fiction drama broadcasted from 1993 to 2002. Scully was one of the first female characters in a science, technology, engineering, and mathematics (STEM) field to be featured on a popular television show, and the first to play a leading role. The veracity of a 'Scully Effect' has been the subject of analysis both for the mainstream media, including articles, interviews and surveys, and for academic institutions: in the latter instance, reference is made here to the report drawn up by the Geena Davis Institute on Gender in Media (Corsbie-Massay & Whealty, 2022), excerpts of which are given as follows. This report presents the findings of the first systematic study of the influence of Dana Scully on women pertaining to STEM, confirming that entertainment sci-fi media narratives are influential in shaping life choices. In the case of the 'Scully Effect', science fiction influences what career options women can envision for themselves: Scully's character "manifested a woman not yet depicted on TV, and as the fan response soon proved, a desperately needed role model for women of all ages, everywhere."

1.4. Relationship with innovation

That of 'possible futures' is a central theme for science fiction, and throughout the evolution of this style and genre, ideas imprinted on paper or film by writers and filmmakers have contributed to human technological evolution, stimulating and inspiring new ideas, new processes and ways of analysing the world around man. As a matter of facts, science fiction has affected society significantly, inspiring many to pursue careers in science which has, in turn, resulted in advancements in technology

– from robotics to rocketry and everything in between actual science. As writer Christopher Ottesen recalls in his recent article 'How Science Fiction inspires scientists', the science fiction genre has been called 'literature of ideas'[4]. The author states that the stories of H.G. Wells, who is often referred to as the father of science fiction, with works covering topics such as space travel, time travel and biological engineering – published since the late 19th – inspired actual technologies developed in the 20th century. The father of rocketry, Robert H. Goddard, pinned his initial interest in making space travel a reality on reading 1898's The War of the Worlds by H.G. Wells when he was 16. In 1926, he launched the first liquid-fuelled rocket, a momentous event in the history of space flight, and six years later he sent a letter Wells, in which he declared that the novel[5]:

"*Made a deep impression, I decided that what might conservatively be called 'high altitude research' was the most fascinating problem in existence. The spell did not break, and I took up physics. How many more years I shall be able to work on the problem I do not know; I hope, as long as I live. There can be no thought of finishing, for 'aiming at the stars,' both literally and figuratively, is a problem to occupy generations*".

The theoretical and engineering advancements Goddard achieved throughout his lifetime provided a crucial foundation for scientists working at the dawn of the Space Age. Furthermore, in 1914's The World Set Free, H.G. Wells predicted a city-destroying weapon, which he called an 'atomic bomb', that was small enough to be deployed from planes and "would continue to explode indefinitely." His novel not only predicted the atomic bomb, it also inspired physicist Leo Szilard to help create it. Szilard went on to help create and work on the Manhattan Project, and in 1954, he credited Wells as the father of the atomic bomb: the scientist once said that The World Set Free made clear to him "what the liberation of atomic energy on a large scale would mean" (Rhodes 2012). These two examples concerning aerospace and military engineering highlight the relevance of science fiction as an inspiration for scientists committed to changing the world. In fact, remaining within the space sphere, besides H.G. Wells also Frank Herbert, author of Dune (1965), inspired scientists from all over the world by setting the space research engine in motion in the late 1960s. For example, a team of researchers working on theories for intergalactic travel through the folding of space-time attributed the novel by Herbert as their main inspiration for their research (Rhodes 2012). It follows from all of the above that well-known individuals

[4] Ottesen, C. (2021). How Science Fiction inspires scientists. *DataEspresso*.

[5] https://www.nasa.gov/sites/default/files/atoms/files/bolden_goddard_2016.pdf

in a range of scientific and technical fields have spoken or written publicly about their interest in science fiction.

While admittedly make-believe, science fiction derives inspiration from real-world elements and its imagination often shapes future innovation, generating an inverse process to the one considered so far. With a view to analysing the consequences of science fiction's innovation, Table 1.2 lists the best-known scientific innovations and their debt to science fiction.

Technology	Origin	Description
Helicopter	*The Clipper of the Clouds* Jules Verne (1886)	As a young boy, Igor Sikorsky read a Russian translation of Jules Verne's 1886 book *Robur the Conqueror*, in which is described the concept of the modern helicopter. In 1939, Sikorsky successfully performed a tethered test flight of the VS-300, the prototype of the first practical helicopter and by 1942 he had created the first mass-produced helicopter, the XR-4, and his rotor configuration is still used for most helicopters to this day.
Remote Manipulators	*Waldo* Robert Heinlein (1942)	The short story *Waldo* is about a scientist named who invents a device that can perfectly mimic his hand movements, but with greater strength and from a distance. Development of such devices occurred in numerous fields, including the nuclear industry and medicine. In 1948, scientist John Payne submitted the patent for the first 'waldo', just six years after the original publication.
Humanoid Robots	*Astro Boy* Osamu Tezuka (1952)	Tomotaka Takahashi is one of the leading scientists working on humanoid robots, and for him, it all started with Osamu Tezuka's *Astro Boy*. The manga series, which initially ran from 1952 to 1968, follows the adventures of an android—the titular Astro Boy—created by Dr. Umataro Tenma
Earbuds	*Fahrenheit 451* Ray Bradbury (1953)	One of the most famous sci-fi novels foresees 'seashells' and thimble radios tucked into people's ears, as well as Bluetooth-like headsets, producing "an electronic ocean of sound, of music and talk and music and talk, coming in on the shore of unsleeping mind.
World Wide Web	*1964 World Fair* Arthur C. Clarke (1964)	In an interview made in 1964 for the World Fair, speaking on the GM pavilion, the acclaimed sci-fi writer Arthur C. Clarke stated that the future "will make possible a world in which we can be in instant contact wherever we may be, where we can contact our friends anywhere on earth, even if we don't know their actual physical location".
Drones	*Dune* Frank Herbert (1965)	The novel is the first of numerous books and movies that envision autonomous flying vehicles, often tiny "hunter seeker" assassin drones. The U.S. Federal Aviation Administration issued its first commercial drone permit in 2006 and gave out 16 over the next eight years. Then, interest skyrocketed after Amazon CEO Jeff Bezos' 2013 announcement that the company was considering using drones to deliver packages.
Cellphone	*Star Trek* Gene Roddenberry	The 'communicator devices' used by the characters on Star Trek have long been noted as being the inspiration for the handheld cell phone, which was first invented in the early 1970s by Martin Cooper at Motorola. Cooper himself stated

	(1966)	that his inspiration for creating the world's first portable phone was indeed the 'communicator device' used in the Star Trek episodes.
Self-lacing Shoes	*Back to the Future Part II* Robert Zemeckis (1989)	First appearing on movie screens worn by Marty McFly's character, self-lacing shoes have been a coveted item among consumers and fans of science fiction fiction. After numerous experiments, Nike marketed the first model in 2016.Each of the shoes incorporates sensors that prompt motors to tighten the elastic laces in reaction to pressure; the laces can also be adjusted using buttons just inside the tops.
Metaverse	*Snow Crash* Neal Stephenson (1992)	Describing a fully immersive online 'universe' where people interact with one another through representations called 'avatars', Stephenson not only foresees virtual reality scenarios – already in develop at his age – but also and more specifically what today is intended as Metaverse: a virtual-reality space in which users can interact with a computer-generated environment and other users.
Targeted Advertising	*Minority Report* Steven Spielberg (2002)	Adapting a short story by Philip K. Dick set in 2054, the filmmaker describes a man that is constantly confronted by personal advertisements from various brands the minute he enters a public area, where his retinas are scanned by computers. Spielberg consulted with several scientists while creating the blueprint for the movie: he wanted to show a plausible future extrapolated from what was available in 2002. Twenty years after the release of the *Minority Report*, the right to privacy has diminished even more.

Table 1.2: Examples of science fiction references used in modern technology

1.5. Sci-fi and Foresight

The relationship between foresight and science fiction was born a decade ago with the pioneer and greatest representative of the subject Brian David Johnson. Johnson was commissioned by the multinational technology company Intel to work on a "smart TV," when it was not yet even conceivable to connect a television to the Internet. To see what possible impact this technology could have on individuals and society, he thought of an innovative approach, that of "Science Fiction Prototyping" (Johnson, 2011). This is a methodology that uses fiction to tell the future of "anything" through a 5-step process, tracing what is already being done by authors of real science fiction. Science fiction prototyping will be explored in more detail in the section on literature, but here we briefly summarize the 5 steps to be undertaken: the creation of a world with detailed characters and settings, the introduction of an inflection point that may be a threat or a new technology, the analysis of how the inflection point may affect the world that has been created, a second flection point that is nothing more than the solution to the first, and finally the conclusions or lesson that may be drawn from the story.

Unsurprisingly, numerous corporate organizations, including Google, Microsoft, Apple, Visa, Ford, Pepsi, Samsung, Nike, Ford, Hershey's, Lowe's and Boeing hire science fiction writers to help them exploring fictional futures that would have been

unthinkable otherwise[6]. Recently, science fiction writers have also been employed by organizations in the public and military sectors, including NATO, the U.S. Army, and the French Army, to envision upcoming threats[7].

Not to mention all the other companies that are doing this without it being in the public domain for reasons of confidentiality and competitiveness. An interesting example is Future Visions: Original Science Fiction Stories Inspired by Microsoft, an anthology created by the company in 2015 in which 9 famous science-fiction authors tried their hand at writing stories that explored worlds generated by innovative technologies, such as quantum computing, machine learning, artificial intelligence, and so on. The company allowed the authors to visit its research labs in order to align them on what technologies were being tested the most, and although each had written his story independently, many themes overlapped with each other.

In addition, there are several companies involved in advising large organizations on the use of sci-fi. The Near Future Laboratory which has as its mission to explore the future in an experimental way, moving away from the confines of traditional tactics; the Creative Science Foundation, an educational organization that explores the synergies between the creative arts such as can be books, films, etc., and the sciences to foster innovation; Orange Labs a corporate structure in which researchers from various disciplines are brought together to develop foresight projects in the field of ICT (Michaud and Appio, 2022). In particular, Musso, Ponthou, and Seulliet (2007) show how Sci-fi and the imaginary laid at the heart of the Orange Labs, which were at the forefront of a wider creative process shared by centers such as Xerox Parc, CISCO, the Ars Electronica Center, and the Bauhaus model.

Given the growing relevance of the issue, it was discussed at the academic level in 2022 by Michaud and Appio, who launched a call for papers to solicit research to study its development and encourage its wider dissemination.

[6] Romeo N., The New York Times (2017). Better business through sci-fi: https://www.newyorker.com/tech/annals-of-technology/better-business-through-sci-fi

[7] BBC (2019). French sci-fi team called on to predict future threats: https://www.bbc.com/news/world-europe-49044892

2 Literature review

The literature review of this study aims to investigate the use of the science fiction genre to support organizations' processes and objectives. The aim is to shed novel light on the methodologies through which organizations can use science fiction and on how the organizations' goals could be achieved through these methods. The study of literature allows to acquire in-depth knowledge on the topic of interest and highlights potential gaps and open questions to be explored.

In this chapter, a systematic literature review on the topic of interest has been performed. First, the methodology used to conduct the research is explained, which involves the identification of literature on the topic and a subsequent screening aimed at selecting the papers that meet the research objectives. Then, a qualitative analysis of results is presented, with the aim of framing the relevance of the topic and of the selected papers in academic research. Finally, the content of the selected papers is analyzed with the aim of identifying the methodologies to use science fiction and their possible applications in business processes.

2.1. Paper Identification

A systematic literature search was performed in order to analyze the state of the art of the topics of interest. The systematic approach made it possible to identify, select, and critically appraise all relevant findings and construct an analysis that was accurate, relevant, rigorous, and replicable. The systematic literature review was conducted via Scopus by Elsevier, a curated abstract and citation database.

The starting point was the selection of the keywords of interest in order to accomplish the research query. The selection of keywords was guided by the objective of combining the tools related to the science fiction subject and the organizational processes in which science fiction can be used. Therefore the keywords in the research query are organized in two blocks linked by an AND, which represent the two topics whose relationship we want to investigate.

Research query:

("Sci-fi" OR "Sci fi" OR "Science fiction" OR "Speculative fiction" OR "Design fiction*" OR "Speculative design" OR "Future persona" OR "Future prototyp*") **AND** (Foresight OR "Futures stud*" OR Scenario OR Innovation OR Strateg* OR "Decision-making" OR (Future* AND Technology))

1. Science fiction tools

("Sci-fi" OR "Sci fi" OR "Science fiction" OR "Speculative fiction" OR "Design fiction*" OR "Speculative design" OR "Future persona" OR "Future prototyp*")

The first block of keywords contains all those terms used to refer to the concept of science fiction, both as a literary production or a design practice.

- "Science fiction" and its shortenings "Sci-fi" and "Sci fi", are different terms to refer to the same concept, which is the literary genre as defined in the introduction. Science fiction falls into the broader category of speculative fiction, which does not necessarily deal with science and technology, but we also included this term because they are often used as synonymous in the literature.
- The string has been expanded to be more inclusive than pure sci-fi usage, including methodologies derived from sci-fi. Preliminary research in the literature highlighted the existence of design practices aimed at production of science fiction stories for purposes other than entertainment. There is a wide variety of practices to design science fiction stories for exploring futures, whose difference is subtle, therefore we selected the most frequent terms in the literature: Design fiction, Speculative design, Science Fiction Prototyping (not included in the research query, because it is already covered by "Science fiction" keyword), Future persona, Future prototyping. The meanings of these terms are partially overlapping but boundaries remain blurred, therefore their combined usage could capture all the facets of the topic.

This first block of keywords is combined with the following second one.

2. Organizational processes

(Foresight OR "Futures stud*" OR Scenario OR Innovation OR Strateg* OR "Decision-making" OR (Future* AND Technology))

This block of keywords contains the relevant terms related to the processes in which Science fiction can be introduced. The usage of this genre is investigated to support several organizational processes that may deal with the future and long-term orientation. As discussed in the introduction, activities that aim at the systematic exploration of the future in companies belong to the field of foresight, also referred to as "Future studies". Even though there are many different terms to refer to this field, futures studies and foresight are the academic field's most commonly used terms in the English-speaking world (Sardar, 2010). Moreover, several other business activities can benefit from the use of a future-oriented and long-term approach, similar to the one that characterizes foresight activities. Specifically, the study wants to investigate how Science fiction tools can be applied in the innovation process, development of scenarios, also called scenario planning, and strategic decision-making. Preliminary research in literature brings out that sometimes this topic is discussed using other terms than the proper academic ones just presented. For this reason, we decided to include a combination of "future" and "technology" to grasp the concept of reasoning on the future, constrained to technology topics.

As a result of the research query, the number of articles emerged was 1,842.

2.2. Paper Screening

The paper selection consisted of two stages.

Firstly, some filters were applied to limit search results to papers of significant relevance. Secondly, the second stage of the collection process involved a consultation of the articles' abstracts and a subsequent more thorough analysis of the articles.

The first filter is related to the **timeframe** for publication. Indeed, although the relationship between science fiction and foresight has always been discussed in the last decades, the topic gained relevance in literature after the conceptualization of the "Science Fiction Prototyping" methodology, introduced by Brian Johnson in Intel in 2010 (Johnson, Brian David, 2011). For this reason, we choose to select the results published from the beginning of 2010 until today.

Consistently with the objective of this dissertation, the most compliant **subject areas** selected have been: Computer science, Social science, Business, Management and Accounting, Decision Science, Economics, Econometrics, and Finance, Engineering and Arts and Humanities.

Subsequently, among all possible **document types**, only articles, reviews, book chapters, conference papers and conference reviews published in the **English language** were selected.

The number of articles selected after the application of filters was 1,219. It is interesting to point out some preliminary insights on results regarding the subject areas.

Subject area	Number of results
Computer Science	509
Social Sciences	479
Arts and Humanities	385
Engineering	232
Business, Management and Accounting	129
Decision Sciences	44
Economics, Econometrics and Finance	28

Table 2.1: Number of results per subject area

As shown in Table 2.1, most of the documents belong to the subjects of Computer Science, Social Sciences and Arts and Humanities. The Computer Science field shows a particular interest in this topic, being characterized by research on cutting-edge technologies that are most likely to disrupt our future. The combination of Social Sciences and Arts and Humanities highlights the multidisciplinary of the topic investigated and reflects the relevance of science fiction in combining technology with society and individuals. However, the topic is still less explored in the corporate field for business-related applications.

At this point, to ensure the maximum reliability of the analysis, papers with a **Q1 ranking** were selected. To assess the robustness of the Journal of each article, SCImago Journal Ranking was used. The SCImago Journal Rank or SJR indicator is an indicator that measures the degree of scientific influence of academic journals. The number of documents selected after this step was 650.

In the second stage of the collection process, the articles selected have been consulted by the authors. Through a reading of the abstract, the papers that did not meet the research objectives were excluded. Specifically, the following exclusion criteria were identified:

- **Out of scope**: in this category, articles that were distant from the topic of interest were considered. In particular, articles that did not focus either on foresight activities nor on the use of science fiction.

- **Absence of focus on future-oriented activities**: since the topic of this study is quite new in the literature, we included in the research query several keywords that describe future-oriented activities to collect as much information as possible. However, some selected keywords are common terms also used in other fields out of interest for the study.
- **Absence of focus on science fiction**: some papers contain the terms related to science fiction in the title, keywords or abstract, but the role of science fiction in the discussion is very limited.
- **Description of scenarios**: papers that use science fiction to explore future scenarios with the aim to inform research on a certain field, but do not present methodologies nor results on the work.

Table 2.2 shows the number of articles excluded for each category.

Exclusion criteria	#Articles excluded
Out of scope	268
Absence of focus on foresight	200
Absence of focus on science fiction	78
Description of scenarios	13
Total number of articles excluded due to reading of abstract	559

Table 2.2: Number of articles excluded according to the criteria selected after the reading of the abstract

Among the articles selected as relevant, the papers not downloadable and not available were discarded. At this point, the reading of 64 full papers was performed. The complete articles were analyzed and excluded by using the same criteria presented earlier. Ultimately, the number of articles approved and deemed relevant for the analysis resulted to be 38. The funneling process is shown in Figure 2.1.

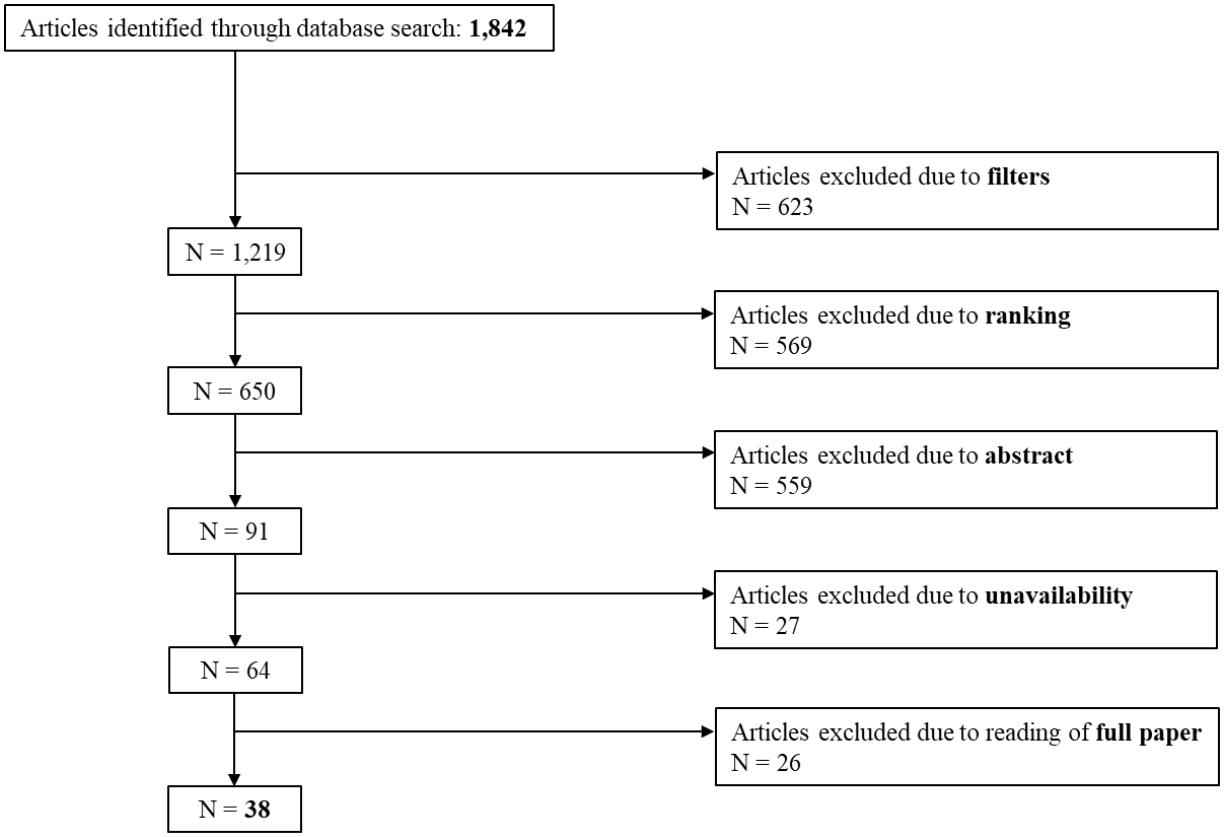


Figure 2.1: Funneling process

2.3. Qualitative analysis

As shown in Figure 2.2 and Figure 2.3, the increasing number of papers suggests that there is an increasing interest in the topic from 2010 to the date. The value in 2022 is negligible, since the results of the research query have been extracted on October 9, 2022, before the end of the year. As discussed in the introduction, the fast pace of change and the increasing frequency of disruptive events in the environment required companies to broaden the time horizon of their analyses. It can be seen that the interest in the topic started increasing especially in the aftermath of the pandemic, which has raised relevance of using approaches oriented toward exploring the future in order to be prepared for the occurrence of disruptive events. Moreover, the rapid progress of cutting-edge technologies, such as AI and Robotics, are starting to raise concerns about their future development and long-term trajectories. As a result, foresight studies and future-thinking approaches, including the use of science fiction, have gained interest from the research.

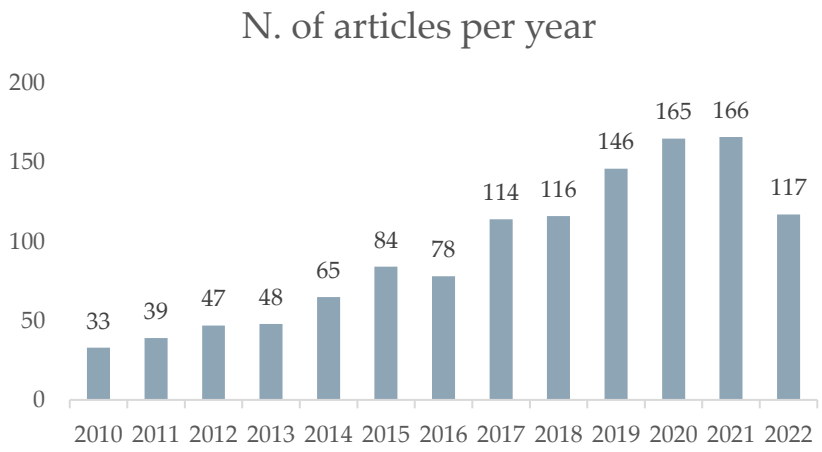


Figure 2.2: Number of articles per year among the selected ones

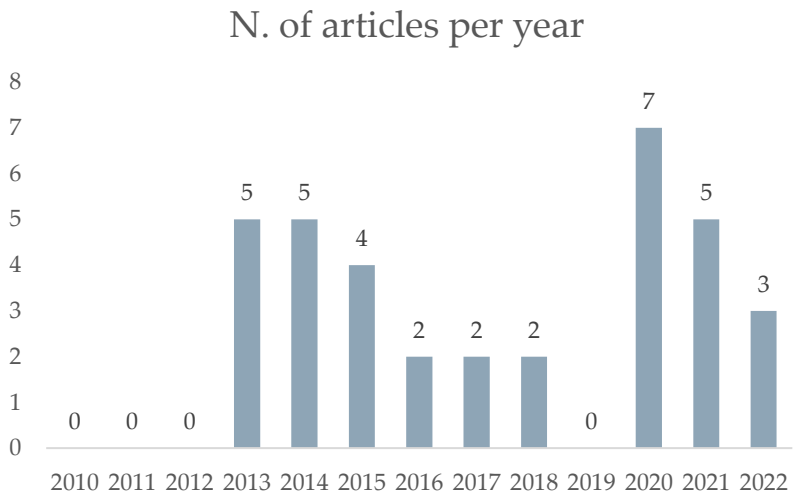


Figure 2.3: Number of articles per year among the full read

The number of citations for each selected article was retrieved from Scopus by Elsevier and analyzed, because it is considered a good measure of the "prolificacy" of an article in a particular field. Moreover, this measure also indicates the impact of the papers selected on the scientific research. Among the 38 approved papers, the number of citations of 4 articles was not available through Scopus. The results are shown in Figure 2.4. In particular, articles were collected in 5 clusters, according to the number of citations received.

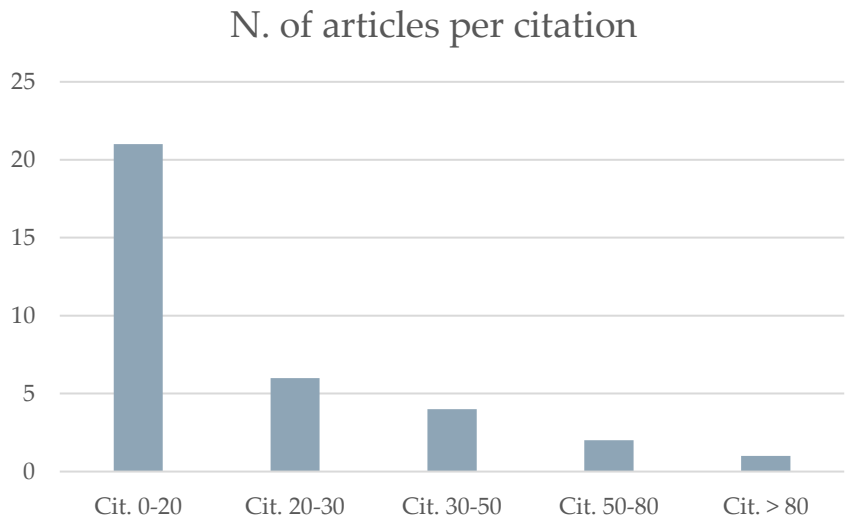


Figure 2.4: Number of articles per citation

In addition, the overall number of citations per journal was analyzed and reported in Figure 2.5. As can be seen in the figure, most cited articles are published in the following journals: Futures, Technological Forecasting and Social Change, Journal of Urban Technology.

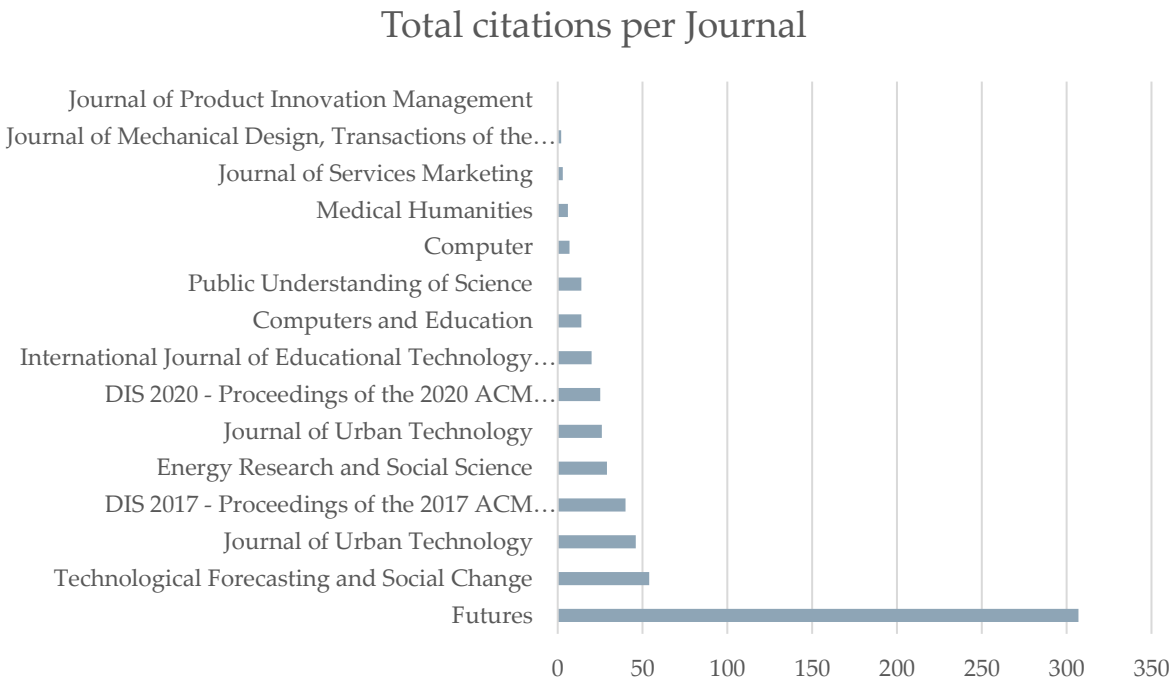


Figure 2.5: Total citations per journal

2.4. Content analysis

The content of the analyzed studies has been categorized on the basis of two dimensions, the first regards the methodologies through which science fiction is employed to support companies' objectives, which we will refer to as the sci-fi based approaches, while the second dimension refers to the application of the methodologies on different organizational processes.

In the context of the first dimension, the studies on the topic have been clustered in two main approaches to the use of sci-fi: the analysis of existing science fiction landscape and the exercise of designing new sci-fi stories. These two approaches imply different methodologies to exploit the science fiction genre, but they can also be used in a complementary way to support a certain process. The second dimension of the literature deploys the usage of science fiction into innovation process or into strategic foresight practice. Both types of sci-fi based approaches are proposed in the literature for being applied in the two kinds of organizational processes.

2.4.1. Sci-fi based approaches

The methodologies discussed in the literature can be clustered in two main approaches: the analysis of existing sci-fi landscape and the design of ad-hoc sci-fi stories. The two approaches will be in-depth analyzed in the following chapters. Before going into the details of the two approaches, recurring features that have emerged from the literature on the characteristics of sci-fi methodologies are discussed in detail below.

2.4.1.1. Common features

Science fiction genre has specific characteristics that make it a useful tool for introducing future-oriented and innovative approaches within organizational processes. For this reason, many methodologies have been conceptualized and tested in experimental environments with the aim to introduce into organizations the systematic practice of using science fiction as a research tool to investigate the future. Indeed, sci-fi based approaches are meant to leverage common characteristics specific to the science fiction genre, that are also illustrated in Figure 2.6. The following paragraphs present an overview of the benefits that sci-fi based approaches could bring to organizational activities.

Science facts as starting point. Science fiction stories are grounded on scientific research and current knowledge. They start from scientific, social and technological innovation trends, to explore their potential consequences on alternative futures, through a speculative and imaginative approach. Indeed, many sci-fi authors are scientists or have a scientific background. For example, Isaac Asimov was not only a

highly successful and prolific writer of Sci-Fi and of science books, but also got a Ph.D. in biochemistry at Columbia University. The American sci-fi author Edward Elmer Smith also earned a Ph.D. in chemical engineering from the University of Idaho, Moscow and worked as a chemist at the United States Department of Agriculture in Washington, D.C. Also, several sci-fi filmmakers sought the help of famous scientists to make their stories as realistic as possible. For example, Steven Spielberg assembled a team of scientists to create *Minority Report*. NASA has provided significant expertise to many sci-fi writers since its inception. The services of NASA were used by both Kim Stanley Robinson to write *The Mars Trilogy*, and by Andy Weir for *The Martian* (Michaud & Appio, 2022).

Speculative approach. Starting from reality, science fiction explores alternative futures, both utopic and dystopic, through the power of imagination without constraints, resulting in a more transformative and disruptive way of thinking about the future. Fiction writers are accustomed to thinking outside the confines of feasibility criteria (money, time, resources, etc.) and beyond the boundaries of the imagination of the general populace (Kotecha et al., 2021), opening the future to the possibility of radical change.

The interplay between technology, society and individual dimension. The three core elements of sci-fi are technology, society and individuals (Fergnani, 2020). The stories explore the systemic consequences of innovative technologies on society, capturing the human experience with science and technology and showcasing the routine of individuals in the future context.

Narrative form or story-telling. Using Science fiction-based approaches allows to exploit the power of story-telling on the future. Science fiction builds a vivid representation of future scenarios through a narrative, with a plot and characters' stories. Narratives are implicit theories, explaining how outcomes are achieved through a sequence of events: the plot shows a specific course of action, allowing to better understand cause-effect relationships and the trajectories that lead to a certain future world (Hällgren & Buchanan, 2020). Additionally, narratives get furnished with objects and technologies that, on the one hand provide participants with the everydayness, that enables them to relate with the proposed future; and on the other hand, these elements evoke emotional responses and enable participants to speculate what futures might be and feel like. These real emotional responses to experiences that are not directly lived, generate memories that might allegedly lead to behavioral change (Garduño García & Gaziulusoy, 2021).

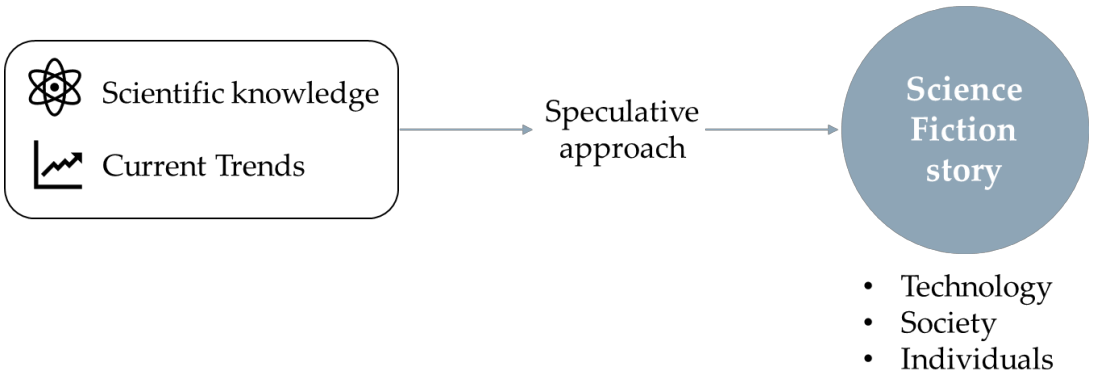


Figure 2.6: Key features of science fiction

2.4.1.2. Analysis of science fiction landscape

The first approach to the use of sci-fi consists in the analysis of existing science fiction content in the cultural landscape, in its different artistic forms, including books, movies, TV shows, comics or video games. In the following paragraphs, a comprehensive overview of the methodologies, benefits and main frameworks of such approach that emerged from the literature is presented, while the achievable objectives will be discussed in chapter 2.4.2.

METHODOLOGY

A methodology to perform the analysis of the sci-fi landscape is proposed, by combining the insights and techniques emerged from the analyzed studies.

Source. Science fiction production can be found in different artistic forms, books, movies, TV shows, comics or video games. Studies make use of all these forms, except for the video game one, and they do not suggest a preferable one. The source of the sample can be any online database providing a list of sci-fi production, eventually already filtered. With respect to the film form, the literature brought out the use of the following databases: IMDB, LUMIERE, Cineuropa, the National Film Preservation Board, specific Wikipedia lists (i.e. Wikipedia's list of films set in the future); while as repositories of novels: Librarything, Goodreads, and Isbndb. A database of films and novels has also been developed as part of the EU project FLAGSHIP, which sought to explore fiction as an alternative source of imagined futures. Within the broad and prolific field of speculative representations of future worlds FLAGSHIP focused on work that has had a significant and lasting impact on the public imagination. As for the purpose of innovation, a publicly available site called "Technovelgy" can be exploited, that lists inventions, technology, and ideas conceptualized in science fiction.

The website contains over 3200 speculative technologies and over 5800 news articles reporting their realization.

Sample selection. The literature presents suggestions on how to select the sample, i.e. the population of sci-fi of interest, to be analyzed. Every choice must be aligned with the application and the objective of the analysis, however some guidelines can be provided. The following choices are recommended:

- The selection of well-established in the social domain (Zheng & Callaghan, 2018) and culturally significant representations of future worlds (Bina et al., 2020); this can help the connection with society and the imaginary. To this end, the selection process involves the definition of indicators of quality (e.g. award nominations) and influence (number of editions and languages of publication), weighted to ensure some regional diversity and historical spread (Bina et al., 2020).
- The use of science fiction set in the future, particularly characterized by transformational futures. It is suggested to exclude fictions set in a future where mankind is portrayed with no detectable transformational change from the present (Fergnani, 2020).
- Fictions describing plausible and realistic futures, in order to ensure plausibility and relevance of the output. It is suggested to exclude fictions set in a fictional future as a result of a fictional past, or featuring a substantial amount of fantastic, or surreal phenomena, superpowers, monsters (not aliens), magic, the supernatural, time travel to the past that modifies the present (Fergnani, 2020).
- Sample size and filters: it can be selected as a set of fictions or just one. When selecting *a set*, the fictions can deal with a generic topic or can be filtered. The filters can be used to select works on a particular research field (i.e. Urban future), a particular technology (i.e. AI and robotic systems) or focused on specific dimensions we want to investigate in the context (i.e. social, economic, ethical, pedagogic, …). It is also possible to select *only one* fiction that deals with the scenario or technological topic of interest to be analyzed in depth (i.e. 2013 fiction novel "The Circle" to explore privacy and surveillance implications of sensing technologies).

Analysis. At this point, an analysis of the content can be conducted by qualitative approaches to the research of information, or it can also be supported by algorithms and Artificial Intelligence. The study conducted by Kotecha et al. on the use of written science fiction for design ideation suggests the utilization of Text Mining and Natural Language Processing as technological enablers: sophisticated algorithms could be useful to mine for relevant and contextual words from the large corpora of speculative fiction and find analogies from sci-fi databases to look for stimuli (Kotecha et al., 2021). The analysis of science fiction content is aimed at extracting valuable information from the story, in order to take inspiration from a transformative portrayal of the future.

According to the objective of the organization, it can be used to find innovative technological ideas, detect weak signals and extract scenarios of the future.

BENEFITS

As previously discussed, science fiction stories have a strong connection to scientific research, technological innovation, and the collective imaginary and feeling of society about the future. This connection can be strategically exploited by companies, by incorporating systematic analysis of science fiction products into their operating practices. The following paragraphs will present the potential benefits from exploring the existing science fiction production.

Sci-fi imaginary. Famous science fiction stories have a high influence on the society imaginary about the future. Science fiction should be read alongside technology research, because it does not merely anticipate, but actively shapes the technological futures through its effect on the collective imagination. Science fiction can be regarded as a type of virtualized prototype or simulation for imaginative ideas; if such a fiction contains a plausible amount of reality, then innovations it contains, that people like, are likely to be desirable in real life (Zheng & Callaghan, 2018). Indeed, thanks to its speculative nature, the sci-fi imaginary is a powerful source of *utopic futures* depiction and innovative technologies, that has inspired many researchers and engineers throughout history in the development of several technologies and motivated research toward progress in science and society. This turns into a co-evolutionary relationship between science and science fiction, where scientific research and technology has inspired writers to dream up compelling stories and astonishing new worlds, and generations of scientists have in turn had their imagination set on fire by science fiction stories that inspire them to devote their life to science.

Since fictional images of the future can help us think the unthinkable (Fergnani, 2020), on the other hand, science fiction landscape is also considered a rich source of *dystopic scenarios* about the future, from where we can take inspiration to identify possible risks and warning signals that wouldn't be considered by means of other approaches.

Society sentiment analysis. Sci-fi authors embed significant characteristics and feelings of contemporary society in their stories, reflecting society expectations, aspirations and fears towards the future (Zheng & Callaghan, 2018). Indeed, science fiction stories provide good indicators of how the general public perceives the future and new technologies (Osawa et al., 2022). Through science fiction organizations can connect with society and their markets, gaining a deeper understanding and insights.

MAIN FRAMEWORKS

The literature has revealed several frameworks that guide the process of analyzing existing sci-fi content to support innovation and foresight activities. In the following paragraphs, the two respective most relevant frameworks in academic research are presented.

- **Diegetic Innovation Templating**

Zheng & Callaghan developed the "Diegetic Innovation Templating" (Zheng & Callaghan, 2018), a methodology that seeks to extract innovative ideas from established science fiction to be transferred into real innovation outputs, i.e. product or process design. The methodology provides a way to identify fictional technology disruptors and then map their potential route to reality, through the use of two concepts: the "Diegetic Innovation Templates" (DiT) and the Diegetic Gap" (DiG). It starts with the definition of a template of needs by mapping emerging trends in the industry, that will guide the extraction of ideas from fictions. Then, fictions are analyzed to identify the DiT, an artefact extracted from the science-fiction story that captures an innovative concept. The following step is the assessment of the DiG, which is the analysis of the gap between the fictional idea and reality, based on technological feasibility, capability, utility and timeline dimensions. This analysis enables to assess the idea with respect to the company needs, in order to develop future action plans and drive R&D investment decisions.

- **Six Scenario Archetypes framework**

The "Six Scenario Archetypes" is a framework developed by Fergnani (Fergnani & Song, 2020), that extracts predetermined archetypal images of the future from the science fiction landscape. 140 films have been analyzed to find mutually exclusive, recurring, and consistent patterns representing different macroscopic futures of mankind. The analysis uncovered six images of the futures:

- Growth & Decay: a future of continuation of the current growth trajectory, but also with elements of social decadence;
- Threats & New Hopes: a future where an incoming threat significantly challenges the status quo globally, and forces humanity to build new resilience capabilities;
- Wasteworlds: a future where a catastrophic event or phenomenon transforms the atmospheric environment, and the world regresses due to scarcity of resources;
- Disarray: a future of disorder, with high levels of war, famine, epidemics, disinformation or social unrest;

- Inversion: a future where a transformational event or phenomenon inverts human beings sovereignty over the globe; and
- The Powers that Be: a future where a totalitarian or dictatorial regime significantly decreases the agency of organizations and individuals globally.

2.4.1.3. Design of science fiction stories

The other possible approach to take advantage of the characteristics of the science fiction genre is to create ad-hoc sci-fi stories in organizations' operating practices. The literature brought out the existence of several design practices aimed at the production of sci-fi stories to explore futures, with purposes other than entertainment. Similarly to the previous section, in the following paragraphs, a comprehensive overview of the methodologies and benefits of such approach is presented, while the achievable objectives will be discussed in chapter 2.4.2.

METHODOLOGY

The two most relevant and diffused methodologies emerged from the literature are "Design Fiction" and "Science Fiction Prototyping" and they will be discussed in detail in the next paragraphs.

- **Design Fiction**

Design fiction is a design practice that aims at creating multiple speculative scenarios through designed artifacts, to explore and envision possible futures. The expression "design fiction" (invented in 2005 by the author Bruce Sterling) has been popularized by Julian Bleecker, author of the 2009 manifesto *Design Fiction: A Short Essay on Design, Science, Fact and Fiction*. The manifesto presents a synthesis of the topic and proposes a method that has subsequently become the subject of courses and advice to companies. Indeed, design fiction has begun to get attention for its ability to drive organizational innovation initiatives (Michaud & Appio, 2022).

Design fiction draws its inspiration from weak signals of our everyday lives, such as innovations in new technologies or cultural trends, and uses extrapolation to build disruptive visions of society. It may be enacted in written stories, comics, movies, and it describes "diegetic prototypes" embedded in plausible worlds. The prototype is categorized as diegetic, which refers to a technology established in a narrative that does not exist in the real world but appears to be conceivable in the near future (Kirby, 2010). Bruce Sterling's own definition: "Design Fiction is the deliberate use of diegetic prototypes to suspend disbelief about change" (Sterling Bruce, 2013). This is a central aspect of design fiction: through the use of objects (the prototypes) that do not exist in reality, but are materialized in the fictional narrative context (the diegetic form), viewers can be made to explore scenarios and planning of futures, exponential

technologies that are easily usable and conceivable, and that are difficult to imagine in the abstract. David Kirby, a professor at the University of Manchester, in his essay *The Future is Now. Diegetic Prototypes and the Role of Popular Films in Generating Real-world Technological Development*, talks about how diegetic prototypes show the general public "a need, feasibility, and benevolence of a technology" (Kirby, 2010).

Researchers strived for identifying guidelines for developing design fictions, however, design fiction is still an "open" practice, in which diverse perspectives and enactments can exist side by side (Rapp, 2020).

France Télécom's R&D, a company in which researchers from various disciplines develop foresight projects in the field of ICT, was at the forefront of design fiction by creating dozens of dream stories between 1997 and 2003, sci-fi short films imagining the telecommunications technologies of the future (Michaud & Appio, 2022). Within the firm, design fiction was used as a bridge to sci-fi diegetic prototyping, which will be discussed in the next paragraph.

- **Science Fiction Prototyping (SFP)**

The idea was introduced by Brian David Johnson in 2010 who, at the time, was a futurist at Intel working on the challenge his company faced anticipating the market needs for integrated circuits at the end of their 7–10 years design and production cycle. Intel corporate futurist Brian David Johnson theorized and experimented with sci-fi prototyping, a methodology to design fictional prototypes which are introduced into the innovation strategies of companies (Michaud & Appio, 2022).Science Fiction Prototypes are short fictions, grounded in scientific fact, created for the explicit purpose of acting as prototypes for people to explore a wide variety of futures and to start a conversation about the implications, effects, or ramifications of technology. These prototypes use narrative techniques to test the development of a new technology, evoking some of the complexity of the real world through the emotional lenses of fictional characters impacted by a changed future. In practice, science fiction prototyping involves writing stories, creating films or comics, or building immersive experiences such as virtual reality simulations.

The methodology developed by Johnson defines the following five-step process for writing SFP (Johnson, 2011), also illustrated in Figure 2.7:

- **Pick your Science and build your World:** the first step is the choice of the technology and the underlying science about which we want to develop the SFP. For example, an emerging technology that would allow us to build a robotic dog, or a new scientific discovery of a medicine to make us live longer. It has to be based on a robust scientific foundation. Inputs should include

scientific research on the domain of interest, technology trends, economic trends and social sciences. It is crucial to build a believable world that pushes the boundaries of current technological and social/institutional structures.

- **Identify the Scientific Inflection Point:** the second step speculates on the future implications of technology for the society. It involves the development of a narrative device where the world changes in some significant way. Here technological and societal problems introduce a tension to the story.
- **Consider ramifications of the Science on People:** the impacts of changes on people lives are explored.
- **Identify the Human Inflection Point:** "human inflection point" shows how individuals do not simply react to changes, but rather interact with them. The process here is shown along a line, but can be recursive and iterative.
- **Reflect on "What did we learn?"**: finally, since the goal is to learn something new about potential futures in the system of interest, after finishing the scenario(s), it is important to have a period of reflection, reporting-out and learning on what should be done in the present when design and further develop such technology.

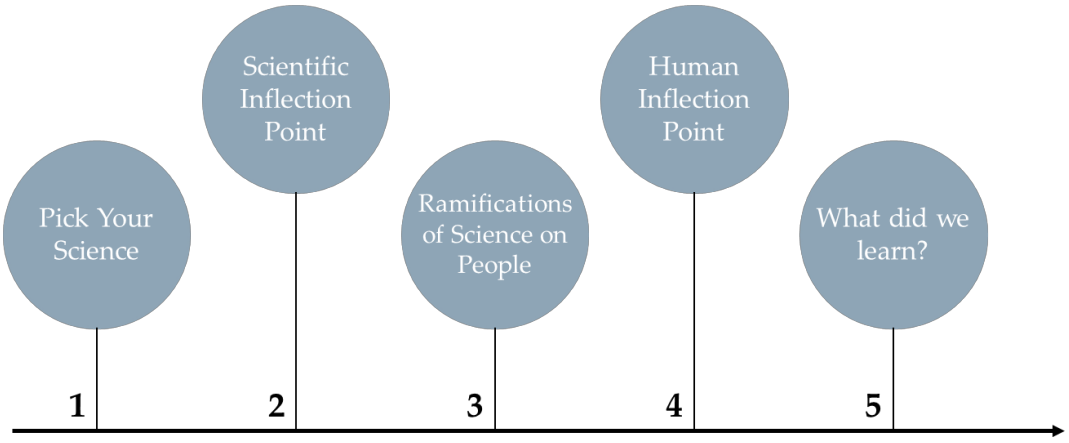


Figure 2.7: Science Fiction Prototyping process

An extended version of the SFP has been proposed by Brucker-Kley E. et al., with the objective to further improve the communicative effectiveness of the stories. "Immersive Sci-fi Prototyping" (Brucker-Kley et al., 2021) builds on the principles and processes of SFP, but extends it by three novel aspects. First, fully immersive Virtual Reality (VR) prototypes are developed, dipping the user completely into a computer-generated world, to experience the scenarios from various perspectives and increase emotional involvement. The second novel addiction is interactive multilinear storytelling, presenting alternative versions of the future. This enables the recipient to

take decisions and foster thinking in alternatives. The third novelty is the deployment of a technological framework, the sci-fi prototyping generator, that enables immersive VR prototypes to be automatically generated from narrative scenarios. This methodology allows to conduct SFP in a replicable, efficient and effective manner. Figure 2.8 summarizes the main building blocks of the technique.

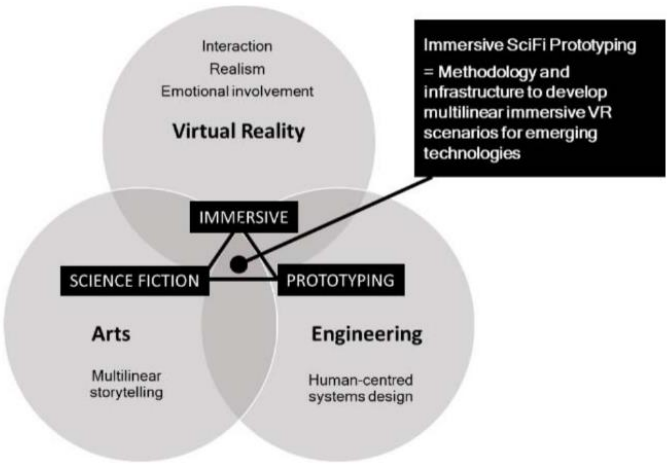


Figure 2.8: Immersive SFP building blocks

BENEFITS

The following paragraphs will present the potential benefits that the creation of sci-fi stories could bring to innovation and foresight activities.

Generative exercise to shape the future. Design techniques do not try to predict the future, they promote creative thinking to open up all sorts of possibilities that can be discussed, debated and used to collectively define a preferable future for a given group of people, companies or societies (Strachan C.G., 2016). P. Drucker once famously said "The best way to predict the future is to create it", meaning that what is decisive about the future is how we shape it in the present. In this regard, sci-fi design techniques can help in actively shaping technology futures through sophisticated imagination (Potstada M., 2014).

Collaborative exercise. Design techniques enable people from totally different backgrounds to share their visions of the future for technology, business and society and their interaction. The design exercise creates high participatory spaces for co-creation and democratization of the future (Pinto J.P., 2021). Moreover, since the stories that people tell about their world are part of the social reality, these speculative methods can provide us with real insight into social problems (Baumer E.P.S., 2020).

Finally, it can be a useful approach to merge different actors from different disciplines, including creative and scientific profiles in building the future.

Problem-solving exercise. Creating stories fosters creativity and imagination in problem-solving (Spiers E., 2022) and fosters critical thinking concerning long-term developments.

2.4.2. Applications in organizations and objectives

The sci-fi based approaches illustrated can be employed systematically by organizations to support different objectives and in different fields of research. The two macro areas of interest for the use of science fiction are the innovation process and the strategic foresight process. In turn, these techniques can fit in to support one or more phases of these processes. The analyzed studies explore the application of science fiction to support such processes in different industries and research fields, with its application being of particular interest in the areas of Technology and Emerging technologies (with particular focus on HCI), Global change, Urban studies, Education and Healthcare. Studies are addressed to different types of organizations: corporate, public institutions (policy-makers), academic institutions (schools and universities), research institutes.

The following sections present the different applications of sci-fi approaches within organizational processes and their objectives, by combining conceptual knowledge and results from empirical studies.

2.4.2.1. Innovation process

The pace of technology and the fast-changing external context pose significant challenges to modern companies in the innovation process. As a result, engineers, product managers, inventors are under growing pressure to come up with inventive and effective solutions faster. Science fiction is a useful tool to face these challenges and to come up with disruptive innovations. Sci-fi based approaches can support different phases of the innovation process: the idea generation at the front-end of innovation (R&D); the idea implementation by testing the idea and driving organizational change.

IDEA GENERATION

According to innovation studies, employee creativity and the ability to generate creative ideas for new products is crucial for organizational innovation, in order to be able to respond to changing market needs. Creativity can be engendered into the innovation process by integrating Science fiction methodologies.

Innovation managers can improve their quest for innovative ideas by engaging in a new type of *search based on science fiction landscape and imaginary*. Engineers, scientists and inventors can take inspiration from existing sci-fi to envision innovation opportunities, such as utopian technologies to include in R&D programs and product innovation ideas (Michaud & Appio, 2022). The claim is supported by the rich evidence of engineers, scientists and inventors that have been inspired by science fiction's powerful imaginary in choosing their career path and thereafter in the production of their inventions. As discussed in paragraph 1.1, the expected benefits of using such approach lay in taking inspiration from a source of more disruptive innovation, but nevertheless science-based, and in the ability to connect to the expectations of society. Indeed, the imaginary is powerful for designing new products and services because it makes it possible to capture the expectations of the public and stimulate the creativity of product managers and engineers who have the knowledge needed to realize such technological wishes (Michaud & Appio, 2022).

Alternatively to the analysis of existing sci-fi, or using it as an input, the generative potential of sci-fi design tools may be used to drive creativity and produce unique ideas by the innovation team (Michaud & Appio, 2022). Design fiction and Science fiction prototyping have been identified as a means to develop new products and services in light of their potential of enhancing creativity by generating new ideas, broadening perspectives, and revealing other solutions to problems (Rapp, 2020).

IDEA IMPLEMENTATION

Once the disruptive idea is generated, companies often fail to adapt to innovation due to several factors: the inability to understand and communicate the radical change, uncertainty about the potential impacts of disruptive innovation and the fact that they are usually risk-adverse towards initiatives with uncertain outcomes. Science fiction prototyping (SFP) can help companies in this decisive phase of innovation, by addressing these barriers to change. In particular, SFP helps in changing organizational culture in order to create disruptive innovations. As this tool is more widely adopted, we can expect to see more radical innovations in the world (Popper, 2015).

As illustrated in paragraph 2.4.1.3, SFP builds a science fiction story around the innovation, in order to explore the possible future worlds in which the technology will be placed, creating inspirational and transformative narratives of the future. Through this process, "diegetic prototypes" of the idea are created, that can be seen as preliminary prototypes. These prototypes are useful to meet several objectives for the implementation of the technology and to drive the organizational change.

Testing the innovation. SFP can be used to test the potential of the idea before product development, in order to inform the technology design and the strategic choices to achieve the "future product-market fit".

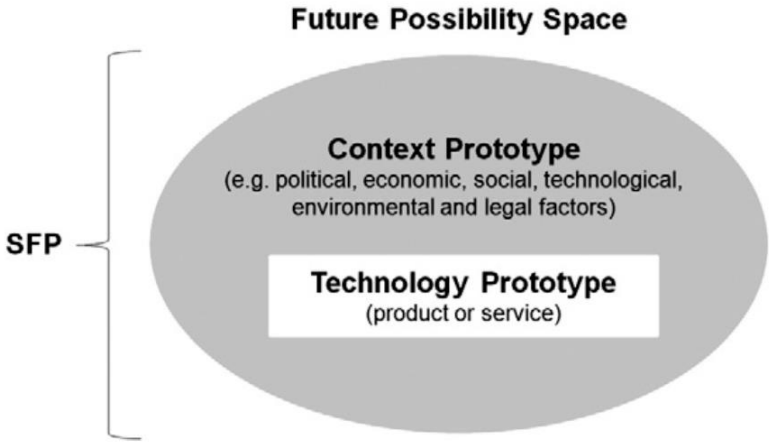


Figure 2.9: SFP, Context prototype and Technology prototype in future possibility space.

SFP has been developed by Johnson as a process for using science fiction based on science fact to prototype the human, cultural, ethical, and legal implications of early-stage research and technology (Johnson, 2013). Indeed, in order for SFP to support technology development, the prototype should elaborate two interconnected dimensions, illustrated in Figure 2.9: the technology and the context, as the context is essential to anticipate proper product design and technology needs for future settings (Potstada & Zybura, 2014). A SF technology prototype focuses on a current early-stage science and technology, often in a very immature stage, and looks beyond what is currently feasible, creating use cases in which this technology can evolve; the context dimension around it addresses implications and how consumers and society will interact with the technology in future possibility space (Potstada & Zybura, 2014). The design of the fictional story is a powerful tool for this purpose, since it has shown to spur people in reflecting on long-term and systemic consequences of science and technology (Rapp, 2020). In particular, by envisioning a distant future and an imaginary world, people are pushed to reflect on the potential side-effects of technology that may occur over the long term, as well as how their introduction may connect with wider changes happening in the individual and society (Rapp, 2020). Therefore, during this phase, SFP can be a powerful tool to reflect on the possible future scenarios in terms of social, political, and economic applications. Product managers and engineers will receive valuable insights that will help them define product development plans and appropriate marketing strategies (Michaud & Appio, 2022).

Drive organizational change. Thanks to an engaging narrative and a visual representation, SFP is an effective tool to communicate and share the innovation inside the organization. The fictions can motivate, inspire and align the company's members towards the same vision: having a common idea about a preferred future and a clear understanding of the corporation's role within that future is providing to be very valuable to drive organizational change (Popper, 2015).

2.4.2.2. Scenario planning

Sci-fi based approaches can be used as add-on tools to the traditional foresight methodologies, specifically supporting the activities of scenario planning.

DETECTION OF WEAK SIGNALS

Science fiction is a valuable source to identify weak signals in the context of change in society and culture, as well as in the field of technology and science. A study conducted by Hiltunen (2007) shows that in the context of searching for weak signals and trend management, science fiction can broaden the perspective of managers, increase their reception of weak signals and can act as valuable sources for upcoming trends. If managers are familiar with reading visionary, inspiring novels, they can broaden their cognitive perspective and perception of the environment and they are more likely to discover weak signals earlier than competitors without a similar perceptive background (Schwarz et al., 2014).

CREATION OF SCENARIOS

Moreover, the analysis of science fiction production can reveal more transformative scenarios of the future, which can be extracted and exploited to enrich the generation of scenarios in foresight activities. The observed frequency of disruptive, critical events and phenomena in the external environment is constantly increasing. Scenarios can help corporations to develop a capacity for dealing with the unknown and unpredictable, however non-linear change is rarely incorporated in traditional methods for developing scenarios (Merrie et al., 2018). Sci-fi rich landscape of dystopic futures and warning signals can support the current need for foresight practice to create scenarios in turbulent environments and grow prepared to critical, disruptive futures. The "Six Scenario Archetypes" framework developed by Fergnani and Song seeks to extract predetermined images of the future from science fiction to create domain-specific scenarios, which can help organizations in thinking the unthinkable more systematically and test their organizational strategies (Fergnani & Song, 2020).

COMMUNICATION

When it comes to thinking about the future, human beings are not prone to abstraction. Scenario planning methodologies can be complemented with Science Fiction Prototyping for generating a more concrete view and storytelling of the identified scenarios, in order to produce stories to communicate more effectively the scenarios, support the decision-making and the identification of strategic actions.

As scenarios are typically developed by a small group (e.g. a strategic planning commission, executive management), and then disseminated to a broader community (e.g. the public, external stakeholders), they must be credible and persuasive to have an impact on the future course of events. A common problem in the use of scenarios is sharing the insights generated in the workshop with a broader community. In most cases, this activity is limited to summarizing the final results of the workshop. In order to improve storytelling on scenarios, scenario planning methodologies can be complemented with the use of sci-fi design techniques to craft compelling and infectious visions of the future (Burnam-Fink, 2015). SFP is also a communication mean that could represent a key enabler to engage a broad lay audience in the discussion on alternative futures, in order to promote the exchange and the discourse between scientists, decision makers and a broad public audience (Brucker-Kley et al., 2021).

Moreover, the fiction narratives provide greater materialization of the identified risks, which enables increasing the participants' awareness, contributing to the identification of a large number of actions for avoiding it. These processes are even more relevant when organizations face situation of crisis or a hostile environment (Pinto et al., 2021).

2.4.2.3. Complementarity with traditional methodologies

Sci-fi based techniques are not meant to be incompatible with the traditional methodologies employed by organizations. On the contrary, these innovative methodologies based on science fiction could complement and enrich existing practices. Indeed, companies should make an effort to establish environments in which researchers, engineers, product managers may experiment with the possibilities of sci-fi. Given the novelty of the topic and an expected low familiarity with forms of creative narrative techniques, organizations can provide employees with ad-hoc training programs or refer to existing ones (Michaud & Appio, 2022). Moreover, in order to effectively employ sci-fi based techniques within organizational processes, sci-Fi authors should be involved in the activities, alongside scientists, engineers, managers and policy-makers.

3 Hypotheses development and theoretical framework

3.1. Introduction

This study aims to investigate the factors that could influence the generation and sharing of knowledge on the future, through the use of sci-fi based approaches within organizational activities. For this reason, the research model includes constructs from three theories: the Institutional Theory, i.e., the Regulative Pillar, Normative Pillar, and Cultural Pillar; the Technology Acceptance Model, i.e., the Perceived Usefulness; and the Knowledge Management Theory, i.e., Knowledge Generation and Knowledge Sharing.

The Institutional Theory is used to explore the influence of organizational structures on the non-rational individual behavior towards the usage of science fiction in the company, while TAM aims at explaining the individual rational assessment of the usefulness of the innovative methodology. Knowledge Management Theory is introduced to investigate the effects that the use of sci-fi approaches may have on individuals' ability to innovate and think about the future, by assessing the generation and sharing of knowledge on the future.

This innovative combination allows to generate interesting practical insights on the actions and levers that the organization should implement to introduce sci-fi based approaches into its practices in an effective manner, that is, in a way that fosters innovation and long-term thinking. In the following paragraphs, the model will be described and the list of tested hypotheses will be formulated.

3.2. Definition of the constructs

The constructs that are part of the model are based on different theories. Therefore, they are presented together with the associated theory.

Technology Acceptance Model Factors

The Technology Acceptance Model (TAM) derives from the Theory of Reasoned Actions (TRA) developed by Fishbein and Ajzen (1975), which aims to investigate and predict individual behavior in different domains. Specifically, TAM is a theory which aims at understanding the adoption and use of a particular technology by an individual through a rational assessment. It was developed by Davis in 1989 after noting employee resistance to using technologies provided to them by companies (Davis, 1989; Davis et al., 1989). As the authors argue, the promotion to use a technology is critical to its adoption. In turn, the acceptance of a technology was determined by the users' expressed willingness to use it in the future. It follows that it is critical for organizations seeking to increase employee adoption and, consequently, use of certain technologies to understand what factors influence the intention to use those technologies in the future. TAM continues to be one of the most widely used models for defining and predicting user acceptance of a technology (Holden and Karsh, 2010).

According to the model shown in Figure 3.1, two variables are considered the main predictors of the user's intention to use (ITU) an innovation and, consequently, of the usage behavior: Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU).

- ***Intention to Use (ITU):*** given a technology or method, the Intention to Use is the willingness, drive and effort of the individual to use or apply it.
- ***Perceived Usefulness (PU):*** according to Davis (1989), Perceived Usefulness is "the degree to which a person believes that using a particular system would improve his or her job performance." For Davis, Perceived Usefulness is greater when the person using the technology sees a positive relationship between use and performance.
- ***Perceived Ease Of Use (PEOU):*** Perceived Ease Of Use is defined as "the degree to which a person believes that using a particular system would be free of effort".

Moreover, the model introduces the presence of external variables influencing PU and PEOU, such as design and user features, task characteristics, nature of development and implementation process, political influences, and others.

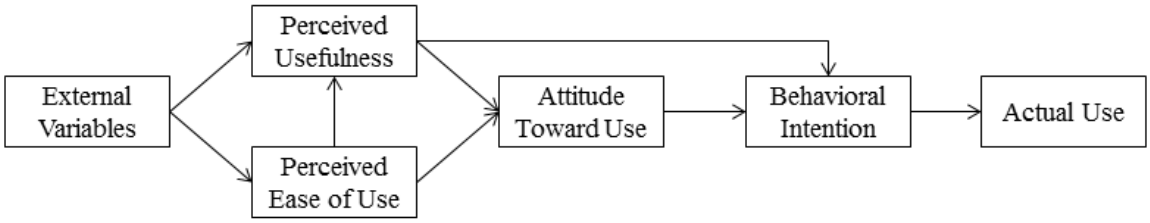


Figure 3.1: TAM model (Davis et al., 1989)

Institutional Theory

The literature has brought to light the fact that some decisions are influenced by non-rational evaluations. If the actions of some managers are viewed as purely rational, some decisions would be inexplicable from this perspective. Indeed, the answer lies in the irrationalities that arise from the institutional context (Mignerat and Rivard, 2015).

Institutional theory investigates the role of institutional structures in guiding the actions of individuals within them, how they are formed and their change and decline over time. (Scott, 2005). The focus of institutional theory is on legitimacy (Barley, 2008) and the role that both organizations and actors play in achieving it (Meyer and Rowan, 1977).

According to the theory, the individual does not orient his behavior only according to a cost-benefit assessment. Individuals are indeed embedded in a larger context, such as states, regions, or organizations, which shape and limit their decisions through a system of norms, institutional rules, and their culture (Barley and Tolbert, 1997; Scott, 1995). According to Scott (2001), individuals operate within an iron cage that influences their behavior and prevents them from making purely rational evaluations; these pillars are regulatory, normative and cultural. The analysis through the use of institutional theory can be declined on different levels, such as employees in a company, groups of professionals in a country or companies in an industry (Besharov and Smith, 2014; Lawrence et al., 2009; Tolbert and Zucker, 1999). The regulatory, normative, and cultural influences will be different and peculiar to each specific context (Scott, 2003). Taking the regulatory aspect as an example, companies have a system of rules within them, states enact laws and professional groups establish rules of participation. These three pillars, as mentioned before, exert as many types of influences. They are listed below and represent the factors of the institutional theory that are included in the model.

- ***Regulative Pillar (RP)***

The regulatory pillar is the one associated with the set of norms, rules, and procedures that define what individuals are allowed to do. The role of those who issue these rules is to monitor compliance and determine the possible penalties or sanctions that may be imposed for non-compliance. Regulative influences are operated through explicit organizational expectations, e.g., in plans and budgets.

- ***Normative Pillar (NP)***

Normative influence is determined by the behaviour expected of the individual in a particular context, e.g., organizations. It is exercised by social groups, and the individual, in order to belong, adheres to this system of norms and expectations. In organizations, it is usually found in the form of peer influence, with activities such as mentoring, constant interchange with colleagues, or training by specialists (Bauer et al., 2007; Cable and Parsons, 2001). Peer influence aims to ensure that individuals have a clear and aligned vision of the organisation's goals and spread the shared idea that the use of new technologies is meaningful and adds value. The more coherent and shared the opinion on the use of a new technology, the easier it is for individuals to adhere to this social norm. A divergent behaviour of the individual could in fact cause problems within the social group or undermine his status.

- ***Cultural Pillar (CP)***

The cultural pillar is constituted, within a social group, by the shared mindset and the common way in which meaning is given. In organizations, it is exercised with recurring activities aimed at normalizing the use of technologies or signalling the need for greater use of technologies (Schein, 2010). The better companies succeed in communicating the need to change the current situation to satisfy their customers, the more individuals are likely to change their behaviour. Therefore, cultural influences are operated through a culture of change.

Knowledge Management Theory

The activities performed in using science fiction-based approaches are aimed at generating new knowledge related to the future and at sharing this knowledge within the organization to guide strategic decisions and organizational change. For this reason, the science fiction-based activities outlined in Chapter 2, represent novel and useful approaches to knowledge management within organizations.

Knowledge can be defined as an abstract entity consciously or unconsciously created by an individual through an interpretation of information sets that have been acquired through experience and the consideration of that experience, thus providing its owner with a skill within a given "art" (Albino et al., 1999; Schiuma, 1998). Knowledge is the result of an individual or organizational interpretation process (Huber, 1991; Weick, 1979) of a set of information, which can be new as well as existing information. Through the interpretation process the individual or the organization may develop new or maintain previous knowledge (Daft and Weick, 1984).

Management research has suggested that knowledge is the main source of competitive advantage for firms (e.g., Spender and Grant, 1996), particularly for firms operating in knowledge-intensive industries. Rapid changes in markets and technologies increasingly require companies to generate new knowledge faster than their rivals, in order to innovate successfully and remain competitive (Prahalad and Hamel, 1990; Teece and Pisano, 1994). This implies also being able to properly manage information within the organization in order to make successful use of it. Therefore, knowledge management practices are crucially important to researchers and managers.

Following the process characteristic of knowledge, in order to effectively manage knowledge within the organization, the firm should approach it as a process, by performing the three phases of generation, codification and transfer of knowledge (Davenport & Prusak, 1998). Although generating, codifying, and using knowledge are rarely analyzed in process terms, the activities that take place under these phases can be viewed as attempts to make knowledge markets work more efficiently and effectively.

- ***Knowledge Generation***

Knowledge generation refers to activities that lead to the acquisition and/or the development of "new" knowledge within the organization. Knowledge can be generated by acquisition from an external source, or by developing a new idea, or a combination of the two. The initiation of knowledge creation begins with an idea or intuition initiated by individuals through their intellect, experience, observation or imagination (Crossan et al., 1999; Nonaka, 1994) or resulting from exploration activity (Gupta et al., 2006). Kanter (1996) identifies three stages in knowledge generation: the production of ideas or recognition that knowledge in some other domains (inside or outside the organization) can be exploited to create value; the individual validation of the knowledge claim; actual knowledge generation activities, that may require organizational resources.

The acquisition of knowledge from external sources regards the ability of the firm to see and understand external changes happening in their environments, causing

business to adapt. New products and technologies, social and economic changes drive knowledge generation, because companies that don't adapt to the changing conditions are likely to fail (Davenport & Prusak, 1998). In this regard, the concept of knowledge generation can be built on the concept of market intelligence generation of Kohli and Jaworski (1990) (Song et al., 2006). Market intelligence is a concept that includes in customers' verbalized current needs the analysis of exogenous factors that influence them, generated by performing environmental scanning activities. Indeed, effective market intelligence generation concerns anticipated future needs, which are relevant because it often takes years for an organization to develop a new product (Kohli & Jaworski, 1990). By narrowing it down to technology-oriented knowledge generation, technological scanning is the organizational activity by which external information is collected and analyzed in order to make better decisions on technological change and innovation and to increase the firm's competitiveness (Raymond et al., 2001). Alternatively, the common way to generate knowledge within the organization is to create groups specifically for this purpose, as research and development departments, where the creativity comes from breaking down old assumptions and ways of working to intentionally shake-up the status quo (Davenport & Prusak, 1998).

As discussed in Chapter 2, the sci-fi-based approaches can help organizations in the generation of new knowledge regarding the future. Scanning the content of science fiction production aims at the acquisition from external sources of innovative technological ideas, visions of future scenarios, as well as detecting changes in the external environment (technology, society, economy, politics). These types of information extracted from science fiction are purposefully future-oriented. In this sense, the sci-fi analysis activities can be viewed as technological and environmental scanning activities. Moreover, the design of sci-fi stories is a structured activity aimed at incentivizing a group of people to the generation of new knowledge through imagination, problem-solving and critical thinking. The knowledge generated in this activity also encompasses the identification of action and reaction strategies.

- ***Knowledge Codification***

Codification concerns converting organizational knowledge into a form that makes it accessible and useful to those who need it. It turns knowledge into a code to make it as organized, explicit and easy to understand as possible (Davenport & Prusak, 1998). The codification strategy concerns extracting explicit knowledge from the person who developed it, storing it, and promoting its subsequent reuse by anyone who needs it (Ajith Kumar & Ganesh, 2011).

- ***Knowledge Transfer***

Knowledge transfer refers to explicit and often formal process through which knowledge is moved between larger entities within organizations, such as departments or divisions of the organization (Manohar Singh & Gupta, 2014). Though researchers discuss knowledge transfer as a formal process of sharing knowledge, the concept has seldom been discussed along with knowledge sharing. Although knowledge management theory implies formalized transfer, one of its essential elements is developing specific strategies to encourage such spontaneous exchanges (Davenport & Prusak, 1998).

When managing knowledge through the employment of sci-fi based approaches, the phases of codification and transfer overlap in the activity of designing the ad-hoc story, i.e., the Science Fiction Prototype. For this reason, the research model explores the SFP as an activity to share knowledge, using the broader concept of "Knowledge Sharing" (KS) to include both the activities of knowledge codification and transfer in it. The creation of a SFP represents an activity in which individuals "codify" the knowledge they are generating about the future into a story, which can be in a written or visual form. The story-telling form is a powerful means to convey meanings. Indeed, the engaging narrative and a visual representation make SFP an effective tool to communicate and transfer the generated knowledge inside the organization. This is especially relevant when we deal with the management of future-related and oriented knowledge, because individuals are not prone to abstraction, thus helping in making the future more concrete and comprehensible to the recipient. Moreover, the final step of the SFP activity involves a moment of collective reflection and sharing of what has been learned about potential futures and what should be done in the present. The sci-fi story produced by these activities are thus used to "transfer" the results among the organization's members to align everyone on the future vision.

3.3. Research model and hypotheses

Figure 3.2 illustrates the research model that this study aims at testing. The research model integrates the constructs presented in Chapter 3.2.

This research has the objective to explain the factors that could drive employees' participation in sci-fi activities, aimed at generating and sharing knowledge regarding the future. Szulanski (1996) suggests that motivational forces that drive a certain behavior derive from two bases: (1) employees' personal belief structures and (2) institutional structures, i.e., values, norms and accepted practices, which are

instrumental in shaping individuals' belief structures (Delong and Fahey 2000) (Bock et al., 2005).

Thus, the model integrates the Perceived Usefulness from TAM, used to evaluate the employees' rational assessment of usefulness of innovative methodologies introduced in the company, i.e. the sci-fi based approaches, with respect to his or her ability to innovate and think about the future. The three pillars from Institutional Theory are included to understand which organizational factors may influence individuals in adopting and using an innovative methodology, i.e. a science fiction-based approach. Knowledge Generation and Sharing are retrieved from the Knowledge Management Theory to describe the worker behaviour.

The research model investigates the influence of institutional pillars on knowledge generation and sharing within sci-fi based activities, both directly and indirectly through the individuals' Perceived Usefulness as a mediating factor. Indeed, the model explores the direct influence of institutional structures on the behavior of individuals in knowledge generation and sharing activities. Specifically, each institutional pillar is expected to have a positive influence both on Knowledge Generation and Knowledge Sharing. In addition, the model explores how institutional pillars may be instrumental in shaping individuals' rational assessment of the usefulness of sci-fi based approaches, which in turn may influence the generation and sharing of knowledge through their use. Specifically, each institutional pillar is expected to have a positive influence on the Perceived Usefulness, which in turn is expected to positively influence Knowledge Generation and Sharing. Additionally, Knowledge Generation is expected to have a positive influence on Knowledge Sharing. The relationships among the constructs have been hypothesized on the basis of past research.

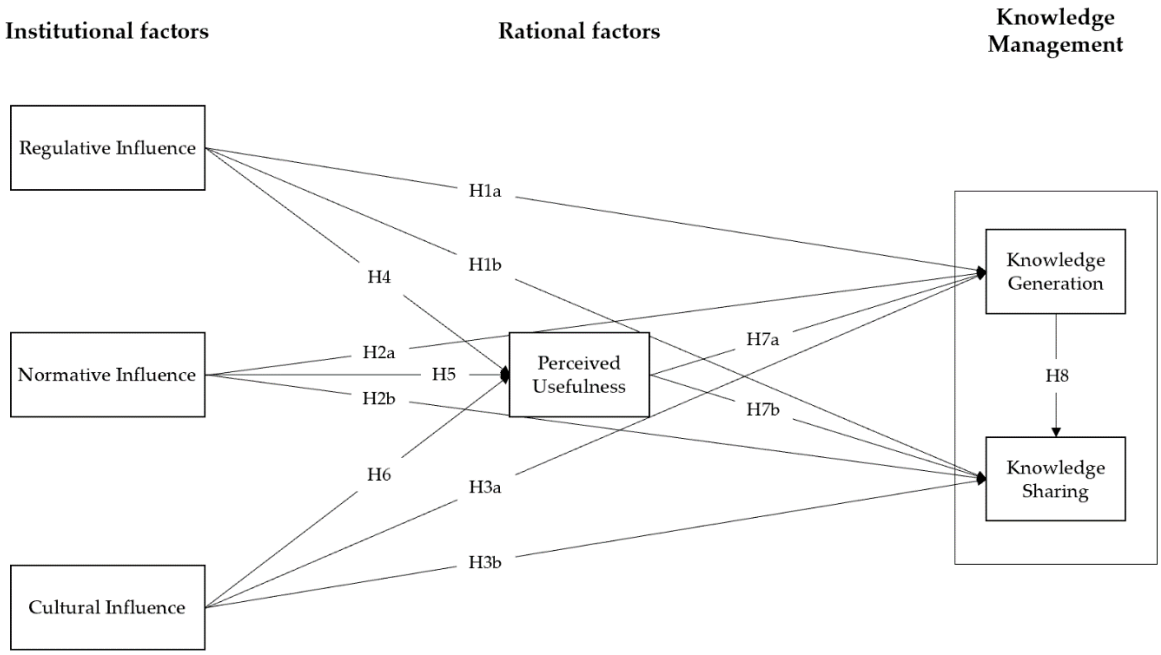


Figure 3.2: Model tested

Institutional factors

The first part of the model explores how the organizational structures drive the non-rational behavior towards the participation in sci-fi activities.

Organizations exert a regulative influence through strategic documents, plans and budgets, which outline the organizational expectations for the short, middle and long terms (Scott, 2003, 2008). The introduction of sci-fi activities by organizations are aimed at improving the workers' ability to innovate and develop long-term strategies. Thus, the research hypothesizes that the more companies use coercive mechanisms to direct and control the participation to sci-fi activities, the more the individuals are likely to comply with the expectations of generating and sharing knowledge in search or fear of retribution for the innovation targets achieved (Gastaldi et al., 2019).

H1a: *Regulative Influence has a positive influence on the generation of future-oriented knowledge through sci-fi based approaches.*

H1b: *Regulative Influence has a positive influence on the sharing of future-oriented knowledge through sci-fi based approaches.*

The subjective norm, defined as the perceived social pressure to perform or not perform a behavior (Ajzen 1991), has received considerable empirical support as an important antecedent to the behavior itself (Mathieson 1991). Lewis et al. (2003) argument that subjective norms, through social influence processes, can have an important influence on knowledge management. Thus, similar considerations can be applied to normative pillars regarding participation in sci-fi activities, by questioning if these pillars are likely to influence organizational members' generation and sharing of knowledge.

H2a: *Normative Influence has a positive influence on the generation of future-oriented knowledge through sci-fi based approaches.*

H2b: *Normative Influence has a positive influence on the sharing of future-oriented knowledge through sci-fi based approaches.*

Organizational culture is considered a crucial driver to learn, acquire, and share knowledge, that can act as a barrier or facilitator to success in KM initiatives (Rabelo & Conte, 2018). These activities are particularly encouraged by the innovativeness of the organizational climate (Bock et al., 2005). Innovativeness reflects the perception that creativity and change are actively encouraged and rewarded, emphasizes learning, open information flows, and reasoned risk-taking. As a result, employees in innovative work contexts are more likely to share new and creative ideas with each other with respect to non-innovative work contexts (Kim and Lee 1995).

H3a: *Cultural Influence has a positive influence on the generation of future-oriented knowledge through sci-fi based approaches.*

H3b: *Cultural Influence has a positive influence on the sharing of future-oriented knowledge through sci-fi based approaches.*

Perceived Usefulness as mediating factor

The second part of the model explores how the regulative, normative, and cultural pillars influence the individual perception of usefulness of the innovative sci-fi based approaches. In particular, it is evaluated if the innovative approach is perceived useful to generate and share new knowledge. Gastaldi et al. suggest that the regulative, normative and cultural influences do not determine individuals' behaviors, but their rational assessment of the new methodology. Specifically, individuals embedded in organizations with stronger institutional influences are more likely to perceive the usefulness of the new methodology (Gastaldi et al., 2019).

Organizational expectations can be used to define what behaviors the individuals need to perform to help the organization reach its targets. In this way, the usefulness of expected behaviors, such as the adoption of a future-oriented approach, is communicated by showing their benefits (Gastaldi et al., 2019). Peer influence among employees can impact their perceived usefulness as they see their colleagues exploiting new approaches and the generated benefits. Indeed, they can be convinced that they could have similar results by imitating the behavior (Gastaldi et al., 2019). A positive change culture is expected to have an influence on the need to engage in activities that foster innovation and organizational change.

H4: *Regulative Influence has a positive influence on the Perceived Usefulness of a sci-fi based approach.*

H5: *Normative Influence has a positive influence on the Perceived Usefulness of a sci-fi based approach.*

H6: *Cultural Influence has a positive influence on the Perceived Usefulness of a sci-fi based approach.*

Rational factors

The third part of the model investigates the influence of personal beliefs on the participation in the activities of generation and sharing of ideas, reflections, intuitions on future scenarios, trajectories of technologies and strategic actions.

Engaging in the sci-fi based activities of generation and sharing of knowledge also comes with participant costs, for example in terms of invested work hours. Thus, an important determinant of the engagement in these activities is the personal belief that expected benefits will outweigh costs (Bock et al., 2005), which can be assessed through the perceived usefulness. Specifically, motivational factors that influence knowledge generation and sharing behaviors are individual, group and organizational benefits.

H7a: *Perceived Usefulness of sci-fi based approaches has a positive influence on the generation of future-oriented knowledge.*

H7b: *Perceived Usefulness of sci-fi based approaches has a positive influence on the sharing of future-oriented knowledge.*

Moreover, the model posits that knowledge creation has an influence on knowledge transfer, through the fact that the "new created knowledge" influences psycho-social factors such as the attitude towards applying knowledge (Miguel, 2016).

H8: *The generation of future-oriented knowledge has a positive influence on the sharing of such knowledge.*

3.4. Control variables

The research model implemented in this work involves the inclusion of control variables. Control variables – or scientific constant – can be defined as an element which is constant – controlled – and unchanged throughout the course of the investigation (Schjoedt & Bird, 2014). User acceptance has been shown to be influenced by certain control variables (Morris & Venkatesh, 2000; Venkatesh & Bala, 2008), so their inclusion adds relevant information to the model. Furthermore, the control variables provide information about differences among individuals in demographics, employment, and behavior. In other words, control variables have the purpose of highlighting the individual differences and the dissimilarities across people (Bernerth et. al., 2018).

Regarding the research model developed here, control variables are defined below and have been integrated into the model in Figure 3.2.

- **Gender - GEN**

Several studies (Giger, Moura, Almeida, Piçarra, 2017) have shown how gender is an essential element when analysing content belonging to the science fiction genre, both in relation to the content aspects of the story told and the formal aspects and interpretation by the audience. Science fiction has traditionally been a puritanical genre orientated toward a male readership, and has been described as being by men for men (Tuttle, 1999). Such statements need to be ascertained, which is why gender was included as a control variable in this research model.

- **Age - AGE**

Among the main users of the science fiction genre are young individuals, who are strongly interested in technological advancement and scientific progress (Parsons, 2015; Menadue & Jacups, 2018): this means that age has both a positive and negative impact on the use and evolution of such progress.

- **Nationality - NAT**

Science fiction and the potential scientific progress that comes with it, are of interest to people all over the world, in the context of an increasingly concrete globalization (Obst, Zinkiewicz, & Smith, 2002). For this reason, nationality is part of the control variables examined here.

- **Level of Education - EDU**

Recent studies have observed how the level of individual education represents a differentiating element in the processes of innovation and scientific progress (Shavinia, 2013; Michaud & Appio, F, 2022). The higher the level, the greater the interests and uses of sci-fi models is expected in everyday life.

- **Company Size - SIZ**

The impact of science fiction on research and innovation has generated new companies over the last two decades, from start-ups to multinationals looking at progress through the lens of sci-fi (Bell, Fletcher, Greenhill, Griffiths & McLean, 2013; Russell & Yarosh, 2018): it is decisive to implement an approach to the research that can gather information about the company size of the respondents, in order to better understand the perception of progress and innovation on the workplace.

- **Company Products and Services – PES**

Looking at the FORTH innovation method (Van Wulfen, 2011) – acronym for Full Steam Ahead, Observe & Learn, Raise Ideas, Test Ideas and Homecoming – and the research around this, in pursuing the objectives of this research work, it is necessary to delve into the work and production dynamics of individuals within contemporary companies: this will lead to the understanding of what the elements of progress are and how they are interpreted within the company. Furthermore, an inquiry is necessary about the degree of innovativeness of the products and services provided by the company of the respondents, as they are seen in the current context of analysis as vectors of innovation and progress: examining how they foster innovation will be essential for the research objectives.

- **Seniority – SEN**

By placing individuals at the centre of the research, it is appropriate to establish the relationship rate with the company in which they work. Recent studies have expressed this relationship rate in terms of age, relative to the time spent within the company (Backes-Gellner & Veen, 2013; Safitri & Anggara, 2019): it will be thus possible to demonstrate whether or not the longer the individual has been working in a specific company, the easier they are involved in the implementation of science fiction activities. In the present context of analysis, it is important to investigate the amount of time that individual employees dedicate to their work within companies, as this is

a key factor in evaluating innovation and progress. Its study can play a crucial role in understanding how they could be involved in the implementation of science fiction activities.

- **Job Role - JOB**

Observing the company role as a control variable will allow the research to confirm the presence of specific roles and jobs prepared to understand and promote innovation through science fiction. By focusing on the role of the worker, companies can foster a culture of innovation, creativity, and progress, leading to long-term success and growth. Therefore, it is essential to evaluate the role of individual workers within a company to understand how innovation and progress can be achieved through science fiction.

- **Sci-fi Employment in Companies - EMP**

Approaching the terms and interests of the research directly, the research model included a control variable aimed at assessing the relationship between the working realities of the study respondents and the science fiction-driven approaches to innovation, as defined by Stanway (2022). One of the aims of the question presented here is to determine whether the company has previously engaged in science fiction activities, with the purpose of assessing its potential impact as a control variable within the current research model. This will allow the deepened studying of science fiction and actual science progression, in order to demonstrate what other researcher have discovered so far, like the presence of interests in science fiction activities, dedicated to a better company development.

- **Individual frequency of engagement in sci-fi - FRQ**

We measured the frequency respondents engage in sci-fi in their spare time, as a measure of interest as well as a measure of how much one could be used to such genre. This, in general, might have a high impact on one's participation, interest and intention to participate in sci-fi activities.

- **Individual interest in sci-fi - INT**

Additionally, it was considered of relevance to control upon how the individual is interested in sci-fi. More specifically, this variable controlled how much interest sci-fi exerts on the individual, in order to measure the engagement, one could have, which in turn can impact on the seizing novel opportunities for technical advancement of societal changes.

- **Psychological safety - PS**

Evaluating the differentiation present within companies allows for a better understanding of how work, in terms of innovation and scientific progress, is best deployed within the lives of individuals (Sánchez-Hernández, et. al, 2019). Gong, et. al. (2018) observe that progress is an interest that is more developed by younger people, with a focus on the current 30-year-olds: observing the company role as a control variable will allow the research to confirm the presence of specific roles and jobs prepared to understand and promote innovation through science fiction. By focusing on the role of the worker, companies can foster a culture of innovation, creativity, and progress, leading to long-term success and growth. Therefore, it is essential to evaluate the role of individual workers within a company for understanding how innovation and progress can be achieved through science fiction: employees are the backbone of any organization, and their contributions play a significant role in determining the future of the company.

- **Environmental dynamism - ED**

Finally, it is particularly meaningful to understand the profiles of the interviewed in terms of environmental dynamism. In a dynamic environment change occurs at a faster pace and with greater magnitude: higher levels of environmental dynamism make it difficult to assess change, forecast the effects, and develop operational responses (Azadegan, Patel, Zangoueinezhad & Linderman, 2013). In other words, a dynamic environment challenges companies through innovation and progression, in order to adjust their production processes more rapidly. Prior research indicates that dynamic environments are conducive to change. While stable environments may encourage the establishment and persistence of routines, changes in the environment prompt organizations and groups to seek new knowledge from both internal and external sources, pursuing both exploration and exploitation to advance processes and products (Becker, 2004; Sidhu et al., 2004). Environmental changes can challenge the status quo and provide a much-needed impetus to search for and implement new ideas both inside and outside the organization. In turbulent environments, organizations must seek new sources of knowledge and ideas to generate innovative solutions (Yli-Renko et al., 2001; Ahuja, 2000; McEvily and Marcus, 2005).

4 Materials and methods

In order to demonstrate through practice the theoretical model proposed in the previous chapters, the methodology and research design of this research work include the creation of data collection tools designed ad-hoc for the aim of this study. These are applied to validate the model and are illustrated below in this section.

4.1. Research design

The research model envisages the development of a survey distributed online only. The decision to conduct an online-only data collection is determined by the validity of this research method: in fact online surveys are a great option for researchers who would like to conduct a self-administrated, non-experimental, cross-sectional, and explanatory research – since they are less time consuming, cheaper, and provide faster results (Lefever, Dal, & Matthíasdóttir, 2007). Furthermore, in order to allow the respondents to be completely free in expressing their thoughts and opinions about the researched subjects (Wrigth, 2005), the survey was conceived as totally anonymous.

Being an online and self-administrated survey, this research method allowed for the possibility of the user to answer both anytime and anywhere: this choice was consequent to the study's need to be as efficient as possible in terms of time and analysis of results (Braun, Clarke, Boulton, Davey & McEvoy, 2021). In fact, as mentioned above, while a self-administered survey allows for easier data collection - avoiding the need to conduct one-on-one interviews with potential respondents- its digital nature allows for easier distribution through the Internet.

The implementation of an online survey determines that the research is non-experimental, as researchers have no effective control or present no opportunity to manipulate both the control variables and the independent variables internal to the questionnaire. Therefore, the research model proposed here is based on the analysis, study and interpretation of the data collected, with the goal of formulating a conclusion that can extend to the entire population of individuals subject to the research topics. Specifically, the questionnaire is specifically aimed at workers in

companies or in research. The study is limited to these two areas, since the goal is to test what levers the organization - be it a company or a research institution - can use to encourage the use of sci-fi based approaches by individuals Also, the online survey was designed through the innovative platform Qualtrics, which optimized the interface easing the answering process and showing the respondent's process.

Thus, this is an evaluation based on the cause-and-effect phenomenon, so the methodology applied here is called explanatory, that is, a research formula that, based on the data collected, allows for vertical insights. It is also possible to define this study and the proposed methodology as cross-sectional, as it aims to capture a single moment in time: the proposed survey allows to make inferences about the population of interest at one point in time. In the specific case of the present research model, the survey saw distribution through the LinkedIn platform and the Instagram account CiakClub, the largest social media community in Italy about cinema and tv-series, counting 1.6 million total followers. Here, respondents were chosen to be a representative subset of the population of interest, so the available results could be extended to the whole population.

4.2. Survey questionnaire

As stated before, the research methodology implemented involved the development of a survey – available in Appendix A of this text – composed of 37 questions. The first part of the questionnaire includes 19 questions concerning personal and socio-demographic information of the respondents, the characteristics of the companies in which they work, their relationship to sci-fi, psychological safety and environmental dynamism, and they are the above-mentioned control variables. Since these variables remain constant in the study, it is possible for the researchers to better understand the relations among other variables – involved in the second part of the survey.

The first 9 questions of the questionnaire investigate through both multiple-choice and open questions, the social, occupational and demographic characteristics of survey respondents. The other 28 questions, including part of the control variables, make use of a multiple-response system: the Likert scale. The one of the Likert scale is an essential measurement model for surveys: it can be defined as a rating scale used to measure opinions, attitudes, or behaviors and consisting of a statement or a question, followed by a series of five or seven answer statements (Joshi, Kale, Chandel & Pal. 2015). Using the Likert scale, here presented in Table 4.1, respondents are able to choose the option that best corresponds with how they feel about the statement or question.

Therefore, the survey questions that used the Likert scale were structured as a sequence of statements to which the user had to give a rating, either agree or disagree,

with units ranging from 1 – complete disagreement – to 5 – complete agreement with the statement.

Complete disagreement	Disagreement	Indifference	Agreement	Complete agreement
1	2	3	4	5

Table 4.1: Likert Scale from 1 to 5

The second part of the survey brings together 18 questions, and it allowed the possibility to measure the Perceived Usefulness, the Regulative Pillar, the Normative Pillar, and the Cultural Pillar, as explained in the previous chapters.

Each question included in the second part of the survey, following the Likert Scale model, includes a brief description of the notions involved. Furthermore, some questions were provided as negative questions: this is done to educate the survey respondent in a clear and comprehensive manner, allowing for genuine response choice. Therefore, a general overview of the questionnaire is proposed below, with a focus on the macro-areas involved, each construct will be presented and explained before delving into the measurement activities.

4.3. Personal Variables measurement

Questions regarding demographics and personal information are developed as the first part of the survey, in order to gain a deeper understanding of the characteristics of the responding sample: in particular, as mentioned above, the topics of the questions range from the socio-demographic conditions to which the users belong, to the endemic properties of their professional activity, to the relationship the subjects have with science fiction content, including elements of Psychological safety and Environmental dynamism. This first part of questioning allows for results concerning aspects of the life of the individual, and can act as contributory support for the contextualization and interpretation of the results. Hereafter, the questions are filtered by clusters, and these are analyzed individually in order to best understand the identity elements of the subjects involved in the survey.

4.3.1. Demographic and Personal Information

The first four questions belong to the first cluster, achieving demographic information as shown in Table 4.2: the data collected in this first phase allow us to understand the scalable potential of the research, which is capable of extending from the particular – the group of respondents – to the general – the entire population of interest –, the

results of the research. To this extent, categories such as gender, age, nationality and education were deepened.

Question	Measurement scale				
Gender	Male	Female	None of the above	I prefer not to declare it	
Age	21-30	31-40	41-50	51-60	61-70
Nationality	Italian	Other			
What is your educational qualification?	Bachelor's degree or higher	Non-graduated			

Table 4.2: Demographic and personal information

4.3.2. Company and Work Characteristics

The second cluster, consisting of five more questions, delves into the company and work characteristics of the respondents: in particular, questions are formulated concerning the size and type of products/services of the company where the respondents work, the nature of the users' job-occupation, and the time they have spent there (Table 4.3). The last question concerns the relationship between the company and the previous application of sci-fi activities within it.

Question	Measurement scale			
The company you work for can be classified as:	Start-up	SME	Large Enterprise	Other
Considering the product or service that most characterizes the company you work at, this can be classified as:	Complex Product	Standardized Product	Complex Service	Standardized Service
How many years have you been working at your current company?	Open question			
What is your role in your current company?	R&D	Marketing	Product Management	Other

To your knowledge, has the company you currently work for ever used (or does it use) sci-fi-based techniques or approaches?	No, to my knowledge they have never been used	No, however, there are plans to use them in the future	Yes, they have been used in one or a few sporadic cases	Yes, they are used repeatedly

Table 4.3: Work-life Characteristics

4.3.3. Individual relationship with sci-fi

The subsequent clusters of questions are characterized by only Likert scale responses. In this first part of questions, the first three focus on personal interests and individual relationship with sci-fi: the user can choose to express interest, related to personal consumption of sci-fi content, by employing Likert's model, generating reliable and measurable results (Table 4.4). Specifically, the first question measures how often respondents engage with science fiction, while the second measures interest in the genre.

Statement	**Measurement scale**				
I read books/comics and/or watch movies/TV series and/or play video games on science fiction subjects in my spare time	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I like science fiction	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Table 4.4: Individual relationship with sci-fi

4.4.4 Psychological Safety

The following questions are closely related to the relationship between individuals and science fiction in the workplace, in the relational and psychological dynamics between peers, investigating personal contribution to professional dynamics of an everyday nature (Table 4.5). Questions in this section refer back to the concept of psychological safety, intended here as the shared belief held by members of a group that the group is safe for interpersonal risk taking (Edmondson, & Lei, 2014): in the present research context, psychological safety describes the perception of people of the consequences of taking interpersonal risks in a particular context such as a workplace (Edmondson, 1999).

Statement	Measurement scale				
If I proposed these sci-fi initiatives, I would not have to worry about my colleagues' judgment of me	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
In my company I could propose new activities, such as this sci-fi one, without incurring negative judgments	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
In my company, I could propose out-of-the-ordinary activities, such as these sci-fi activities, without difficult	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
In my company, it would not be a problem if I participated in innovative activities like these sci-fi ones	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Table 4.5: Psychological safety

4.4.5 Environmental Dynamism

This section of the questionnaire – involving the last cluster of the first half of the survey – is particularly meaningful to understand the profiles of the interviewed in terms of environmental dynamism. In a dynamic environment change occurs at a faster pace and with greater magnitude: higher levels of environmental dynamism make it difficult to assess change, forecast the effects, and develop operational responses (Azadegan, Patel, Zangoueinezhad & Linderman, 2013). In other words, a dynamic environment challenges companies through innovation and progression, in order to adjust their production processes more rapidly. The items of the cluster are in line with the work of Li & Liu (2014) and have been repurposed for our case to measure the dynamism of companies in terms of products/services, competitors, technologies, and customers (Table 4.6).

Statement	Measurement scale				
The products and/or services that most characterize my company evolve rapidly	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Considering my company's typical products and/or services, what competitors will do is difficult to predict	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The technologies behind the products and/or services that most characterize my company are evolving rapidly	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Considering the products and/or services that characterize my company, it is difficult to predict how customers' needs will change	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Table 4.6: Environmental dynamism

4.4. Construct measurement

In order to measure the 6 constructs of the research model as explained in the previous chapters, the second part of the survey investigates the experience of using sci-fi techniques in the workplace. Specifically, each of the 6 constructs was measured through the use of items, that will be described in this section. Each cluster of 3 items was designed with the intention of having meanings close to each other, as their goal is to measure the same underlying construct. In the following sections, the items measuring each construct will be presented in a table along with the code, related questions, possible answers, and source. Each cluster of questions involves statements to be answered on the Likert scale that were retrieved from the literature and adapted to the context, with reformulation that would best lend itself to the purposes of this research. To answer these questions, participants were asked to imagine themselves in a context where the company promotes activities that use science fiction with the goal of imagining the future and innovation (e.g., workshops, seminars, meetings with consulting firms, universities, filmmakers, writers, etc.).

4.4.1. Regulative Pillar (RP)

The regulative pillar refers to rules, norms and regulations that set out what can be done and penalties for violations of rules when these are not respected. The role of those who issue these rules is to monitor compliance and determine the possible penalties or sanctions that may be imposed for non-compliance (Scott, 2003). The items

to measure this construct were retrieved from the work of Ajzen (1991) and adapted to the context. Here we considered the potential conflicts that can arise when sci-fi-based methods are introduced into existing business procedures, rules, and methods. Within the notions involved in the present research, it is possible to say that the questions developed in this cluster are aimed at understanding the relationship between sci-fi and the worker, with a view to proposing integrative professional activities involving science fiction for innovative purposes. These survey questions shed light on the potential barriers to promoting and participating in sci-fi activities within a corporate setting. It is concerning that existing procedures and rules in the workplace may pose a hindrance to the development and growth of such activities. It highlights the importance of acknowledging and addressing these issues to ensure that employees are not discouraged from engaging in activities that could foster creativity and innovation. Additionally, it is crucial to create an environment that is supportive of employees who are interested in sci-fi activities and to provide them with the necessary resources to participate fully. Overall, these survey questions analyze whether or not organizations are open to exploring new avenues of engagement and to foster a workplace culture that encourages creativity and innovation.

Item	Statement					Source
RP1	If I tried to promote sci-fi activities in my company, I would run up against the procedures that are in place in the company					Ajzen (1991)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
RP2	Some business rules would prevent me from participating effectively in sci-fi activities					Ajzen (1991)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
RP3	The regulations I follow in the company would not allow me to promote participation in sci-fi activities					Ajzen (1991)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.7: Items related to Regulative Pillar

4.4.2. Normative Pillar (NP)

Bauer et al. (2007) stated that groups of people, organizations and conglomerates, exert the normative influence through forms of peer influence: between examples of this practice it can be found mentoring, training with specialists and frequent interactions with colleagues across company departments. This means that the normative pillar includes the expectations and norms elaborated from social groups about what could be appropriate behavior in some circumstances or contexts. The items to measure this construct were retrieved from the work of Ravlin and Meglino (1987) and adapted to the research objective. Within our context, peer influence is meant to align individuals to the belief of the necessity of innovation and progression through science fiction. Through this cluster of questions, it will be possible to identify potential obstacles that may arise when promoting sci-fi activities in the workplace, including concerns around colleague buy-in and existing company policies. The aim is to highlight the presence of a positive relationship between peers when involved in science fiction-based activities, recognizing the potential benefits of promoting sci-fi within the workplace.

Item	Statement					Source
NP1	I fear that the colleagues I value most do not consider appropriate to promote activities based on sci-fi ideas					Ravlin and Meglino (1987)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
NP2	The colleagues I value most would think it would be interesting to participate in activities based on sci-fi ideas					Ravlin and Meglino (1987)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
NP3	The colleagues I consider more knowledgeable would not think that I have wasted my time promoting these sci-fi-based activities					Ravlin and Meglino (1987)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.8: Items related to Normative Pillar

4.4.3. Cultural Pillar (CP)

Pozzo et. al. (2020) state that, typically, companies exert cultural influence through activities to shape and normalize the practical implementation of cultural progression. This means that the cultural pillar includes the common mental schemes and the symbolic representations shared among social groups of peers. Science fiction can be used and implemented in order to achieve cultural progression and, by these means, individuals are more likely to adhere to the cultural change. It is essential to recognize that engaging in creative and innovative activities, such as those based on sci-fi, can provide numerous benefits to a company. The items to measure this construct were retrieved from the work of Khoja et al (2007) and adapted to the research objective. This cluster of questions looks at whether sci-fi initiatives would align with the creative thinking of the company, whether the company already encourages "out of the box" thinking, trying to look at a possible interest in fostering unconventional ideas and approaches. Asking these question to understand the impact of cultural pillars on the individual, the cluster aims to assess the company's current approach to creativity and innovation and explore the potential of sci-fi activities to contribute to these objectives.

Item	Statement					Source
CP1	Sci-fi-based initiatives would be coherent with my company's creative thinking					Khoja et al. (2007)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
CP2	My company already now pushes us to think "out of the box"					Khoja et al. (2007)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
CP3	My company engages employees in proposing ideas that can lead to product and/or process innovations					Khoja et al. (2007)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.9: Items related to Cultural Pillar

4.4.4. Perceived Usefulness (PU)

Davis (1989) first described perceived usefulness as the "degree to which a person believes that using a particular system would improve his or her job performance". It means that in the organization of nowadays companies a good performance is reinforced by rewards such as raises, promotions, or bonuses. The construct was measured in three items selected from Davis's (1989) work and adapted to the reference context. In particular, the items explore how useful is perceived the utilization of sci-fi based approaches by individuals in the organization respect to improving innovation and foresight activities. It is possible to say that perceived usefulness may arise when the individual interested in science fiction activities sees a positive relationship between use and performance.

Item	Statement					Source
PU1	Sci-fi-based activities could be useful for me to acquire tools for thinking innovatively					Davis (1989)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
PU2	Sci-fi-based activities could be useful for me to think outside of the box					Davis (1989)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
PU3	Sci-fi-based initiatives could help me think in a more structured way about innovation					Davis (1989)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.10: Items related to Perceived Usefulness

4.4.5. Knowledge Generation (KG)

The construct is the first phase belonging to Knowledge Management theory developed by Davenport and Prusak (1998). The construct was measured with three items retrieved from Song et al. (2006), which adapted the market intelligence concept developed by Kohli and Jaworski (1990) to technological scanning as technology-oriented knowledge generation. In our research, the items used by Song et al. have been adapted to measure the environmental scanning performed by means of science

fiction approaches. By environmental scanning is meant the generation of knowledge about the broader environmental factors characterizing future scenarios, other than technology.

Item	Statement					Source
KG1	Through sci-fi-based activities, I will develop considerations of possible future scenarios					Song et al. (2006)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
KG2	Sci-fi-based activities would help me think about the future impacts of some technologies					Song et al. (2006)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
KG3	Sci-fi-based activities would help me think about the future impacts of some technologies					Song et al. (2006)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.11: Items related to Knowledge Generation

4.4.6. Knowledge Sharing (KS)

The construct includes the second and third phases belonging to Knowledge Management theory developed by Davenport and Prusak (1998). The construct was measured with three items retrieved from the work of Singh and Gupta (2014), which develops a scale for measuring knowledge sharing in teams and teamworking dynamics. The items were adapted to the context, in order to explore the sharing of intuitions, reflections and opinions about the future among the participants to the group activities.

Item	Statement					Source
KS1	During sci-fi-based initiatives, I would gladly share my insights into the future with colleagues					Davenport and Prusak (1998)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
KS2	During sci-fi-based activities, I would not just keep to myself my thoughts on implications of technological evolution and/of society					Davenport and Prusak (1998)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	
KS3	During sci-fi-based activities, I would discuss with my colleagues how to deal with the future competitive environment					Davenport and Prusak (1998)
	1 - Strongly disagree	2 - Disagree	3 - Neither agree nor disagree	4 - Agree	5 - Strongly agree	

Table 4.12: Items related to Knowledge Sharing

4.5. Data analyses

This chapter presents the process and tools used to analyze the data collected, in order to test the research model.

A preliminary analysis has been performed on the control variables presented in Chapter 3.4, in order to investigate the characteristics of the sample population. The analysis has been done using Microsoft Excel tool and the results are displayed by means of bar and pie charts in Chapter 5.

Thereafter, the analysis of the constructs of the research model has been performed, using the main general-purpose statistical software Stata17. Each construct, also known as latent variable, has been tested by collecting results on multiple items, allowing a better accuracy in the measurement. The collected answers on the items were analyzed through the numeric values associated with the Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The first step of the process is the use of the Kaiser-Meyer-Olkin (KMO) test, to assess if the dataset collected from the questionnaire is suitable for performing a factor analysis. After having obtained a positive result, an Exploratory Factor Analysis (EFA) was performed to have a preliminary assessment of the model's latent variables. Then, the framework of the Structural Equation Modeling (SEM) was used to test the

hypotheses of the model, also conducting a Confirmatory Factor Analysis (CFA) to evaluate the validity and consistency of the constructs. The level of significance of the analyses was set at 95%. In the following paragraphs, all the steps of the data analysis are presented more in detail.

4.5.1. Exploratory Factor Analysis

First of all, the Kaiser-Meyer-Olkin (KMO) test was performed to assess the adequacy of the sample and the suitability of data for conducting factor analysis. The test measures sampling adequacy for each variable in the model and the complete model, with values ranging from 0 to 1. KMO values above 0.6-0.7 are considered adequate to conduct an EFA (Taherdoost et al. 2014).

The following step was to conduct the Exploratory Factor Analysis, a multivariate statical method to identify the underlying relationships between the set of collected measures and the validity of the constructs they are measuring. In this study, EFA was used to identify which items were better measuring the constructs, or latent variables, by assessing the factor loading of each item related to the construct. EFA was performed through the principal component analysis (PCA), which is one of the most common among the available methodologies. PCA identifies the principal components of the dataset, which are the components that account for as much variability as possible. After having identified the components, an orthogonal rotation was applied to cluster items correlated to a specific factor and visualize the related factor loadings. Factor loading is a supposed correlation between a latent variable and an observed variable. The factor loadings of each item on the component were analyzed in order to retain only the items with a significant loading value for the measurement of the construct in the model. Hair et al (1998) provide guidelines for assessing the practical significance of standardized factor loadings, with respect to the sample size of the dataset. In particular, factor loadings above 0.45 are considered significant for a sample size over 150.

Moreover, the Cronbach's alpha (Cronbach 1951) was computed for each construct, in order to assess the internal consistency of the items. The formula (4.0) to measure it is:

$$\alpha = \frac{N \cdot \overline{c}}{\overline{v} + (N-1) \cdot \overline{c}} \tag{4.0}$$

Where:

- N = number of items
- $\overline{c}$ = average co-variance between item-pairs
- $\overline{v}$ = average variance

According to the reference provided by Nunnally and Bernstein's (1994), the constructs are considered reliable with values of Cronbach's alpha higher than 0.7.

4.5.2. Structural Equation Modeling

Structural Equation Modeling (SEM) is used to test a theory, which is explained though a model with the predictions among the possible constructs measured through observed variables (Hayduk et al., 2007). In the second part of the analysis the model presented in Chapter 3 was designed through the graphical interface for SEM builder in STATA 17. Starting from the items we included in the survey, this tool enabled to transfer the research model into a structural equation model (SEM) that studies the causal relationships among the constructs of our model. In particular, all the latent constructs are listed and linked to their observed items through arrows, and relations between the different constructs are introduced. First, SEM was employed to perform the confirmatory factor analysis to test the "measurement model", i.e. the relations between the constructs and the observed items. Then, the "structural model" was tested, by exploring the relations between the constructs.

Measurement model

Confirmatory Factor Analysis was carried out to assess the validity of the measurement of the constructs. The construct is better defined if the measures are more strongly correlated (Weston, 2006), which is assessed through the value of the factor loadings of the items. Specifically, excellent factor loadings of the items have to be over the threshold of 0.7 (Hair et al., 2006). Additionally, two indicators were computed to assess the validity of construct convergence:

- Composite Reliability (CR). It was computed for each construct to evaluate the internal consistency of the items measuring the construct. The Fornell & Larcker criterion (1981) indicates that the values for the acceptability of CR should be above 0.7.
- Average Variance Extracted (AVE). It is a measure of the amount of variance that is captured by a construct with respect to the overall variance of its items. To ensure convergence validity the values for the acceptability of AVE should be above 0.5.

Structural model

This part of the SEM aimed at testing the hypotheses on the relations between the constructs of the model presented in Chapter 3. The relations were considered verified when the p-value was below the threshold of 0.05. Additionally, the overall goodness of fit of the model was assessed, by analyzing continuous measures of model-data correspondence (Kline, 2015), through the following indexes:

- Square error of approximation (RMSEA): it measures how well an a priori model explains the data. As it is a badness-of-fit indicator, lower values represent the best results. The maximum threshold for excellent fit is considered 0.01, values below 0.05 are referred to as a good fit, while values ranging from 0.05 to 0.08 are considered acceptable (MacCallum et al., 1996).
- Standardized root mean residual (SRMR): it measures the standardized difference between the observed correlation and what was hypnotized in the model. The value for a good fit should be lower than 0.08 (Hu and Bentler, 1999).
- Comparative fit index (CFI) and Tucker-Lewis index (TLI): goodness-of-fit indexes measuring the relative improvement in the fit of researchers' model over the baseline model (Kline, 2015; Bentler, 1990). They are recommended to be above 0.9 (Bentler & Bonett, 1980).

4.5.3. Control variables

The purpose of the research model is to explore the influence of institutional levers on the effective application of the sci-fi based approaches in organizations, by generating and sharing knowledge. The effective application can be affected by some characteristics of the organization and the employee, that have been measured in the first part of the survey. For this reason, some control variables were included in the model to investigate their influence on knowledge generation and sharing. In particular, the following characteristics were explored:

- Individual interest in sci-fi
- Seniority
- Company Size
- Company Products and Services

5 Descriptive analysis

This section provides an overview of the main characteristics of the respondents who completed the questionnaire. The socio-demographic aspect, the characteristics of their work, the company in which they work, and their relationship with science fiction are examined. The results of the questionnaire, thanks to the control variables, allowed to collect and identify some features of the analyzed sample. In fact, it is important to understand if there are significant limitations in the characteristics of the sample in order to generalize the results obtained. In addition, the control variables have an impact on the model and the relationships studied between the constructs. Microsoft Excel was used to perform the preliminary analysis.

The survey collected a total number of 480 responses, of which 269 with a completion rate of 100%. The data were screened to eliminate outliers and uniform textual answers. Then, the responses were filtered through the control variable assessing the seniority, in order to include in the analysis only the employees that are working in their current organization for at least 2 years. The selection was based on the assumption that people who had worked in the same company for 2 or more years had a better knowledge of the reality and context of the company and therefore the answers would be more relevant. As a result, the final number of answers analyzed was 194.

5.1. Demographic analysis

The first questions of the questionnaire refer to socio-demographic information. In them, respondents were asked about their gender, age, nationality, and educational attainment (Table 5.1).

Variable	Responses (#) (N=194)	Responses (%)
Gender		
Female	70	36%
Male	123	63%
I prefer not to say	1	1%
Age Range		
21-30	34	18%
31-40	53	27%
41-50	59	30%
51-60	41	21%
61-70	7	4%
Nationality		
Italian	188	97%
Other	6	3%
Educational level		
Degree	172	89%
No degree	22	11%

Table 5.1: Demographic variables results

Regarding gender, women accounted for 36 percent of participants compared to 63 percent of men, while only one person preferred not to provide information. This majority of responses from men could be a first limitation to expand the sample to a larger population.

The ages of the respondents ranged from 21 to 68, with an average of 43. This is probably due to the fact that LinkedIn was chosen as the main distribution platform for the survey and that only people who had been with the company for at least 2 years were selected, as it is assumed that there is less stability within the same company at the beginning of an employee's career. Also at the age group level, it is confirmed that

the most important age group is that of 41-50 years old with 30% of the total, followed by 31-40 years old with 27% and 51-60 years old with 21%.

Regarding nationality, the questionnaire was entirely in Italian and was distributed through Italian channels, so the fact that 94% of respondents were Italian is in line with expectations.

The percentage of responses from those with a bachelor's degree or higher (88%) is significantly higher than those without a degree (12%). This figure is also easily explained by the use of LinkedIn as a distribution platform. The latter result could be a limitation of the sample to expand the considerations to a larger sample that includes more non-graduates.

5.2. Company and Work Characteristics

For the purpose of the study, it is crucial to identify the main characteristics of the organizations in which the respondents of the questionnaire work. The first two questions refer to the size of the organizations and the type of products/services offered. The next two questions refer to the specific function and the number of years the person has been working in the same company. Finally, the last question in this part provides information on whether, in the respondents' opinion, some companies have already used science fiction techniques.

To define organizations, 3 multiple-choice answers were included in which size was the main criterion. The first three answer choices were start-up, SME, and large enterprise. Since these choices were not sufficient to characterize the entire spectrum of organizations, an open answer choice was added to identify other recurring categories. As might be expected, most responses (Figure 5.1) came from people working in large companies (52%), followed by SMEs (32%), while only a minority worked in startups (5%). Two other recurring areas could be identified from the open-ended responses: 4% worked in academia or research and 3% in public administration. The effect of organizational size on the model may be relevant in that smaller organizations can be expected to find it easier to adopt an innovative approach such as sci-fi, while standardized and best practices increase with size. However, larger organizations have more tools to effectively address the future through sci-fi.

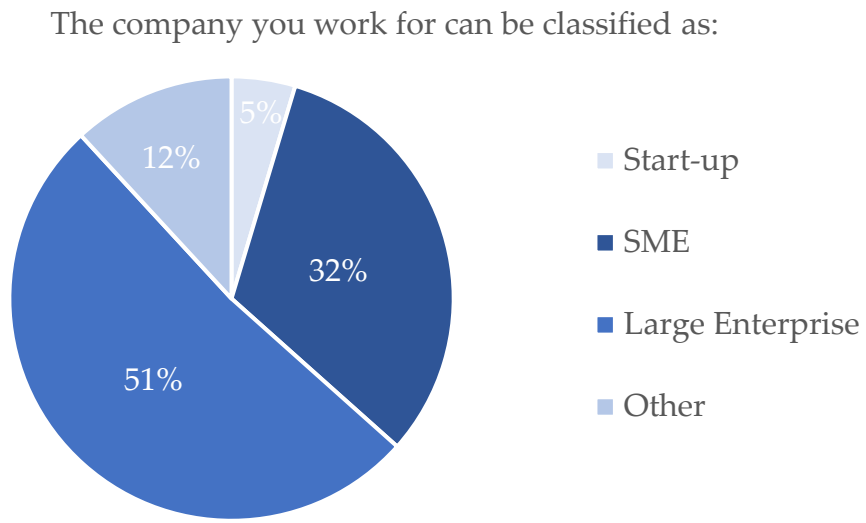


Figure 5.1: Size of the companies of respondents

To further classify the organizations in question, it was asked whether they offered a product or service and whether these could be defined as traditional, largely standardized, or complex. The results (Figure 5.2) showed that most of the respondents worked in complex service organizations (49%). Complex product organizations follow with 27%. Finally, organizations providing standardized products are represented by 14%, while standardized services account for 10%. It is interesting to see how this variable affects the model, as it is to be expected that the companies most committed to a complex product/service will be the first beneficiaries of an approach like sci-fi.

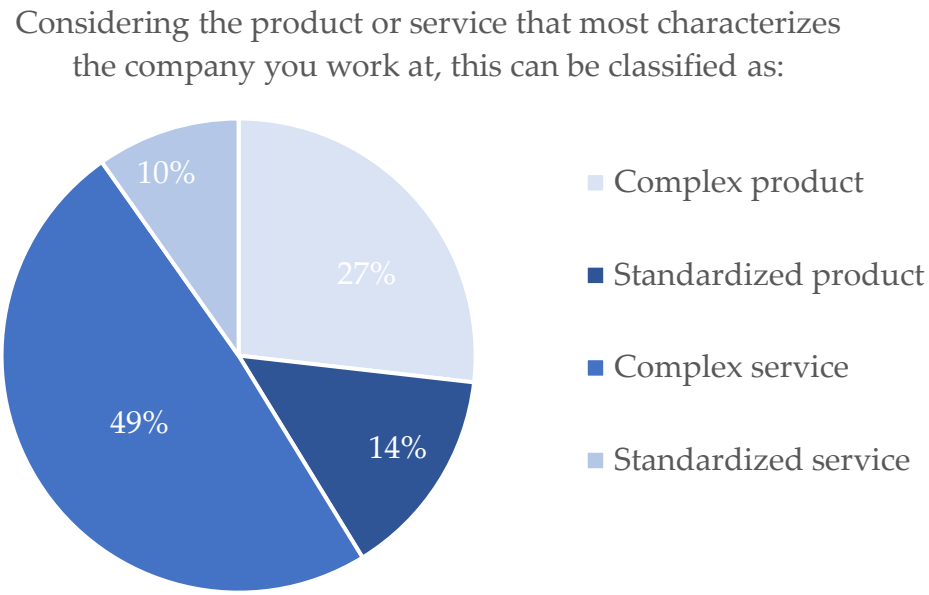


Figure 5.2: Products/Services provided by the companies of respondents

The time individuals have spent in the same company has been called seniority. Individuals with higher seniority are expected to have greater awareness and sensitivity of what institutional factors are within the organization in which they work and their relative influence on employees. In the sample (Figure 5.3), 56% of respondents have been with their current company for between 2 and 10 years. This is followed in descending order by 11-20 with 23% and 21-30 with 18%. The maximum number of years recorded was 38.

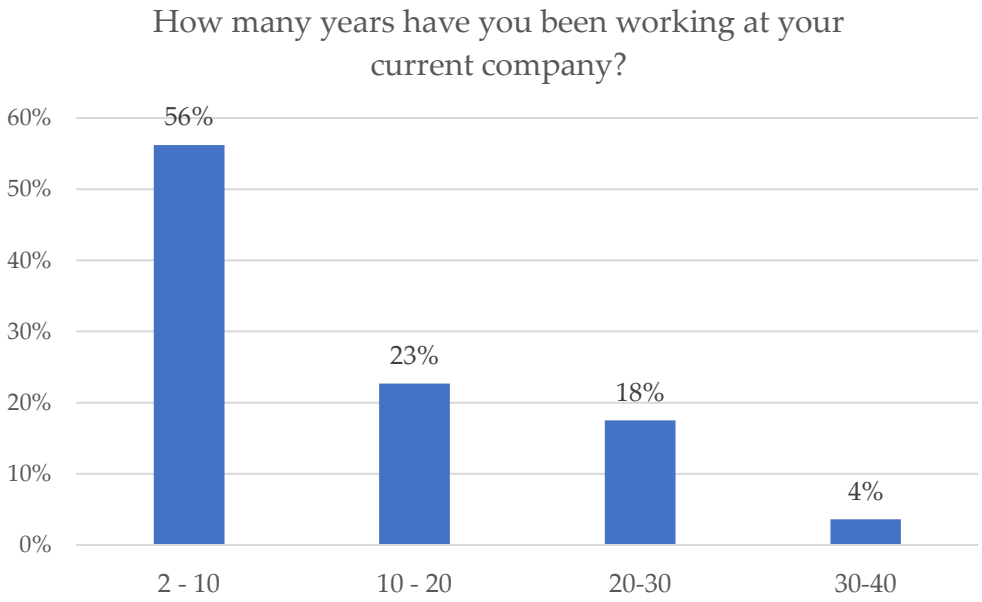


Figure 5.3: Time spent within the actual organizations

To identify the most important functions in the companies, 3 areas were selected that are of particular importance for this study: R&D, marketing, and product management. In addition, a fourth open response option was included to indicate all other functions. Product management was the most represented area with 27% of the responses, 21% of the sample worked in R&D and 16% in marketing. 36% of respondents worked in other areas (Figure 5.4).

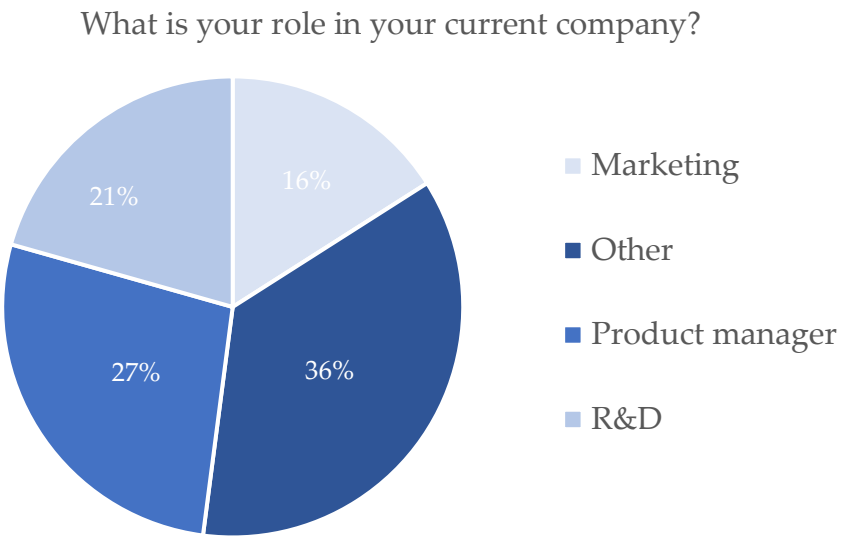


Figure 5.4: Job roles of the respondents

Considering that the sci-fi based methods proposed in this study are very innovative, the fact that 87% of the companies in the sample have never used them is in line with expectations. It is also interesting that 5% of the total companies in the sample plan to use them in the future and 7% have already used them sporadically (Figure 5.5).

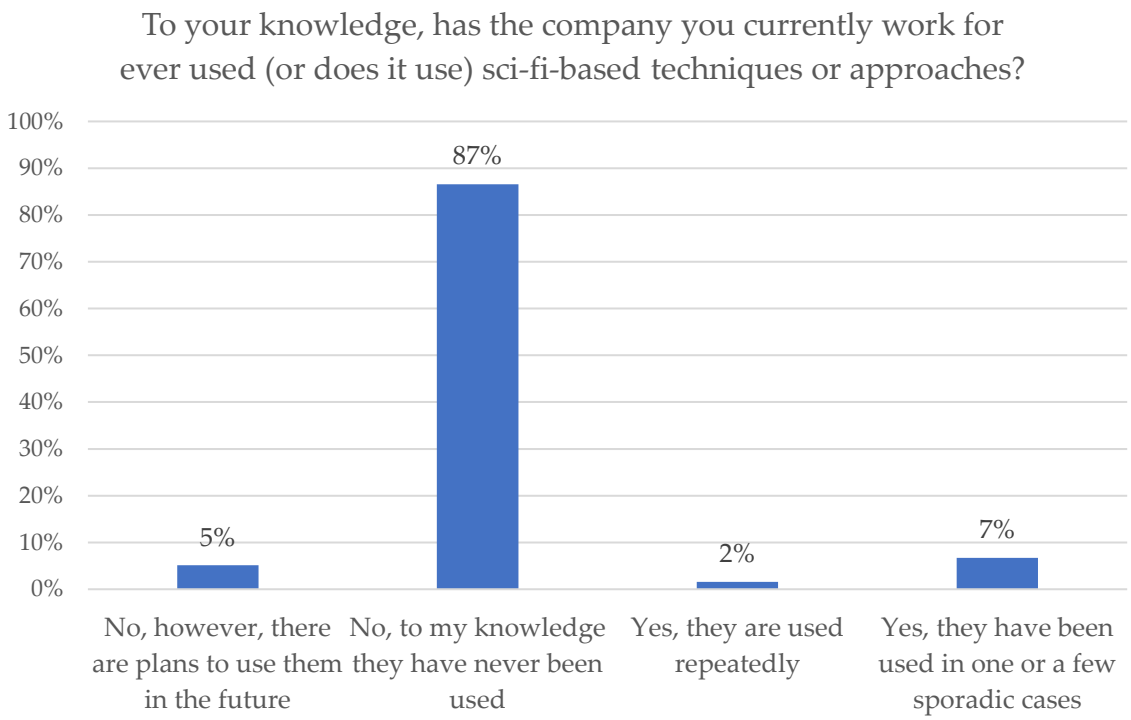


Figure 5.5: Usage of sci-fi-based techniques by companies

5.3. Individual relationship with sci-fi

Another aspect relevant to the sample in question is the respondents' relationship to science fiction. This was analyzed with two variables: the degree of interest in it and the frequency of consumption of science fiction content. They were measured with a range of values from 1 (strongly disagree) to 5 (strongly agree).

To measure the frequency of use, the respondents assessed the sentence "*I read books/comics and/or watch movies/TV series and/or play video games on science fiction subjects in my spare time*". The answers were mostly positive, 28% strongly agreed and 31% agreed. The percentage of those who never or rarely use science fiction content is respectively 10% and 16%. Finally, 14% neither agreed nor disagreed with the statement.

To measure interest in science fiction, the sentence submitted in the questionnaire was "*I like science fiction*". In this case the sample trend for appreciation was confirmed, with the percentages of those who agreed and strongly agreed at 38% and 32%. 13% of respondents were indifferent to it, while 10% and 7% were not interested or not interested at all (Figure 5.6).

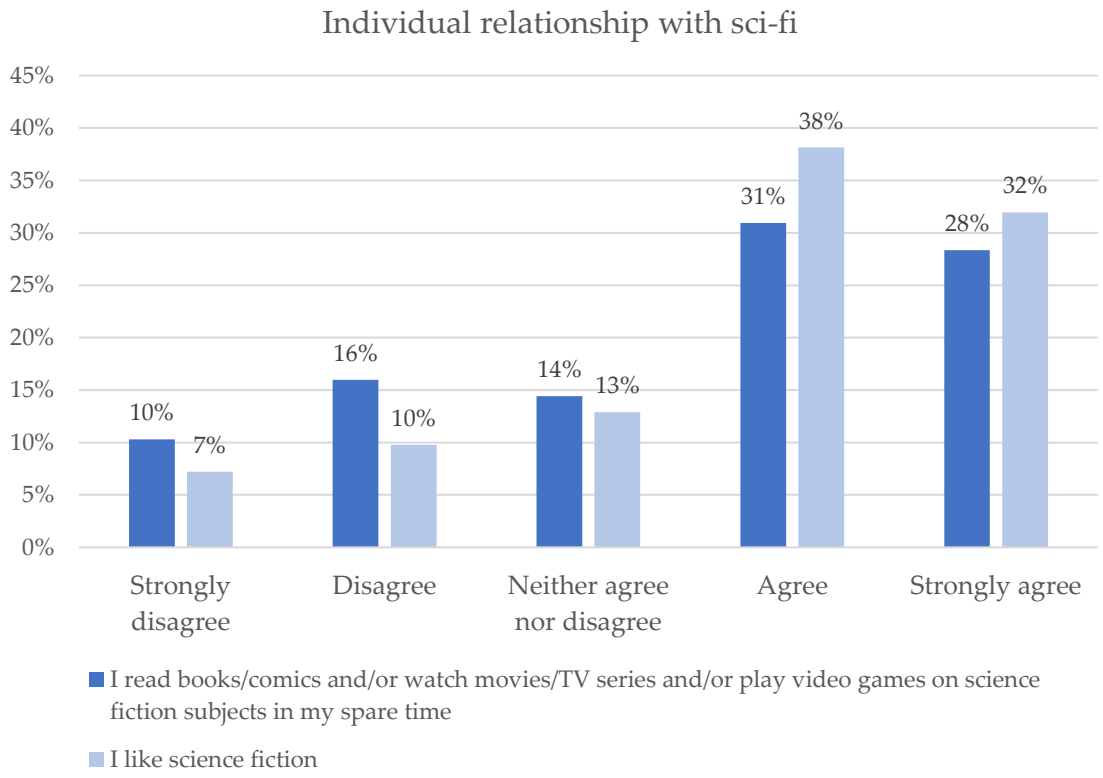


Figure 5.6: Individual relationship with sci-fi

5.4. Psychological Safety

A set of 4 questions similar to each other was used to assess the psychological safety of individuals within the work context. This was done to avoid the emergence of bias and to ensure the integrity of the responses obtained. The sentence questions to be rated from 1 to 5 all had a structure that resembled the following, "*in case I propose sci-fi initiatives, I would NOT worry about the judgment of others.*" To analyze the results, the average of the number of responses to the 5 different Likert scale values on the 4 items was performed, as they were similar to each other. It turned out (Figure 5.7) that 45% of the respondents agreed, and 13% very much agreed with the statements, that the individuals in the sample mostly felt psychologically safe in the organizational context for that which concerned sci-fi-related initiatives. 27% neither agreed nor disagreed, and the remaining 12% and 2% did not feel safe or at all to propose sci-fi initiatives without incurring negative judgments.

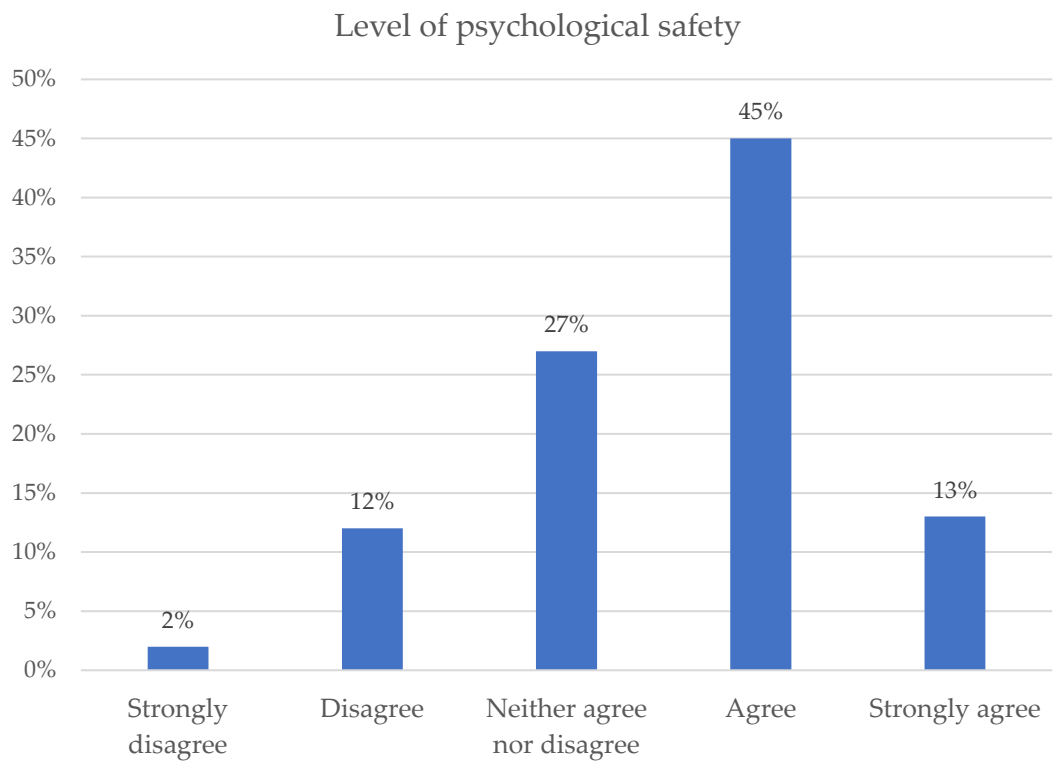


Figure 5.7: Level of psychological safety

5.5. Environmental Dynamism

To assess the environmental dynamism perceived by survey respondents, the same approach of psychological safety was used: 4 questions similar to each other were asked. The 4 statements to be rated from 1 to 5 investigated the following aspects: speed of evolution of both products/services and technologies of the organization they worked for, and difficulty in predicting competitor moves and customer needs. Again, the responses were in line with each other, and the results from the 4 items were averaged (Figure 5.8). 34% and 14% agreed and very much agreed with the proposed statements. Only 21% disagreed and 1% not at all, while the remaining 25% were indifferent.

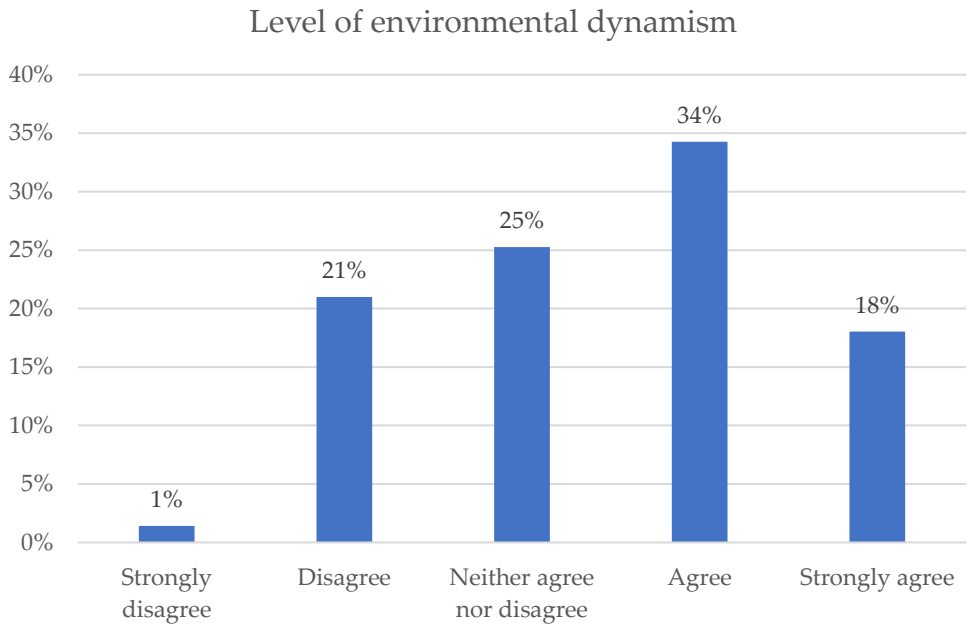


Figure 5.8: Level of environmental dynamism

6 Results

The results of the analyses on the data set and the research model, discussed in Chapter 4.5, are illustrated in the following sections.

6.1. Exploratory Factor Analysis

First of all, the Kaiser-Meyer-Olkin (KMO) test was carried out to assess the adequacy of the sample and determine if it would be appropriate to conduct an EFA.

Item	kmo
RP1	0.8333
RP2	0.7075
RP3	0.7883
NP1	0.8957
NP2	0.8742
NP3	0.8856
CP1	0.9132
CP2	0.7536
CP3	0.7003
PU1	0.8957
PU2	0.9063

PU3	0.9238
KG1	0.9241
KG2	0.9270
KG3	0.9028
KS1	0.9086
KS2	0.8429
KS3	0.8822
Overall	**0.8721**

Table 6.1: KMO test

The results, illustrated in Table 6.1, show that for all items the KMO is higher than 0.7, specifically with a minimum value of 0.7075 and a maximum value of 0.9270. Also, the overall KMO is above 0.7. Following the guidelines presented in chapter 4.5 (values above 0.6-0.7 are considered adequate) (Taherdoost et al. 2014), it can be deduced that factor analysis is worthwhile.

EFA was performed to understand how well the items are valid in representing certain constructs for exploratory purposes, in the sense that the relationships between items and constructs can be investigated from the data. The results of the PCA showed that each of the six constructs of the model (RP, NP, CP, PU, KG and KS) is defined by the three items used to measure the construct itself. Then, the orthogonal rotation allowed to visualize and evaluate the factor loading of each item on the construct it is measuring. When rotating, the Kaiser normalization was applied and the number of components (or factors) to be rotated was specified to be equal to 6, which is the number of constructs in the proposed model. In this phase, the objective was to select all items with a factor loading greater than 0.45 (Hair et al., 1998), to verify the validity of the item in representing the latent variable. In this analysis, the item CP1 showed a factor loading of 0.3595, below the acceptability threshold, so it was removed from the proposed model. All the other items had acceptable loadings and were selected to be included in the research model.

In parallel, Cronbach's alpha was computed to assess the reliability of data collected on the items in representing the construct, excluding CP1 from the analysis. According to the reference provided by Nunnally and Bernstein's (1994), the constructs are considered reliable with values of Cronbach's alpha higher than 0.7. Considering the indicated threshold, all the constructs showed an acceptable value of Cronbach's alpha.

The results of the EFA are summarized in Table 6.2.

Construct	Item	Factor Loading	Cronbach's alpha
Regulative Pillar (RP)	RP1	0.5471	0.8606
	RP2	0.5928	
	RP3	0.5042	
Normative Pillar (NP)	NP1	0.5028	0.7329
	NP2	0.5530	
	NP3	0.6346	
Cultural Pillar (CP)	**CP1**	**0.3595**	-
	CP2	0.6475	0.7504
	CP3	0.6247	
Perceived Usefulness (PU)	PU1	0.5440	0.8616
	PU2	0.5848	
	PU3	0.5017	
Knowledge Generation (KG)	KG1	0.4832	0.8747
	KG2	0.5234	
	KG3	0.6621	
Knowledge Sharing (KS)	KS1	0.4718	0.8896
	KS2	0.6282	
	KS3	0.5919	

Table 6.2: Factor loadings and Cronbach's alpha from EFA

6.2. Structural Equation Modeling

This section presents an analysis on the causal relationships among the proposed constructs through a structural equation model (SEM). In this phase, the structure of

the model was designed through the graphical interface for SEM builder. SEM, usually, relies on a measurement model and on a structural model.

Measurement model

A preliminary study consists in verifying the validity of the measurement model, analyzing the results of SEM estimation. In particular, the confirmatory factor analysis (CFA), the average variance extracted (AVE) and the composite reliability (CR) were performed. A Confirmatory Factor Analysis was done with the objective to understand if the structure of the model is suitable with respect to the collected data, in terms of relationships between constructs and items. More in detail, the CFA is realized by connecting each latent variable with the observed ones through a set of arrows. For this purpose, the standardized factor loadings of each item were derived from the CFA and the results of the analysis are shown in Table 6.3. To ensure an excellent goodness of the model, factor loadings have to be over the threshold of 0.7. The item NP1 was removed from the model presenting a value of 0.5884, which means it doesn't describe the construct well.

Construct	Item	Factor Loading
Regulative Pillar (RP)	RP1	0.7552
	RP2	0.8669
	RP3	0.8518
Normative Pillar (NP)	**NP1**	**0.5884**
	NP2	0.7487
	NP3	0.7574
Cultural Pillar (CP)	CP2	0.8120
	CP3	0.7431
Perceived Usefulness (PU)	PU1	0.8770
	PU2	0.8545
	PU3	0.7694
Knowledge Generation (KG)	KG1	0.8950
	KG2	0.8170
	KG3	0.7788

Knowledge Sharing (KS)	KS1	0.8646
	KS2	0.8575
	KS3	0.8238

Table 6.3: Factor loadings from CFA

Subsequently, the indicators Composite Reliability (CR) and Average Variance Extracted (AVE) were computed to assess the convergence validity. As shown by the results in Table 6.4, both the indicators respect the limits of acceptability for each construct, that are higher than 0.7 for CR and higher than 0.5 for AVE. Moreover, all the factor loadings now exceed the recommended cut-off of 0.7.

Construct	Item	Factor Loading	CR	AVE
Regulative Pillar (RP)	RP1	0.7545	0.8653	0.6825
	RP2	0.8679		
	RP3	0.8514		
Normative Pillar (NP)	NP2	0.8163	0.7412	0.5899
	NP3	0.7166		
Cultural Pillar (CP)	CP2	0.8149	0.7544	0.6062
	CP3	0.7405		
Perceived Usefulness (PU)	PU1	0.8752	0.8732	0.6972
	PU2	0.8559		
	PU3	0.7700		
Knowledge Generation (KG)	KG1	0,8948	0.8701	0.6913
	KG2	0.8170		
	KG3	0.7783		
Knowledge Sharing (KS)	KS1	0.8637	0.8860	0.7215
	KS2	0.8592		
	KS3	0.8248		

Table 6.4: Factor loadings, CR and AVE

Structural model

At this point, the path diagram of the model was designed (Figure 6.1), in order to test the proposed model using the Structural Equation Modelling (SEM) technique. Specifically, the objective of the analysis is to verify the significance of the hypothesized relationships among constructs with reference to the sample analyzed. Each hypothesized relationship is represented by a path in the diagram, that was analyzed by means of two parameters. Firstly, the p-value was evaluated, which has the function of testing the statistical significance of the path in question. For a confidence interval of 5%, a p-value lower than 0.05 is indicative of statistical significance, therefore the hypothesis is verified. In the opposite case, i.e., a p-value higher than 0.05, the hypothesis is not verified. After the validation, the β coefficient was evaluated, which indicates the strength of the correlation, to produce additional inferences about the impact of the independent variable on the dependent one. The results for each path are shown in Table 6.5.

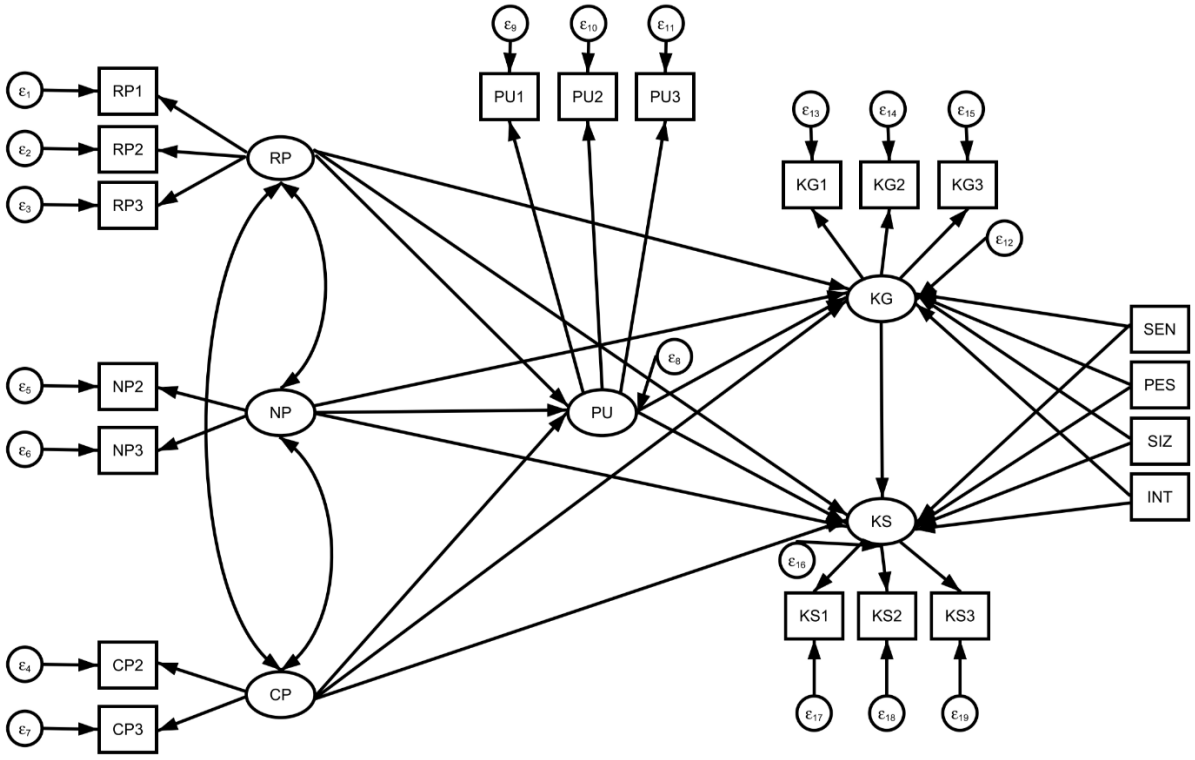


Figure 6.1: Tested model

Hypothesis	Path	Coefficient β	Std. Err.	p-value	Results
H4	RP → PU	0.0668	0.0784	0.394	Not Significative
H5	NP → PU	0.6268	0.1065	0.000***	Significative
H6	CP → PU	-0.1521	0.0820	0.064	Not Significative
H1a	RP → KG	-0.0761	0.0644	0.237	Not Significative
H1b	RP → KS	0.0432	0.0704	0.540	Not Significative
H2a	NP → KG	0.2163	0.1059	0.041*	Significative
H2b	NP → KS	0.1269	0.1129	0.261	Not Significative
H3a	CP → KG	-0.0244	0.0691	0.723	Not Significative
H3b	CP → KS	0.1863	0.0814	0.022*	Significative
H7a	PU → KG	0.7876	0.0967	0.000***	Significative
H7b	PU → KS	0.1014	0.1511	0.502	Not Significative
H8	KG → KS	0.4793	0.1416	0.001***	Significative

p-value representation: ***p ≤ 0.001; **p ≤ 0.010; *p ≤ 0.050

Table 6.5: Hypotheses testing results

Table 6.5 presents an overview of the results. The hypotheses H1, H3, H4, H5, H7, H8 and H11 show a p-value higher than 0.05, so they are not verified. Instead, the hypotheses H2, H6, H9, H10 and H12 present a p-value lower than 0.05, thus these correlations are considered statistically significant. Specifically, H2, H10 and H12 show p-value results very close to or equal to 0.000, which represents maximum statistical significance. The results of the hypotheses tested will be further analyzed and discussed in Chapter 6.5.

Goodness of fit

A further analysis was conducted through SEM to assess the overall goodness of fit (GOF) of the structural model. The selected indexes for this evaluation are the root mean square error of approximation (RMSEA), the standardized root mean square

residual (SRMR), the comparative fit index (CFI) and the Tucker-Lewis index (TLI). The results are shown in Table 6.6, compared with the thresholds of acceptability.

Indicator	Threshold	Value
RMSEA	< 0.08	0.053
SRMR	< 0.08	0.069
CFI	> 0.9	0.957
TLI	> 0.9	0.945

Table 6.6: Goodness of fit indicators

All fit indicators are included in the reference range of acceptability. Thus, it can be claimed that the proposed model shows an overall goodness of fit.

6.3. Control variables

In terms of control variables, those that were shown to be the most interesting and capable of enriching the model were chosen. The effect of various combinations of control variables on knowledge generation and knowledge sharing was specifically tested, and the one with the best relevance and outcome in terms of goodness of fit was chosen. In particular, two types of control variables were selected, the first type concerns those related to some characteristics of the organization, i.e., company products and services, company size, and seniority while the second type concerns individual characteristics of the respondent, i.e., interest in science fiction. As shown in Table 6.7, four significant relationships were found, considering a p-value less than 0.05 as the threshold for significance.

Item	Control Variable	Path	Coefficient β	Std. Err.	p-value	Results
SEN	Seniority	SEN → KG	-0.0020	0.0042	0.626	Not Significative
		SEN → KS	-0.0089	0.0045	0.050*	Significative
PES	Company Products and Services	PES → KG	0.0254	0.0390	0.515	Not Significative
		PES → KS	-0.0912	0.0423	0.031*	Significative
SIZ	Company Size	SIZ → KG	-0.0187	0.0554	0.736	Not Significative
		SIZ → KS	0.1189	0.0592	0.044*	Significative
INT	Individual interest in sci-fi	INT → KG	0.0915	0.0336	0.006**	Significative
		INT → KS	0.0527	0.0383	0.170	Not Significative

p-value representation: ***p ≤ 0.001; **p ≤ 0.010; *p ≤ 0.050

Table 6.7: Incidence of control variables on KG and KS

Seniority has an impact on knowledge sharing (p-value ≤ 0.050, coefficient β = -0.0089). Specifically, given the negative coefficient, individuals with less time spent within the organization in which they currently work are more likely to share knowledge obtained through sci-fi activities.

The products and services offered by the organization also have an impact on knowledge sharing (p-value ≤ 0.050, coefficient β = -0.0912). Having set up the multiple-choice question with values from 1 to 4 starting with product companies (answers 1 and 2) and ending with services (answers 3 and 4), and having a negative coefficient as a result, it can be concluded that employees of product companies have a greater propensity for knowledge sharing of knowledge gained from sci-fi activities than those who work in a service organization.

In addition, company size also has a significant impact on knowledge sharing (p-value ≤ 0.050, coefficient β = 0.1189) In this case, the positive coefficient suggests that the latter is practiced more by employees in larger companies. However, there is to be noted that response 4 - the highest value of the multiple response to the question - left the option of putting an open answer. The option, as analyzed above, was selected by

12% of respondents, so it is not expected to have a major impact on the results, but it is definitely something to be noted.

Finally, the only individual-related control variable included in the model, namely interest in science fiction, has a significant impact on knowledge generation (p-value ≤ 0.050, coefficient $\beta = 0.0915$). Indeed, as might be expected, individuals with greater interest in the genre are more likely to generate new knowledge through sci-fi activities.

6.4. Hypotheses testing

Regulative Pillar

- H1a: Regulative Pillar and Knowledge Generation
- H1b: Regulative Pillar and Knowledge Sharing
- H4: Regulative Pillar and Perceived Usefulness

The hypotheses H1a and H1b, that states the influence of the regulative pillars on the activities of KG and KS, are not statistically significative (respectively p-value = 0.237 > 0.05, p-value = 0.540 > 0.05) and the correlation between the pairs of constructs results to be weak (respectively $\beta = -0.0761$, $\beta = 0.0432$). This means that the system of procedures, norms and standards imposed by the organization does not incentive the employee's active participation and involvement in sci-fi activities. Moreover, the hypothesis H4, positing the correlation between regulative mechanisms and perceived usefulness of the approach, is not supported (p-value = 0.394 > 0.05) and results to be weak as well ($\beta = 0.0668$). The findings suggest that regulatory actions on the implementation of sci-fi based activities are not useful to the company in conveying to employees the benefits this approach can have in improving their ability to innovate and develop long-term strategic plans.

Normative Pillar

- H2a: Normative Pillar and Knowledge Generation
- H2b: Normative Pillar and Knowledge Sharing
- H5: Normative Pillar and Perceived Usefulness

Hypotheses H2a and H2b aim at describing the effect of the normative pillar on the activities of KG and KS. From the results obtained, the correlation between normative pillar and KG appears to be supported, showing statistical significance (p-value = 0.041 < 0.05 and $\beta = 0.2163$), while the correlation between normative pillar and KS is not verified (p-value = 0.261). The outcomes show that the opinion, behavior and

experiences of colleagues influence the participation of employees in sci-fi activities, incentivizing their engagement in the generation of knowledge. Indeed, if peers believe that it is relevant and appropriate to generate innovative ideas and reflecting on future scenarios by exploiting science fiction, the employee will be incentivized to engage in these activities to be in alignment with the social context. This result is particularly relevant, considering that teamworking is at the basis of sci-fi activities. On the contrary, the sharing of such knowledge seems not to be affected by peer influence.

In addition, the hypothesis of the influence of normative mechanisms on the PU is verified (p-value = 0.000 < 0.05). It is interesting to point out that it presents a p-value of 0.000, which means that the correlation is strongly significant. In addition, the β coefficient (β = 0.6268) is indicative of a strong influence of the normative pillar on PU, greater than the one exercised on KG. The results show that the peers experience with the approaches can increase the assessment of its usefulness by the employee, by showcasing the benefits in improving his or her innovative and strategic performance.

Cultural Pillar

- H3a: Cultural Pillar and Knowledge Generation
- H3b: Cultural Pillar and Knowledge Sharing
- H5: Cultural Pillar and Perceived Usefulness

The hypothesis that correlates CP and KG is not supported in relation to the sample considered (p-value = 0.723). Instead, the influence of CP on KS is statistically significant (p-value = 0.022, β = 0.1863). This result means that an organizational culture that fosters the need for change has an impact on the willingness of employees to share the ideas and intuitions generated within the sci-fi activities. Surprisingly, the correlation between the CP and the PU is not supported (p-value = 0.064), meaning that a culture for change is not sufficient to make the employee perceive the benefits of using science fiction in the workplace.

Rational factors

- H7a: Perceived Usefulness and Knowledge Generation
- H7b: Perceived Usefulness and Knowledge Sharing

The influence of PU on KG results to be statistically significant (p-value = 0.000, β = 0.7876). This represents the most interesting result, since the p-value equal to 0.000 indicates that the correlation is strongly significant, with the highest value of correlation observed (β = 0.7876). The individual belief on the utility of the innovative

methodology influences his or her behaviour towards the willingness to generate future-oriented knowledge. This is explained by the fact that the perceived usefulness here is measured at the individual level, through the benefits related to the worker's ability to generate new ideas. Indeed, on the contrary H7b is not supported (p-value = 0.502, $\beta = 0.1014$), since the activity of sharing is mostly related to organizational-level objectives.

- H8: Knowledge Generation and Knowledge Sharing

The influence of KG on KS is validated (p-value = 0.001, $\beta = 0.4793$), observing a strong correlation between the constructs. The result suggests that the generation of intuition, reflections and ideas on the future of the company naturally leads employees to the willingness to share and discuss the findings with his or her peers. The finding is also coherent with the proposed activity of designing a sci-fi story, during the activity of generating ideas on the future.

7 Discussions

This study offers two main theoretical contributions to current literature, and some important managerial considerations and insights can be derived.

From a theoretical standpoint, the research contributes to science fiction studies and knowledge management literature. Specifically, the study investigates the management of knowledge produced in foresight studies and proposes the employment of science fiction to support such process. Moreover, this research contributes to the call for papers issued by Michaud and Appio (2022) on the usage of science fiction within organizations. In particular, the focus is on studying the organizational drivers to promote the introduction of approaches based on sci-fi into innovation and foresight activities. As a result, some managerial recommendations can be deduced from the findings, on the actions that organizations should implement.

7.1. Theoretical Contribution

The findings of this research contribute to science fiction studies by exploring the way in which knowledge related to the future can be managed within organizations. Specifically, the study introduces a new approach, based on science fiction, to generate and share this kind of knowledge. Thereafter, the factors influencing the employment of these activities by employees were studied.

Knowledge management theory has been revised and expanded, by studying the process of management of a particular type of knowledge in the company, which in this study has been referred as "future-oriented" knowledge. It refers to the production and sharing of knowledge about what may occur or is intended to occur in futures that are usually at least 10 years away, such as alternative long-term developments and trajectories of technologies, competitive scenarios, and society. The management of this process is deemed relevant by authors for the success of foresight practices in companies, with the aim of guiding strategic decisions and organizational change. The contribution of the study on this topic is the proposal of science fiction as a tool to manage future-oriented knowledge, being the genre by definition aimed at speculation about the future trajectories of technology, society and individuals. Indeed, the activities performed in using science fiction-based approaches are aimed

at generating new knowledge related to the future, codifying it and transferring this knowledge within the organization. The literature review brought out two main approaches for using science fiction to manage future-related knowledge: science fiction content analysis and the creation of science fiction stories (i.e. SFP). In particular:

- **Knowledge Generation phase** is supported by the sci-fi content analysis to extract information from external sources and by the design of sci-fi stories to develop knowledge within the organization.
- **Knowledge Codification and Transfer phases**, that are referred to with the broader concept of Knowledge Sharing, are supported by the design of sci-fi stories. Moreover, any kind of sci-fi based activity promotes informal mechanisms of knowledge sharing, being conceived as a group activity.

Thereafter, the outputs and results expected for the company by performing these activities are retrieved from the science fiction literature. The activities through which sci-fi based approaches support knowledge management are summarized in Table 7.1.

KM phase	SF tool	Activities	Company's Objective
Knowledge Generation	Content Analysis	**From external sources:** acquisition of innovative technological ideas, visions of future scenarios, weak signals in the external environment (technology, society, economy, politics).	Identify: • Innovative ideas • Future scenario(s)
	Design of stories	**Internal development:** structured activity aimed at incentivizing a group of people to the generation of innovative ideas, future scenarios and strategic actions through imagination, problem-solving and critical thinking.	Identify: • Innovative ideas • Future scenario(s) • Strategic actions
Knowledge Sharing	Design of stories	• Codification of the knowledge generated into a story, with a narrative and a visual representation. • A final moment of collective reflection and sharing of what has been learned. • Transfer the results among stakeholders through the sci-fi story.	• Communication and alignment • Motivation • Drive organizational change
	Both	• Group activity that promotes informal mechanisms of sharing.	

Table 7.1: The use of science fiction-based activities for future-related Knowledge Management

Making use of the theory introduced above, the research aims to contribute to Michaud and Appio's call for papers, by studying the factors that incentivize employees to participate in these activities. Specifically, new considerations have emerged on the influence of institutional and individual rational factors on the employee's behavior towards the generation and sharing of future-oriented knowledge through science fiction. The study explores the approaches that make use of science fiction genre in a broad sense; thus the findings are valid for any specific approach identified in the reviewed literature and beyond.

The first remarkable finding is a positive influence of KG on KS, suggesting how the two stages of the knowledge management process are closely related. This result confirms the literature on knowledge management according to which, once I generate some ideas, I am naturally disposed to share it to promote their application. This implies that the generation of intuitions, reflections and ideas on the future naturally leads employees to the willingness to share and discuss them with his or her peers. The correlation confirms the validity of creating science fiction stories being both a generation and communication tool.

The rational assessment of the worker on the activities was studied, by introducing the **Perceived Usefulness** as an antecedent of the behavior of Knowledge Generation and Sharing. The study revealed a positive influence of Perceived Usefulness on the Knowledge Generation, while no impact on the Knowledge Sharing was found. This means that the individual belief on the utility of the innovative methodology influences his or her behavior towards the willingness to generate future-oriented knowledge. The result is explained by the fact that the usefulness here is measured at the individual level, by evaluating the benefits related to the worker's ability to improve his or her performance in generating new ideas. On the contrary, the behavior of sharing is mostly aimed towards organizational-level objectives, that are not included in the worker's rational assessment of the methodology. The PU is also resulted to be the factor that has the strongest influence on KG, among all antecedents considered in the study. Therefore, PU is the main driver of worker's participation and engagement in sci-fi activities.

The three institutional pillars were introduced as antecedents of the worker's behavior towards Knowledge Generation and Sharing, and as antecedents of the Perceived Usefulness that rationally drives the behavior.

The **Regulative Pillar**, i.e., the system of procedures, norms and standards imposed by the organization on the worker, was found to have no impact on the Perceived Usefulness, nor on the activities of Knowledge Generation and Sharing. Thus, regulatory actions on the implementation of sci-fi based activities do not incentivize the employee's active participation and involvement in sci-fi activities, nor they are

useful in conveying to employees the benefits of improving their ability to innovate and develop long-term strategic plans.

The **Normative Pillar**, i.e. the expectations and norms elaborated from social groups about what could be appropriate behavior, was found to have a positive influence on the Knowledge Generation. The findings show that the opinions, behaviors and experiences of colleagues positively influence the participation of employees in sci-fi activities, incentivizing their engagement in the generation of knowledge. Indeed, if peers believe that it is relevant and appropriate to generate innovative ideas and reflect on future scenarios by exploiting science fiction, the employee will be incentivized to engage in these activities to be in alignment with the social context. This result is particularly relevant, considering that teamworking is at the basis of sci-fi activities. Moreover, peer influence resulted to have a strong impact on the Perceived Usefulness: the colleagues' experience with the approaches can increase the assessment of its usefulness by the employee, by showcasing the benefits in improving his or her innovative and strategic performance. On the contrary, normative mechanisms were not found to be relevant in incentivizing knowledge sharing.

The **Cultural Pillar**, i.e. the belief system, attitudes, thoughts transmitted by an institution, resulted in having a positive impact on Knowledge Sharing. This finding implies that an organizational culture that fosters the need for change has an impact on the willingness of employees to share the ideas and intuitions generated within the sci-fi activities. Surprisingly, the cultural environment didn't show evidence of influencing the Perceived Usefulness and the Knowledge Generation.

In Figure 7.1 the influence of institutional and individual factors on future-oriented knowledge management is shown.

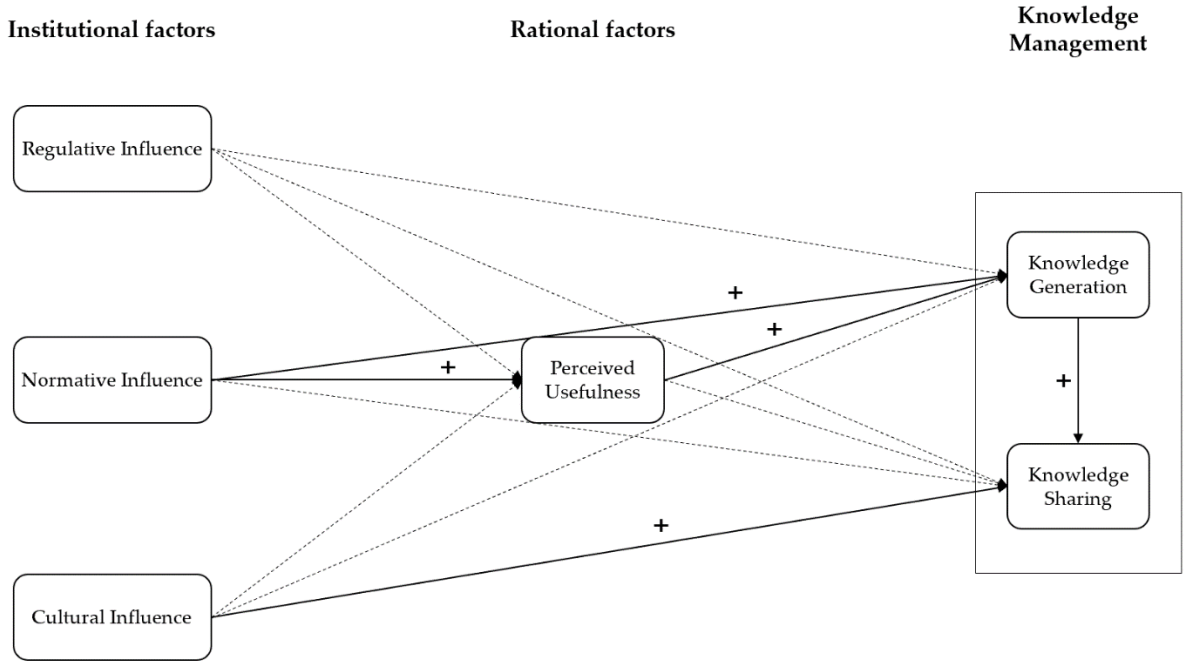


Figure 7.1: Validated Model

7.2. Managerial Contribution

The interpretation of the study results and the insights retrieved from the literature made it possible to deduce some managerial considerations.

The review of the literature on science fiction-based approaches provided insights on the results expected from the use of these approaches in organizations. By introducing activities based on sci-fi, companies can expect to improve their ability to innovate, explore future scenarios and drive organizational change. Specifically, the proposed science fiction tools aim at supporting workers in generating and sharing future-oriented knowledge, i.e. information about what may occur or is intended to occur in futures that are usually at least 10 years away, such as alternative long-term developments and trajectories of technologies, competitive scenarios, and society. If a company wants to adopt sci-fi approaches to improve workers' innovative and strategic performances, in order to achieve the desired results, it should design proper levers to promote the effective participation and engagement of workers in these activities.

The significant managerial contribution of this study was the investigation of institutional factors that could drive the successful introduction of sci-fi-based approaches into innovation and foresight practices within different types of organizations (corporate, public, governmental, research institute). Indeed, the discussions provided insights into the interplay of institutional and individual factors that influence workers' participation and engagement in sci-fi activities.

While performing sci-fi activities, the study shows that if the worker generates innovative ideas and considerations, then he or she will be willing to share them with colleagues.

To incentivize the worker to successfully participate in knowledge generation, study results show that the company should leverage the normative pillar. In fact, normative mechanisms, i.e., opinions, behaviors and experience of colleagues, turn out to have an influence on both the willingness to participate in promoted sci-fi activities and on the perceived usefulness of this approach. In addition, the factor that shows the greatest influence on engagement is perceived usefulness, showing the importance of communicating the benefits of the method to employees in terms of innovative and strategic performance. The opinion of peers is very important in this context, because they are very far from the traditional organizational approaches, and sci-fi is not usually associated with the work field. Indeed, the research shows that while there is a strong personal interest in the genre and curiosity about what can be done, there is a concern about the opinion that peers may have toward promoting an approach that is far from traditional procedures and the work environment. In order to overcome such barriers, supervision from experienced mentors and training with specialists in these practices can be relevant in getting people to understand the validity and potential of the method. It is also very relevant that these activities are performed in groups, to foster interaction among colleagues. In particular, the company should include sci-fi authors and consultants in the group activities, who act as sponsors of the practice, show how to apply the method effectively, and demonstrate the benefits that can be achieved.

In contrast, the results on the regulative pillar show that enforcing participation in sci-fi activities through their proceduralization within company practices has been shown to be ineffective in any way in gaining employee engagement. However, this means that companies could adopt this approach even in experimental forms and still being able to generate the desired results.

Finally, the findings show that sharing of emerged knowledge is positively influenced by cultural structures, i.e., the belief system, attitudes, thoughts transmitted by an institution. In fact, the shift to sharing is a behavior motivated by the perceived need for change, prompting the individual to act to foster it. Therefore, organizations should, through day-to-day initiatives and discussions, share the idea that it is important to innovate, think outside the box and have a long-term orientation.

Additionally, a climate must be created in which the proposal of ideas is well received and promoted.

7.3. Limitations and Future research

The findings also disclosed some limitations in the research, that are useful to discuss in order to inform future research on the topic.

First, some limitations lie in the characteristics of the sample analyzed. The survey was administered via LinkedIn and CiakClub channels and collected a total of 269 valid answers, of which 194 respondents with seniority of at least 2 years were retained, to increase the relevance of results. Therefore, the first limitation is the small number of answers analyzed. Further research could carry out the presented analyses on a higher number of responses, in order to generalize the results to a larger population. Moreover, given the novelty of the topic, the sample was broadened as much as possible to collect preliminary insights. Thus, every type of organization, industry and business area were included in the characteristics of the respondents. More accurate and useful results could be obtained by limiting the sample and conducting the analysis on a specific type of organization, industry or business area.

Another limitation is related to the methodology used to perform the literature review, which was systematic research through a defined string on Scopus Elsevier. This approach may have missed some contributions to science fiction literature. For this reason, the study kept the focus very broad on the employment of different types of sci-fi approaches. Indeed, the survey introduces respondents to the topic, by giving examples of several activities that it is possible to do with science fiction. Further research could perform a similar, more focused study on a particular methodology based on sci-fi, among the ones emerged from literature or otherwise. A comparison among the different studies would also be interesting for companies, in order to choose the most effective tool for their objectives.

The last remarkable limitation regards the methodology through which the behavior of workers towards the participation and engagement in sci-fi activities was investigated. Indeed, the survey introduces the respondents to a hypothetical scenario in which their company organizes a workshop to experiment with sci-fi activities. The choice of the authors was driven by the fact that empirical results on the application of the methodologies were not found in the literature. Considering that 87% of the sample respondents reported that they have never used sci-fi approaches in the company, the majority of the results of the study are related to an expected behavior, rather than an actual one. For this reason, future research can contribute to validation of results and

developments of the topic repeating the analysis after the worker's actual participation in the sci-fi activities, once introduced within the company.

8 Conclusions

This study aims to explore what actions and efforts organizations can take to effectively introduce science fiction-based approaches into their processes. Specifically, the study's objective is to identify the institutional and individual factors that drive employees' engagement in activities that use science fiction approaches. The target group consists of individuals who work in a corporate setting or in the research context.

The research contributes to science fiction studies and knowledge management literature. Specifically, the study investigates the management of knowledge produced in foresight studies and proposes the employment of science fiction to support such process. The literature review brought out two main approaches for using science fiction to manage future-related knowledge: science fiction content analysis to generate knowledge and the creation of science fiction stories to share it. Moreover, the rational assessment of the worker on the sci-fi activities was studied, by introducing the Perceived Usefulness as an antecedent of the behavior of Knowledge Generation and Sharing. Finally, the three institutional pillars were introduced as antecedents of the worker's behavior towards Knowledge Generation and Sharing, and as antecedents of the Perceived Usefulness.

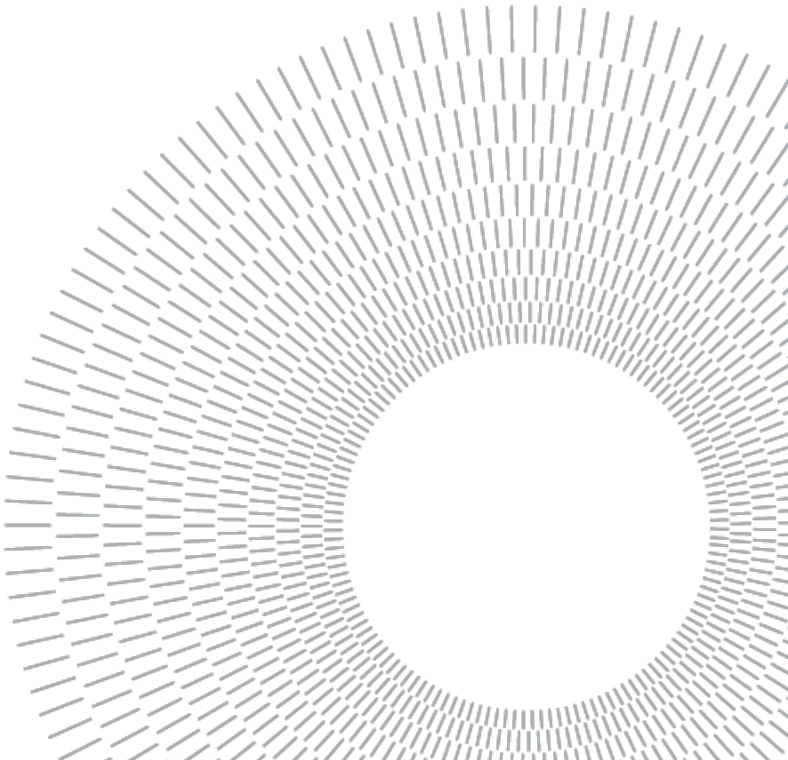
The results of the study showed the positive influence of KG on KS, suggesting how the two stages of the knowledge management process are closely related. At the same time, Perceived Usefulness positively influences Knowledge Generation, while no impact on the Knowledge Sharing was found. This means that the individual belief on the utility of the innovative methodology influences his or her behavior towards the willingness to generate future-oriented knowledge.

Looking at the institutional influences, the Regulative Pillar was found to have no impact on the Perceived Usefulness, nor on the activities of Knowledge Generation and Sharing. The Normative Pillar was found to have a positive influence on the Knowledge Generation. The findings show that the opinions, behaviors, and experiences of colleagues positively influence the participation of employees in sci-Fi

activities. On the contrary, normative mechanisms were not found to be relevant in incentivizing knowledge sharing nor Perceived Usefulness. The Cultural Pillar resulted in having a positive impact on Knowledge Sharing. This finding implies that an organizational culture that fosters the need for change has an impact on the willingness of employees to share the ideas and intuitions generated within the sci-fi activities. Surprisingly, the cultural environment didn't show evidence of influencing the Perceived Usefulness and the Knowledge Generation.

The results obtained allowed the formulation of theoretical and managerial contributions. Consequently, this research is valuable to organizations wishing to integrate sci-fi initiatives to identify what factors they need to leverage to maximize their effectiveness.

Finally, the use of a combination of existing theories to build the model allowed such a novel topic to be rigorously investigated.



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Appendix

The online survey is reported here in the original language.

Part 1

#	Quesito	Risposte
1	In quale genere si identifica?	Femmina
		Maschio
		Nessuno dei precedenti
		Preferisco non dichiararlo
2	Qual è la sua età?	.....
3	Qual è la sua nazionalità?	Italiana
		Altro (specificare)
4	Qual è il suo titolo di studio	Laureato o titolo superiore
		Non laureato
5	L'azienda presso cui lavora si può classificare come:	Startup
		Piccola-media impresa
		Impresa di grandi dimensioni
		Altro (specificare)
6	Considerando il prodotto o servizio che più caratterizza la azienda presso cui lavora, questo può essere classificato come:	Prodotto complesso (es. fortemente personalizzato, ad alto contenuto di conoscenza ecc.)
		Prodotto tradizionale (es. largamente standardizzato, con molti altri prodotti simili ecc.)
		Servizio complesso (es. fortemente personalizzato, ad alto contenuto di conoscenza ecc.)
		Servizio tradizionale (es. largamente standardizzato, con molti altri servizi simili ecc.)

7	Da quanti anni lavora presso la sua attuale azienda?	.....
8	Qual è il suo ruolo nella sua attuale azienda?	Sono impegnato in attività relative alla ricerca & sviluppo
		Sono impegnato in attività relative al marketing
		Sono impegnato in attività relative alla gestione di prodotto
		Altro (specificare)
9	Che lei sappia, l'azienda pressa cui lavora attualmente ha mai utilizzato (o utilizza) tecniche o approcci basati sulla science-fiction?	No, che io sappia non sono mai stati utilizzati
		No, però c'è intenzione di utilizzarli in futuro
		Sì, sono stati utilizzati in uno o pochi casi sporadici
		Sì, sono utilizzati in maniera ripetuta

Likert Scale 1 (Completamente in disaccordo) to 5 (Completamente d'accordo)

#	Quesito	Completamente in disaccordo	In disaccordo	Né in accordo né in disaccordo	D'accordo	Completamente d'accordo
10	Leggo libri/fumetti e/o guardo film/serie TV e/o gioco a videogiochi su temi fantascientifici nel mio tempo libero					
11	La fantascienza mi piace					
12	Se proponessi queste iniziative di Sci-fi, non mi dovrei preoccupare del giudizio dei miei colleghi nei miei confronti.					
13	Nella mia azienda potrei proporre nuove attività, come questa di Sci-fi, senza incorrere in giudizi negativi.					
14	Nella mia azienda potrei proporre senza difficoltà attività fuori dall'ordinario, come queste di Sci-fi.					
15	Nella mia azienda, non sarebbe un problema se partecipassi ad attività innovative come queste di Sci-fi.					
16	I prodotti e/o servizi che caratterizzano maggiormente la mia azienda evolvono rapidamente.					

17	Considerando i prodotti e/o servizi tipici della mia azienda, ciò che faranno i competitor è difficilmente prevedibile.					
18	Le tecnologie alla base dei prodotti e/o servizi che caratterizzano maggiormente la mia azienda evolvono rapidamente.					
19	Considerando i prodotti e/o servizi che caratterizzano la mia azienda, è difficile prevedere come cambieranno i bisogni dei clienti.					

Part 2

#	Quesito	Completa-mente in disaccordo	In disaccordo	Né in accordo né in disaccordo	D'accordo	Completa-mente d'accordo
20	Se cercassi di promuovere delle attività di Sci-fi nella mia azienda, mi scontrerei con le procedure che sono in essere in azienda.					
21	Alcune regole aziendali mi impedirebbero di partecipare efficacemente alle attività di Sci-fi.					
22	Le regole che seguo in azienda non mi permetterebbero di promuovere la partecipazione ad attività di Sci-fi.					
23	Temo che i colleghi che stimo di più non ritengano opportuno promuovere attività basate su idee di Sci-fi.					
24	I colleghi che stimo di più penserebbero che sarebbe interessante partecipare a attività basate su idee di Sci-fi.					
25	I colleghi che reputo più competenti non penserebbero che ho perso il mio tempo a promuovere queste attività basate sulla Sci-fi.					
26	Le iniziative basate sulla Sci-fi sarebbero coerenti con il pensiero creativo della mia azienda.					

27	La mia azienda già ora ci spinge a pensare "out of the box".					
28	La mia azienda coinvolge i dipendenti nella proposta di idee che possano portare a innovazioni di prodotto e/o di processo.					
29	Le attività basate sulla Sci-fi potrebbero essermi utili per acquisire strumenti per pensare in modo innovativo.					
30	Le attività basate sulla Sci-fi potrebbero essermi utili per pensare fuori dagli schemi tradizionali.					
31	Le iniziative basate sulla Sci-fi potrebbero aiutarmi a pensare in modo più strutturato all'innovazione.					
32	Tramite le attività basate sulla Sci-fi, svilupperò delle considerazioni su possibili scenari futuri.					
33	Le attività basate sulla Sci-fi mi aiuterebbero a pensare agli impatti futuri di alcune tecnologie.					
34	Le attività basate sulla Sci-fi mi permetterebbero di ragionare su come facilitare o rallentare l'avverarsi di alcuni eventi futuri.					
35	Durante le iniziative basate sulla Sci-fi, condividerei volentieri le mie intuizioni sul futuro con i colleghi.					
36	Durante le attività basate sulla Sci-fi, non terrei solo per me le mie considerazioni sulle implicazioni dell'evoluzione tecnologica e/o della società.					
37	Durante le attività basate sulla Sci-fi, mi confronterei con i colleghi su come affrontare il contesto competitivo futuro.					

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