Exploration of post-scarcity economies in science fiction and their implications on contemporary speculative economic theory

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Statutory Declaration

I declare in lieu of an oath that I have written this master thesis by myself, and that I did not use other sources or resources than stated for its preparation. I declare that I have clearly indicated all direct and indirect quotations, and that this thesis has not been submitted elsewhere for examination purposes.

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List of Abbreviations

AI	Artificial Intelligence
Co-op	Cooperative Guild
DS9	Deep Space 9
GSV	General Systems Vehicle
Industry 4.0	The Fourth Industrial Revolution
ST	Star Trek
SC	Special Circumstances
Sci-fi	Science Fiction
SF	Science Fiction
TOS	The Original Series
TNG	The Next Generation
VR	Virtual Reality
VOY	Voyager
WWIII	World War III

Abstract

Resource scarcity is at the root of economic problems. As one of the core assumptions upon which contemporary economics are based on, its absence would up-end almost every established aspect of economic thought as we know it today. Science fiction depicts worlds in which this problem has been overcome. The omnipresence of scarcity in reality forces science fiction authors to come up with a variety of plot devices explaining how it was overcome in their constructed fictional worlds. Therefore, by examining the sample consisting out of three works, namely the *Star Trek* franchise, the *Mars* trilogy by Kim Stanley Robinson, and the *Culture* series by Iain M. Banks, the researcher identifies those plot devices and juxtaposes them to the obstacles and solutions proposed by post-scarcity theorists. The study is conducted as an inductive qualitative research executed by means of generic content analysis. This methodology allowed for identifying the three main criteria necessary for development of a post-scarcity scenario, those being technological advancement, macroeconomic elements, and socio-psychological elements. Parallels between fiction and theory were drawn out of all three viewpoints and include concepts such as the invention of technological devices that bring about abundance, the introduction of planned economies, and a global shift towards egalitarian values. The final implication is that all three fields need to be covered for a post-scarcity state to become plausible in the real world.

1 Introduction

1.1 Statement of Research Problem

What would the world look like if there were no need to economize? Would abundance of resources lead to a utopia-like society, or would humanity introduce artificial scarcity where it would not otherwise exist? Economizing is defined as having to relinquish one want for the satisfaction of some other, as a direct result of the scarcity of goods and services (Robbins, 1935, p. 14). Scarcity, as such, is the foundation upon which economic science rests (Robbins, 1935, p. 15, Hoeschele, 2014). Infinite supply would lead to a collapse of economies and even economics as we know it. Having unlimited access to every good imaginable removes the necessity to economize and attribute value to goods. Namely, economic value is attributed only to those goods or services whose quantity is limited and ultimately finite (Hoeschele, 2014). On the other hand, contemporary economic theory views economies of abundance as a contingency in which human desires are infinitely realized (Bookchin, 1986, p. 13). However, limited access to resources and endless human desire often prove it to be a purely theoretical concept (Newman, 2015). As such, post-scarcity is achieved almost exclusively in speculative fiction through technological achievements (Mizerák, 2019, p. 107). Returning to the scarcity definition, Daoud (2018, p. 210) manages to examine it through a scale going from absolute scarcity and culminating with post-scarcity. Absolute scarcity is directly connected to basic needs. A step upward from that is relative scarcity, referring to human wants. While the final step, post-scarcity, conveys the complete abolishment of the previous two types, i.e. there are no longer unfulfilled wants or needs (Daoud, 2018, p. 210).

In terms of economic epistemology, the idea of a post-scarcity society is quite prominent in Keynes' *The General Theory of Employment, Interest, and Money* and is more acutely explored in his subsequent writing (Chernomas, 1984, p. 1007). Keynes's optimistic views denote post-scarcity as an imminent result of gradual removal of the economic problem – namely,

> The pace at which we can reach our destination of economic bliss will be governed by four things – our power to control population, our determination to avoid wars and civil dissensions, our willingness to entrust to science the direction of those matters which are properly the concern of science, and the rate of accumulation as fixed by the margin between our production and our consumption; of which the last will easily look after itself, given the first three. (Keynes, 1963)

In shorter terms, once humanity has achieved control over aggregate demand, it will have achieved economic bliss, i.e., the abolishment of the economic problem (scarcity). Although influential, Keynes' ideas are often criticized for being built on intuition and having little empirical backing (Lewis, 2011, p. 8). Besides, he was not the first economist to argue for a post-scarcity world. Prior to Keynes, Peter Kropotkin, a Russian historian, and economist advocated for the abolishment of the monetary system, and the introduction of labor where each member of the society would recognize the good of mutual aid for the overall society (Anderson, 2009, p. 30) His perspective was that the population should turn towards a communal and a more "primitive" way of exchange, where material goods are traded based on mutual satisfaction (Anderson, 2009, p. 30). Such economies, although historically inefficient due to lack of agreed-upon value for goods, could, according to Kropotkin, function if currency is exchanged with satisfaction, and the final aim of economics would be mutual satisfaction of traders (Anderson, 2009, p. 30). Both Keynes' and Kropotkin's views of post-scarcity tie in with several concepts explored in science fiction writing, which will be reflected on later in the text.

While theory speculates on methods in which post-scarcity could be achieved, fiction offers an abundance of insight into hypothetical post-scarcity worlds. Their success in reaching post-scarcity states usually lies in narrative mechanisms. Most works of science fiction implement one plot device for the purpose of introducing economies of abundance as a backdrop, and a second plot device for the purpose of moving along their narrative within such a framework. The former helps in worldbuilding by removing any natural obstacles in achieving post-scarcity, while the latter introduces conflict and a measure of artificial scarcity. As such, science fiction plays an active role in imagining aspects of the world and its economy in new and extraordinary ways (Bambini, 2015).

The research problem this thesis will be dealing with is an exploration of these plot devices by examining the following works of fiction, the *Star Trek* franchise, the *Mars* trilogy by Kim Stanley Robinson, and the *Culture* series by Iain M. Banks. The aim is to juxtapose the authors' solutions for the economic problem to the present-day obstacles and, up to a point, historical obstacles. Additionally, the study will address any potential overlap between theory and fiction, as well as its implications - i.e., the focus will be on identifying contemporary obstacles, their perception in theory, and examining how they have been explored in fiction.

Looking back to historical records, each industrial milestone has increased humanity's access to resources. The first industrial milestone happened with the invention of the steam engine, the second was introduced with the invention of electricity and assembly lines, while the third one started in the 20th century with the debut of digitalization (Schwab, 2016, p. 11). The world is rapidly approaching the fourth industrial revolution or milestone built on AI, robotics, and machine learning (Schwab, 2016, p. 12). Human ingenuity is pushing the limits of what was formerly only conceivable in science fiction (Schwab, 2016, p. 63). Furthermore, science fiction has based most of its economic solutions on exactly those scientific discoveries that await humanity in the fourth industrial milestone (Mizerák, 2019, p. 120). Therefore, framing scientific discoveries and their economic implications in a correlative context with science fiction brings undeniable value to the contemporary body of economic research. Fiction, as such, might hold answers to a number of economic speculations (Mizerák, 2019, p. 120).

Contrary to the technological aspects of predictions relating to potential post-scarcity, macroeconomics offers a somewhat bleaker insight into the topic. Technology might allow for an increase in production per unit of raw material; however, it does not assure an increase in the absolute amount of raw materials (Saadia, 2016, p. 79). One must take into account that Earth is currently the only source of natural capital, and this capital is being irreversibly depleted at this very moment (Canavan, 2012, p. 1). To uncover potential solutions and substitute materials for those being exhausted, one must dive into the realm of the impossible. Thus, fixes identified in science fiction offer further insight into real-world problems.

Although the topic of post-scarcity has generated an extensive body of literature available for exploration, there is little comparison between speculative theory and science fiction (Mizerák, 2019, p. 120). Existing literature mostly relies on the examination of the appearance of the steam engine and, later, the assembly line (Mizerák, 2019, p. 120). Therefore, it is crucial to look back at the available discourse and bring it up to date with where the global economy is headed. In addition, answering questions related to how fiction is reflecting real life may introduce new ideas into economic theory, despite post-scarcity being a practical implausibility.

Through consideration of theoretical, as well as fictional texts, and by using a qualitative approach in exploring hypothetical scenarios, one can make an effort to understand the notion of scarcity and its implications - its impact on society and the general state of the economy. Industry 4.0 brings humanity closer to post-scarcity than it has ever been.

Therefore, this research will aim to provide an insightful look into identical and similar dimensions between real life and fiction, that can be used for subsequent research on the future of economics. The study aims to provide economic theorists with ease of access to data that was previously scattered among numerous research papers. In addition, fiction authors wanting to base their works on economic facts will be able to plan out their worlds with greater ease.

The nature of the study is inductive, through a qualitative research approach and implementation of a generic document analysis. A number of books, journals, research and theses are examined with the aim of extracting and juxtaposing data. The findings show a clear link between theoretical and fictional speculations, where a sizable portion of the responsibility is put onto humanity's value systems. Macroeconomic theorists and sci-fi authors mainly rely on planned economies as the potential answer to the economic problem, while technological advancements are perceived as enablers, but not the solutions.

As mentioned, some of the implications discovered throughout research are as follows. Technological advancement is often perceived as a way to end the finity of resources and a way to discover substitutes. However, without making sure that each individual has the same access to those resources (through planned economy), and without each individual working towards that same goal the concept of a post-scarcity society remains in the realm of fiction.

1.2 Purpose Statement and Research Questions

Post-scarcity economies and economies of abundance have mainly been represented in works of fiction. As such, its fundamentals have, perhaps, best been defined in Iain M. Banks's *Consider Phlebas* through the description of Culture as a society,

> In practice as well as theory, the Culture was beyond considerations of wealth or empire. The very concept of money—regarded by the Culture as a crude, over-complicated form of rationing—was irrelevant within the society itself, where the capacity of its means of production ubiquitously and comprehensively exceeded every reasonable (and in some cases, perhaps, unreasonable) demand its not unimaginative citizens could make. These demands were satisfied, with one exception, from within the Culture itself. Living space was provided in abundance, chiefly on matter-cheap Orbitals; raw material existed in virtually inexhaustible quantities both between the stars and within stellar systems; and energy was, if anything, even more generally available, through fusion, annihilation, the Grid itself, or from stars (taken either indirectly, as radiation absorbed in space, or directly, tapped at the stellar core). (1987, p. 451)

For such a post-scarcity state to be plausibly introduced into a work of fiction, authors usually utilize a variety of plot devices. These serve the author in moving the plot or world-building along while reinforcing suspension of disbelief and easing credulity for the reader. The goal

of these plot devices is to overcome any obstacles on the path to abundance both in reality and within the narrative itself. Simply put, the reader is more willing to believe post-scarcity is possible within a work of fiction if the author justifies any skepticism regarding its feasibility, by way of a previously and less scrutinously agreed-upon narrative fabrication - the plot device. Another way to refer to the suspension of disbelief that these devices offer would be through Suvin's "cognitive estrangement". In other words, sci-fi delivers a fictional universe whose seeming scientific consistency causes the reader to perceive alien worlds as familiar and imminent (Suvin, 1979, p. 91).

Accordingly, this study is interested in gaining insight into the aforementioned sci-fi plot devices; thus, juxtaposing them to contemporary and, up to a point, historical obstacles. In addition, a portion of the study will be dedicated to exploring the overlap between economic theory, fiction, and its implications. Namely, this research will focus on present-day restrictions, how they are being perceived in theory, along with how they have been dealt with in fiction. The aim is to inspect humanity's ideas and attempts, be they fictional or theoretical, in addressing a post-scarcity economy and contrast them to one another.

The participants of this study are any journal articles and books examining post-scarcity, as well as science fiction works dealing with the same topic. The research questions guiding this study are as follows:

1. What obstacles to a post-scarcity economy do science fiction authors identify?
2. What plot devices do science fiction authors use to circumvent their perceived obstacles?
3. What obstacles to a post-scarcity economy do economists identify?
4. What solutions do economists propose for the obstacles they identified?
5. What parallels can be established between post-scarcity issues and their corresponding solutions for both post-scarcity economic theory and science fiction?

The remainder of this report includes a detailed review of the literature used as the basis for the research, along with a close observation of the constructed theoretical framework. A comprehensive overview of the relevant research design and methods used is following the theoretical framework description. Likewise, there is a section dedicated to an in-depth analysis of the sampling strategy and data collection techniques. After making sure that all the necessary concepts, theory and intentions are introduced, the study seeks to present its findings through the lens of the selected sci-fi works and research questions as listed in the

introduction. Finally, the thesis proceeds to offer a discussion of the findings, followed by the concluding passage.

2 Theoretical Framework

The purpose of the following study section is to review the existing literature on post-scarcity and explore the current body of knowledge on the aforementioned topic, along with its most significant theories. Since the topic of a post-scarcity economy, as previously mentioned, is often speculative, there is no existing theoretical framework that can lead this research, therefore one has been constructed (see Figure 1). Owning to the inductive nature of the study, the theoretical framework was only created after a substantial amount of research has already been conducted. Throughout the research, several factors potentially influencing the evolution of economics were identified and then grouped into three categories, technological advancement, macroeconomics, and social psychology. After having identified the three major factors, it was a matter of looking through the sample theory works and identifying the most commonly perceived ideas relating to post-scarcity plausibility. Finally, the identified factors are juxtaposed to the sci-fi plot devices with the aim of gaining a perspective on their overlap.

However, before diving deeper into the topic of post-scarcity, it is of essence to define scarcity and its importance to the science of economics. The entirety of contemporary economics is based on the principle of scarcity (Hoeschele, 2014). Societies are organized around scarcity, which also determines who is in power, while individuals aim to preserve their own wealth at the cost of others (Jameson, 2005, p. 174). Therefore, scarcity inevitably arrives accompanied by insecurity for oneself (Clark, 1998, p. 15). Further, resource depletion is generally followed by rise in prices, which results in incentives for cheaper substitutes; however, a constant shift towards newly invented goods (Clark, 1998, pp. 265-266) additionally contributes to the depletion of other natural resources (Hoeschele, 2014), resulting in a cycle or spiral of scarcity and abundance. Similarly, companies often produce goods, and make sure to meet demand as efficiently as possible, while also creating artificial demand if it should naturally fall (Hoeschele, 2014). Artificial demand is usually established through several complementing approaches, namely extensive mass media advertising coupled with shorter product lifecycles (Song, Jang, & Cai, 2016, pp. 802–803), thus leading to the eventual increase in price and profit by means of creating profit for the company through what is essentially artificial scarcity (Hoeschele, 2014). Therefore, economic theory encompasses any situation where individuals face scarcity (Clark, 1998, p. 316). Finally, scarcity is not only the representation of the amount of resources available to individuals, but

it also takes into account the social relationships nurtured as the result of human thought patterns rooted in scarcity (Bookchin, 1986, p. 13).

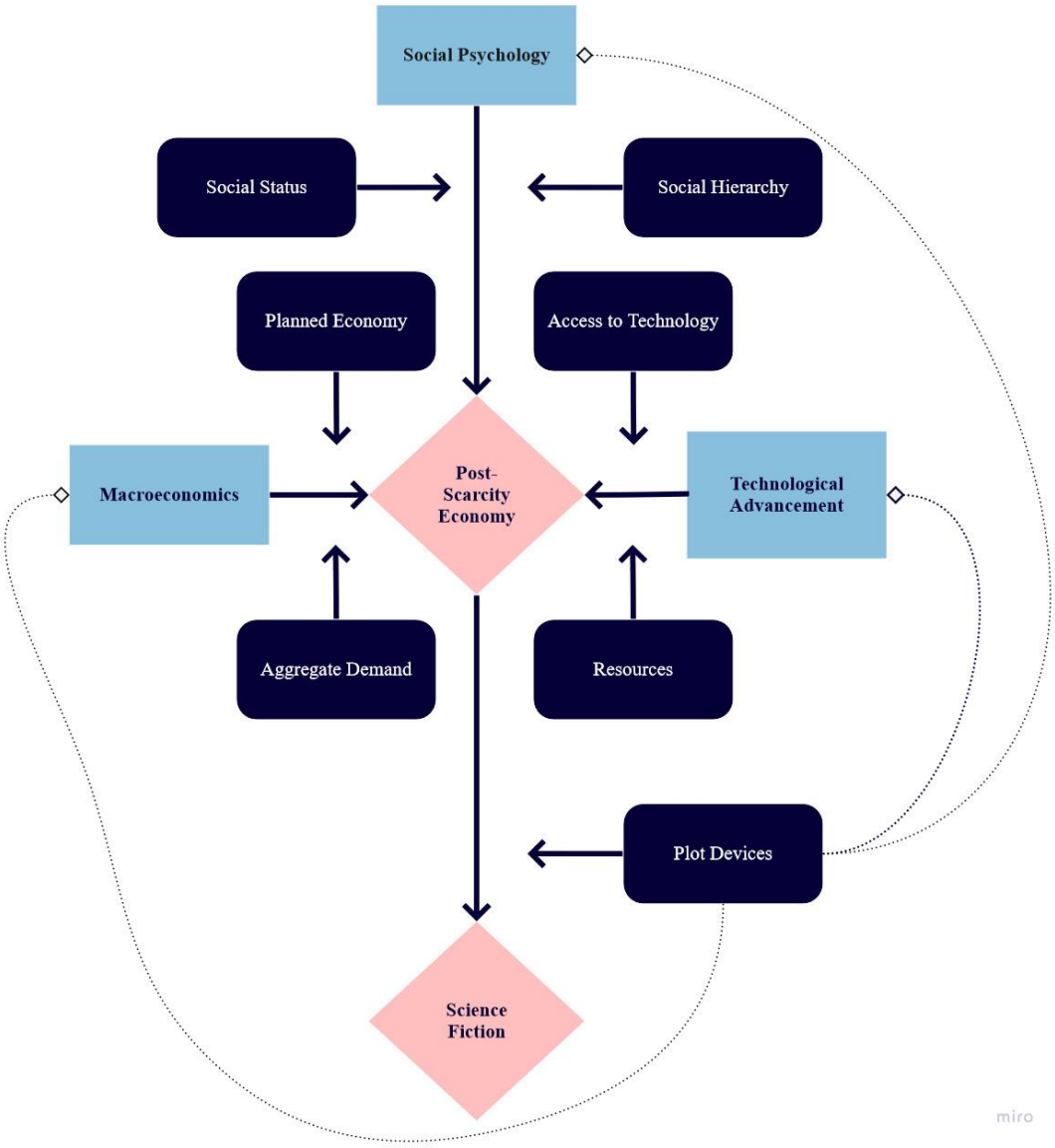

Figure 1: The Conceptual Framework of Post-Scarcity Economies in Science Fiction and Their Implications on Contemporary Speculative Economic Theory

Getting back to the theoretical framework of the research, the first and foremost variable is the concept of a post-scarcity society. Economic theory describes it as a society where not only all of humanity's needs have been fulfilled, but also where there is no material power, and a significant shift in human behavior and interactions have occurred, mainly towards egalitarianism (Saadia, 2016, p. 126). So far, it has been regarded as a merely theoretical concept with some ground in economic theory. It is important to note that post-scarcity can also be referred to as an economy of abundance, and it is often described as access to goods and services that have substantially increased in their abundance and

accessibility (Aguilar-Millan et al., 2010, p. 36; Anderson, 2009, p. 171). A major issue with this theoretical concept is that it seems to imply an absolute - either everything is available, or nothing is available (Webb, 2019, p. 26). The avenue to that absolute is blurred and filled with questionable solutions (Webb, 2019, p. 26). However, contrary to Webb's view, the upcoming passages are going to give an insight into worlds where post-scarcity exists; however, not as an absolute, but rather on a scale, depending on circumstances.

Economic literature has, until now, tried to answer the question of whether such a society is practically possible or just a figment of human imagination. Some economists would even argue that humanity lives in an economy of abundance at this particular moment. Anderson (2009, p. 34) asserts that the developed world of the twentieth century witnessed the arrival of abundance for most of the previously scarce items, such as food, clothing, and shelter. He then proceeds to reflect on how humans tend to uncover resource extraction methods quicker than they can be used, which, in turn, leads to lower prices (Anderson, 2009, p. 38) and might amount to a post-scarcity scenario in the near future. Scarcity of one resource provides scientists with an incentive to look for its substitute, which, consequently, works in shifting the demand away from the deficient capital (Anderson, 2009, p. 39). His claims bring about the question of whether a time will come when no price whatsoever will be necessary, and whether all goods will follow the path of information and become readily available. Anderson's attitude towards economic development is optimistic and neglects accounting for the previously recognized self-interest of companies and individuals alike. Even Banks, a sci-fi author whose works are explored in more detail later in the text, makes a social commentary in his short story collection *State of the Art,* declaring that Earth is able to feed all of humanity, but does not do so because of the propagated notion of "self-interested advancement" (Banks, 1991, p. 178). Is, then, the idea of individual self-worth what is obstructing the worldwide abolishment of needs? These aspects will be further discussed in the Social Psychology section of the framework.

On a separate note, Skilton & Hovsepian (2017, p. 239) reflect that technology has already reached a point where in 2016 the European Parliament had to draft legislation contemplating the legal status of robots and AIs as "electronic persons", along with an ethical code of conduct for any persons owning a robot or an AI. This alone was unimaginable 40 years ago and is exactly the kind of advancement that leads to a post-scarcity scenario drafted through works of numerous sci-fi authors. Works relating to these topics will be used to

gather information on the concept itself and create a comprehensive depiction of a post-scarcity society, its views, and its definition.

The post-scarcity variable is influenced by a number of different viewpoints, as seen in Figure 1 and briefly touched upon in the preceding text. The subsequent writing aims to tackle each of these frames of reference individually and examine how they may, or may not, influence humanity's trajectory towards absolute or partial post-scarcity. Out of the vast pool of research, for each of the named viewpoints (technological advancement, macroeconomics, and social psychology) two main indicators have been chosen and elaborated on (see Figure 1).

2.1 Technological Advancement

According to Schwab (2016, p. 12), humankind is on the verge of a new industrial revolution, which he calls Industry 4.0 or the fourth industrial revolution (see Figure 2). What constitutes this shift, in his opinion, is the emergence of numerous new technologies, which are becoming increasingly hard to keep up with - starting with nanotechnology, machine learning, Artificial Intelligence, etc. These constantly evolving technologies have allowed people's consumption to increase while keeping prices low, and sustainability along with responsibility high (Schwab, 2016, p. 32). The contemporary digital revolution is laying the groundwork for the spread of knowledge and products in quantities never seen before (Skilton & Hovsepian, 2017, p. 6).

In terms of product distribution, it offers substantial market flexibility as to what products are given away for free and what products are sold (Anderson, 2009, p. 18). Anderson's (2009, p. 12) economy of "free" entails a shift of goods from the physical to the digital space, creating a move towards almost negligible price and cost of products. What he means by this is that companies will often give out digital goods or content for free, with hopes of attracting returning customers. Therefore, technology has provided the market with a great amount of flexibility by allowing it to give its products away at no price whatsoever, with the aim of achieving some gain at a later point (Anderson, 2009, p. 18). Along the same lines, blockchain payments are allowing for a new paradigm in customer-retail transactions by providing a trusted system for those purposes on a global scale; thus phasing out and/or minimizing the fees that had to be paid on bank transactions previously (Shapiro, 2018, p. 37). Transactions and trade still exist; however, technology and innovation are continuously allowing individuals to acquire more for less (Greenwood & Vandenbroucke, 2005, p. 1).

In terms of AI, mathematician Vernor Vinge predicted a tremendous growth of technological progress, which, according to him should lead to an age of immense unpredictability and the creation of beings surpassing human intelligence (Vinge, 1993, p. 12), meaning post-humans and/or AI. He referred to this notion as the "singularity theory". It is exactly this "singularity theory" that ought to bring about a shift in the overall perception of "what it means to be human and our relation with time and space" (Botelho, 2014, p. 72), along with moving reality into the realms of what used to be perceived as fiction. Once progress is taken over by higher levels of intelligence, the rate of progress itself will also increase significantly (Vinge, 1993, p. 12). This increase in progress rate further leads to the creation of even more intelligent enitites on a continously shorter time scale (Vinge, 1993, p. 12). Through the creation of entities that are able to extrapolate issues and produce workable answers to "what if" questions rapidly, humanity in general bypasses limitations on the pace of economic development dictated by mechanisms of natural selection (Vinge, 1993, p. 12). Even prior to Vinge's speculations on intelligence enhancement, Licklider (1960) set out to predict the emergence of a "man-computer symbiosis" where humans are more often presented as helpers of machines, rather than the reverse. More recently, Elon Musk has been warning about accelerating innovation and humanity potentially being in some way overpowered by AIs, once the inefficiency of human activity factors into their awareness (Konior, 2019, p. 47).

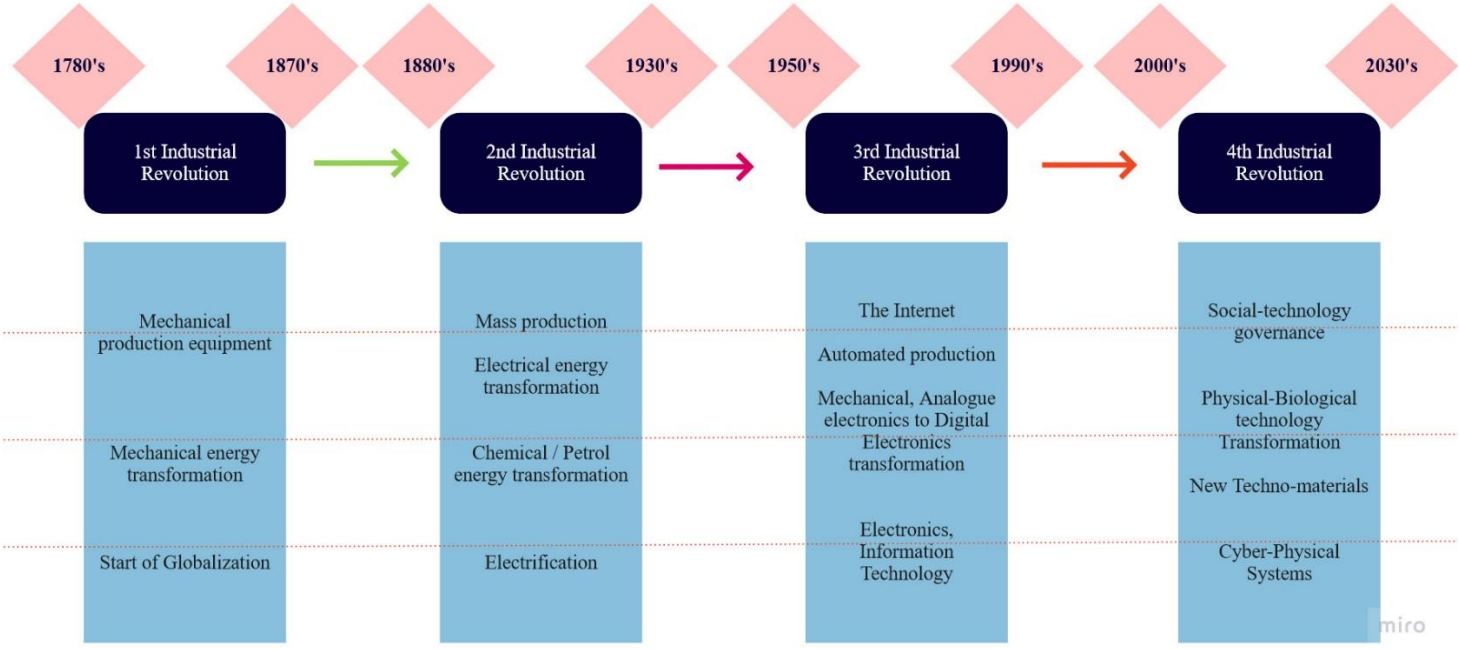

Figure 2: "The Four Industrial Revolutions" (Skilton & Hovsepian, 2017, p. 6)

Looking back at one of the pivotal economic theories from the 20th century, it is notable that Keynes himself was convinced of technological inventions inevitably leading to solving the economic problem (Keynes, 1963, p. 2) Although not predicting post-scarcity in his growth model from the 1950s, neoclassicist Solow stipulates that once a steady-state level of capital is reached, a country's whole investment capacity is used to maintain existing capital, so growth becomes stagnant, barring innovation and/or technological advancement (Ramanayake, 2019, p. 55). This also somewhat indicates the unpredictable nature of innovation. His model was subsequently adapted into the investment-specific tecnological progress model, looking to show that investment into technological advancement automatically increases the efficiency of existing capital, leading to further innovation and economic growth (Gort, Greenwood, & Rupert, 1999). However, it is only in recent history that the most groundbreaking of technological achievements have occurred, ranging from the development of the internet and smart phones to the decoding of the human genome, all of which can be dated within the last 30 years (Skilton & Hovsepian, 2017, p. vii). The pace of innovation increasing with each new advancement facilitating the next one, much as both Vinge and the investment-specific tecnological progress model specify. Still, it is difficult to conclude whether continuous technological improvement will lead to a post-scarcity scenario by itself. The insatiable thirst for uncovering solutions to perceived impossibilities has always lead individuals, followed by the remainder of the population, towards either technological or artistic innovations (Davies, 2018, p. 23), and so far in history, technological advancement is the single viable way of dealing with the depletion of the natural capital (Saadia, 2016, p. 80). Contemporary technological ingenuity has produced a bright outlook for the future directed exactly by this technological mastery, along with added emphasis on an imperative grasp of ethics and morality, which together lead to an overall improvement of the human condition (Botelho, 2014, p. 70). The prospect of achieving this global technological harmony is highly reassuring, especially to those generations which managed to prosper amid perpetual fret of conflict in the second half of the 20th century (Turner, 2006, p. 6).

Burnham (2015), opposes this attitude by highlighting that no matter what the future holds, it is an indisputable fact that humans are using up limited resources which are not being replaced and will inevitably run out. Additionally, sustainability is too often perceived as just another problem that will be solved through some future development, while there is little actual proof of this scenario eventually playing out, and much less proof of it leading to an economy of abundance (Goodbun et al., 2012, pp. 11-12). Continuous integration of

technologies into the market has resulted in a great deal of layoffs, as well as lower employer-employee support (Turner, 2006, p. 7). Employees are continuously pushed into positions of freelancers who jump from company to company and slide in and out of teams (Turner, 2006, p. 7) while lacking any external support. Davies (2018b, p. 28) adds to this notion the possibility of innovation being used as a weapon by the economic elite rather than a foundation for an evolving society. Hence, machines and their infrastructure serve the purpose of obtaining surveillance capital, i.e. collecting data relating to the everyday life of individuals, consequently lowering the chance of economic change substantially (Davies, 2018b, p. 28).

The two viewpoints, the first denominating technology as the savior, and the second doubting its viability contradict each other in more ways than just their predictions. However, the issue shared by all the aforementioned literature is its partial, yet unavoidable, reliance on speculation when making assumptions about the future. Nonetheless, most theories do agree that technological advancement is what has the highest probability of leading humanity towards approaching a post-scarcity economy – making it an essential concept for further exploration.

2.2 Macroeconomics

Scarcity, being the main argument for capitalism, is perceived as a constant and is rarely brought into question(Xenos, 1989, p. 26). Such perception has firmly entrenched it as a taken-for-granted state, as a phenomenon that exists outside of human construction. Hence, examinations of scarcity are a “largely unquestioned discourse” and the most appropriate solution to all economic dilemmas (Mehta et al., 2019, pp. 223-224). Despite this implanted notion of the necessity of scarcity, Webb (2019, p. 28) believes that there are plenty of signs that humanity is, indeed, heading towards a post-scarcity economy. He takes into account the fact that the world’s capacity to feed the entirety of its population is existent, while the only thing missing is organizing labor and capital in such a way for food to be equally available to everyone (Webb, 2019, p. 29). With this claim, Webb oversimplifies the scarcity issue through downplaying the resource demand springing from the logistics components of the economy, along with focusing only on sustenance products. Regardless, it is only natural to conclude that the elements of macroeconomics are going to shift monumentally with the continuous emergence of technological inventions (Schwab, 2016, p. 32). This technological revolution is slowly leading to previously unimaginable possibilities and outlooks regarding

satisfying human needs and wants (Skilton & Hovsepian, 2017, p. 34), and arguably even post-scarcity.

A number of economists focus their attention on a planned economy as a potential solution to resource distribution, as well as the economic problem in general. Davies (2018, p. 15) suggests that, just as states decide on wartime economy, they will begin deciding on the general supply and distribution of goods. Chang (2018, p. 40) argues that it is not science that will solve the economic problem, but that we should focus on politics and ethics since markets are a social construct. Further on, Willems (2018, p. 72) asserts that a guaranteed basic income for all individuals would free humanity from having to pursue employment, thus recreating the world's economic future with a post-scarcity direction. The implementation of a planned economy might lead to a more productive and equitable distribution of resources and goods (Banks, 1994, p. 3). According to this viewpoint, markets, as they are today, are a purely social construct lacking the ability to distinguish between selfish pursuits and moral considerations (Banks, 1994, p. 3). Thus, Sheehan (2009, pp. 34-35) proposes a solution for economic disparity by introducing capitalist "development" as a temporary mechanism to be applied in the economically least prosperous regions of the globe. However, if Earth is no longer capable of accommodating this sort of development on a universal scale, he suggests a redistribution by means of a vaguely defined planned economy solution, more precisely a redistribution of wealth, where "the poor get richer and the rich get poorer, and admits that this is unlikely to occur in reality " (Sheehan, 2009, p. 35).

Throughout the 20th century, Keynes focused on aggregate demand as the major culprit for scarcity. His claims rest on beliefs that economic inequality is too large in capitalism, leading to a disbalance between actual needs and market demand,

> Theoretically, if consumption increases by less than the increase in income, then investment must equal the difference between the level of income and the level of consumption. Stagnation is a suboptimal "equilibrium," where aggregate demand is equal to a total of consumption plus investment, which does not add up to a potential output. With full employment demand sustained for only one generation, Keynes envisaged that enough investment would have taken place for capital no longer to be scarce (Chernomas, 1984, p. 1013)

Keynes' theories are further reinforced through the disbalance of power in supply and demand caused by political transformation, distinctions between finite and renewable resources, along with significant technological changes (Skilton & Hovsepian, 2017, pp. 23-24). As market opportunities and demand for resources rise, goods that were previously abundantly available become scarce (Saadia, 2016, p. 79). In order for this scarcity to be avoided, goods that are highly valued today will either be substituted or ways for their cheap production will be

invented (Greenwood & Vandenbroucke, 2005; Saadia, 2016) {. Additionally, the economy aims to satisfy those needs that are existing in the present day, meaning that as demand changes, so does the productive power (Robbins, 1932, p. 47). These previously mentioned theories support Keynes' idea relating to the relationship between scarcity and demand. Although humanity has passed the bar of sufficiency, it still demands more (Sheehan, 2009, p. 27). On the other hand, neoclassicists would often justify economic inequality under capitalism as a means of promoting economic growth (Chernomas, 1984, p. 1012). This conceptualization of scarcity brought about the notion through which economic development and poverty are bundled up together and defined as the main drivers of healthy economic growth (Mehta et al., 2019, p. 223). Within such a framework scarcity leads to resource depletion and environmental crises, while firmly establishing scarcity as the natural way of the universe (Mehta et al., 2019, p. 223). Returning to the idea of a planned economy, Sheehan (2009, p. 38) uses the example of fiscal policy to indicate that states are the ones that can and should influence aggregate demand in such a way as to stimulate the economy and lead towards a state of plenty, if not actual post-scarcity.

Nonetheless, there exists a well-founded fear that the working class of today will progressively find itself at a loss in terms of social benefits despite the global increase of wealth. The generated profit is not being distributed equally, resulting in the accumulation of wealth by a small percentage of the population (Bambini, 2015, p. 19). According to Fuentes-Nieva & Galasso (2014, p. 12) around 1% of the population owns 50% of the world's wealth. Additionally, they report that seven out of ten people live in countries where economic inequality is rising (2014, p. 6). These stats indicate that our current economic system is generating inequalities and defying those values on which societies are built (Bambini, 2015, p. 20-21). This is further emphasized by Piketty (2014, p. 463) in his book *Capital in the Twentieth Century*, claiming that societies are threading backward into an oligarchical state where the wealthiest population controls and will control a greater and greater percentage of wealth, thus inflating the already existing schism between the rich and the poor. Atkinson and Stiglitz offer a similar viewpoint in their theorem, claiming that the majority of the world's wealth ends up in the hands of the rich, increasing the gap between rich and poor (Stiglitz, 2013). They further aim to devise a solution to the problem through ideas on commodity tax redistribution which might lead to higher tax on e.g., luxury goods, thus also lowering the appeal of high earnings (Allcott, Lockwood, & Taubinsky, 2018, p. 88). The very definition of post-scarcity implies the absence of inequality; therefore, the remainder of the thesis will

consider equality or an egalitarian societal state as both a facilitator for as well as a result of post-scarcity, as neither theory or fiction dwell on the resolution to this "chicken and egg" conundrum.

The aim here is to use the viewpoint of macroeconomics, with emphasis on Keynesian economics, as a starting point for post-scarcity exploration, thus juxtaposing mainly Keynesian viewpoints to those of fiction authors.

2.3 Social Psychology

Opinions on abundance and the possibility of reaching it are not one-sided. By examining the concept of post-scarcity, Newman (2015) concludes that it is a technical impossibility since human needs will always outweigh any available resources. For him, the issue of scarcity is a psychological problem that cannot be overcome. In accordance with this, Anderson (2009, p. 144), although a firm believer in a post-scarcity world, warns humanity of potential greed and "free-riding". He is of the opinion that there will always be "free-riders", meaning those that do not contribute to society, however, do take advantage of its benefits (i.e. consume more than their "fair share") (Anderson, 2009, p. 144). He further notes that economics as such is a science dealing with scarcity (Anderson, 2009, p. 40) and the term post-scarcity economy is a contradiction in itself.

The issue raised by Bookchin (1986, p. 27) is the fact that society has been shaped on the principle of scarcity. He goes on to emphasize that although the potential for post-scarcity already existed at the time he wrote *Post-Scarcity Anarchism*, humans were incapable of overcoming their privileged status – an issue that remains relevant until today. It was the existence of scarcity that provided humanity's developmental outlook, as well as class domination (Bookchin, 1986, p. 11). Marketing institutions, advertising, brand promotion, products, and spending advocacy only amplify populations' desires for more (Sheehan, 2009, p. 27). Scarcity does not only embody the number of resources that humanity has available, it also encompasses social relationships that nurture insecurity in terms of social relations and overall pecking order (Bookchin, 1986, p. 13). Saadia (2016, p. 76) goes on to affirm this by indicating that humans must endure scarcity from childhood; therefore, it is the only known avenue. This works towards instilling an understanding that lack of resources is only natural and expected.

If a post-scarcity state is ever to emerge, a fundamental shift in humanity's moral principles needs to occur (Keynes, 1963, pp. 6-7). Once the quantity of one's wealth is no

longer the most important hierarchical indicator, changes in other realms can be expected (Keynes, 1963, p. 6-7). In other words, what is inhibiting a "utopian" post-scarcity economy is the human factor constantly seeking personal gain (Willems, 2018, p. 72) – what Veblen (1899, p. 49) referred to as "conspicuous consumption". "Conspicuous consumption of valuable goods is a means of reputability to the gentleman of leisure" (Veblen, 1899, p. 53). History has, thus, demonstrated that although many social groups surpass sufficiency, they always tend to desire more (Sheehan, 2009, p. 27). Turner (2006, p. 37) goes on to argue that the shift has to happen in the realm of human consciousness, referring to Reich's three levels of consciousness, where the third one is what creates wholeness in society. Consciousness III rejects authority and invokes harmonious collaboration of citizens, i.e. widespread egalitarianism (Ulrich, 1971, p. 522). According to him, the youth need to shift their thought patterns and build communities around those patterns, where the ruling of subservience would be brought to a halt (Ulrich, 1971, p. 522). Namely, this is the only way for society to change fundamentally, where ethics and consciousness would dominate as educational materials instead of promotion of economic disparity that is currently in practice (Bookchin, 1986, p. 41), thus leading to a post-scarcity scenario.

However, such egalitarian views neglect the political and social dimensions of both scarcity and society (Mehta et al., 2019, p. 224). These tend to endorse scarcity where despite the abundance of resources, hunger is still present among the lower classes of society in several countries. Socio-political dimensions of scarcity enable the rich to accumulate, while the poor are unable to fulfill their basic needs (Mehta et al., 2019, p. 224). Additionally, numerous geographical interventions, i.e. large dams carrying high social and environmental costs, are being justified through artificial scarcity, introduced only as a means to a political end, without regard for marginalized groups (Mehta et al., 2019, p. 224). Such systems and government policies do little in the proper allocation of resources to those most in need (Mehta et al., 2019, p. 225). Why then is society so focused on the individual? Exactly because the current abundant environment allows humans to exhibit all of their vulnerabilities and seek individualism among undefined notions of liberty (Cockell, 2015, p. 3). However, imagining a situation in which enormous collective efforts are required just to obtain food, individualism becomes but a luxury (Cockell, 2015, p. 3).

Contemporary economics is no longer just a study of monetary systems, it embodies behaviors and attempts to examine the reasoning behind people's choices (Anderson, 2009, p. 147). Thus, the aim here is to further explore any possible psychological and sociological

hindrances to post-scarcity and how they are perceived in theory, as well as whether they remain an issue in fiction.

2.4 Science Fiction

Sci-fi as a genre is an attempt of understanding the world and one's place in it (Gunn, 2005, as cited in Bambini, 2015, p. 13-14). Therefore, beyond the scientific elements, it contains all other genres within its boundaries as long as the narrative carries a rational and systematic approach (Gunn, 2005, as cited in Bambini, 2015, p. 13-14). Thus, sci-fi authors tend to focus on concepts and theories, rather than settings and happenings (Gunn, 2005, as cited in Bambini, 2015, p. 13-14). Roberts (2000, p. 10) goes on to describe sci-fi as a laboratory experiment, through which authors are able to control and examine utopic texts in any socio-political setting they desire to. Unlike economic literature, sci-fi authors have the ability to change one or two rules in how society functions, thus examining potential responses and learning what the future holds (Thompson, 2000). In turn, this allows for the creation of societies where abundance is fully established (Mizerák, 2019, p. 107). A plot device that is most frequently used for this purpose is a certain type of machine that turns things abundant (Anderson, 2009, p. 171). Through such worldbuilding, authors are able to bridge the gap between the contemporary world and potential future ones (Jarva, 2014, p. 6).

This thesis will be dealing with three separate works of fiction in the following framework. The *Mars* trilogy by Kim Stanley Robinson depicts humanity as a creative force that upon the achievement of post-scarcity through a wave of technological developments (D'Adamo, 2015, p. 83) is able to dedicate its day-to-day life to metaphysical endeavors, art, and culture (Canavan, 2012, p. 4). *Star Trek* utilizes replicators as energy to matter conversion devices to achieve a state of abundance, where these devices are able to produce anything when provided with the proper template and sufficient energy (Grech & Grech, 2015, p. 40). Its culture and society embody a type of Utopia filled with tolerance, rationalism, and altruism (Grech & Grech, 2015, p. 37). In the *Culture* series by Iain M. Banks, the role of a post-scarcity plot device is filled by AI machines known as Minds who use their near-omnipotence to maintain the Culture's standard of living, including their society of abundance (Norman, 2014, p. 117). The Culture is presented as a fully developed post-scarcity society, where no need goes unfulfilled. The Minds function both as servants and leaders to humanity. Their role is to organize and distribute resources while carefully calculating their way to expansion

(Nicholson et al., 2019, p. 4). All these fictional universes contain the idea of post-scarcity and examine its possibilities.

Overall, research regarding overlap between science fiction and post-scarcity theory is existent, although limited. Mizerák (2019) tries to reconcile contemporary technological achievements with potential futures, using several fictional works as his starting point. He reaches the conclusion, that no matter what the future brings, an all-encompassing post-scarcity is not possible. A number of studies turn their attention to *Star Trek* and Keynesian economics while examining correlations between the two (Chernomas, 1984; Glasner, 2011; Grech & Grech, 2015; Lewis, 2011). In addition, the economic system of *Star Trek* has been further examined in Saadia's "Trekonomics" (2016), Ewing's "Federation Trekonomics" (2016), and Webb's "The Economics of Star Trek (2019). D'Adamo (2015) examines the possibility of an end to the economic problem by viewing the *Mars* trilogy as a bridge between a scarcity-oriented society and a post-scarcity society. All of the mentioned studies explore whether achieving post-scarcity is possible and what the implications might be.

3 Methodology

3.1 Research Design

This study will be conducted through an exploratory qualitative research lens due to two factors. First, there is a need to identify theoretical approaches to post-scarcity based on the existing pool of knowledge, while also trying to understand challenges societies face in potentially achieving a state of economic abundance. Second, identifying those same approaches in science fiction is crucial, for the purpose of drawing parallels between the documented theoretical research and 'post-scarcity fixes' as found in fiction. In conjunction, these two justify using qualitative content analysis as the most appropriate research design methodology, since the goal of the study is to approach the subject from a new and exploratory standpoint with the aim of observing a relatively unexplored phenomenon for postulatory purposes (Beall, 2016, p. 26).

The thesis is designed as an inductive study aiming to understand the intricacies of a post-scarcity society from a seldomly applied point of view in terms of research. Thus, it will provide valuable information and a reference system for future researchers interested in economic theory, as well as fiction authors looking to base their work on established economic principles. The current body of knowledge on post-scarcity is rather sparse. Therefore, due to the lack of a clear preceding theoretical outline and the existence of a myriad of stories attempting to redefine society through the speculative application of narrative devices within fiction, this study will utilize an inductive study approach. Inductive analysis is particularly useful in this situation, where the attempt is to understand, through speculative cognition, an interaction that has previously been, either understudied or lacks a clear theoretical framework (Bansal et al., 2018, p. 2018; Pratt, 2009, p. 859). In addition, an inductive approach is designed to help generate theoretical comparison and produce new insights (Bansal et al., 2018, pp. 1189-1190; Pratt, 2009, p. 859).

The study is concerned with narratives that spring from theory and fiction. Narratives, as such, are aimed at providing structure and meaning to human experience (Holley & Colyar, 2012, p. 115). As much as a generic qualitative analysis allows for the interpretation of challenges and acquisition of new insights; document analysis deals with evaluation and interpretation of documents in order to give them meaning, as well as to develop an understanding (Bowen, 2009, p. 27). Therefore, applying document analysis as the research strategy for this thesis is the only suitable avenue. The study will deal with the careful examination of narratives related to economics, both contemporary and historical. Alongside

this examination, the thesis will dive into documentation offered by the genre of speculative science fiction and juxtapose it to economic theories. The final aim is to understand ways in which meaning is assigned to the purely speculative phenomenon of post-scarcity and how it can be reconciled with particular economic theories.

3.2 Population and Sampling Strategy

Based on extensive research, sourced both online and offline, it has been found that numerous works deal with the topic of economies of abundance. Research has shown that these works often touch on diverse aspects of post-scarcity speculative societies, while they rarely suggest potential 'fixes' for the economic hurdles which frequently entrench post-scarcity in the realm of theory, as opposed to practice. Nevertheless, the population of this study are all journal articles and books examining post-scarcity as such. Owing to the inductive research approach, it is important to examine as many theoretical aspects of this phenomenon as possible, in order to generate a valid and workable conclusion. Additionally, considering that the study aims to form links between fiction and theory, the second part of the population are science fiction works dealing with the economy of abundance and examining its complexities. The following text will indicate methods used for sample identification.

The sampling technique chosen for the study is purposeful sampling. This will allow for the collection of information-rich data with the aim of conducting an in-depth analysis (Coyne, 1997, p. 624). By using such data one can obtain a great deal of knowledge on the central phenomenon of the study (Coyne, 1997, p. 624), which, in this case, is the interplay between theory and fiction around the idea of post-scarcity. Purposive sampling will be of value for the current research, as the aim is to diversify the collected information. Focusing on different theories, from different time periods, with, potentially, conflicting insights, the researcher hopes to gain a holistic view of the phenomenon and understand how it has been perceived in prominent economic theories throughout recent history - starting with the 20th century. Moreover, by utilizing the same sampling technique to works of fiction, the goal is to understand the similarities and differences from the standpoint of fiction, where the boundaries of speculation are all but absent. A potential drawback of utilizing purposive sampling in both cases is personal judgment in determining which works are suitable and which are not, potentially leading to hidden bias. The researcher aimed at eliminating as much bias as possible with the goal of gathering diversified sets of data.

In order to fruitfully examine and contextualize the phenomenon of post-scarcity, this research will utilize the maximum variation design of the purposive sampling technique. This maximizes information diversification relevant to the research question (Coyne, 1997, p. 628). Such an approach aims to obtain a detailed description of several prominent theories relating to economies of abundance in the 20th and 21st century, while also documenting the shared patterns, uniqueness, and developments of their observations. The same applies for the sampling of fictional works, with the aim of providing diverging artistic assumptions about the hurdles on the road to post-scarcity societies (see Figure 4). This sampling strategy is appropriate for the study, due to its ultimate goal, which is to produce an overview of the perception of post-scarcity, its development through history, and examine the similarities between theory and fiction.

The theoretical sample consists of several macroeconomic theories, otherwise referred to as "political economics" stemming from the 20th century. Political economics lies in the goals of both sciences, meaning efficiency, growth, and stability, as well as protection of citizens and their rights (see Figure 3) (Clark, 1998, p. 4). According to political economics, a prosperous society entails working towards each one of these goals equally; therefore, the distinction between the two is redundant, since prosperity and justice go hand in hand, and both sciences aim to achieve overall well-being (Clark, 1998, p. 4). John Maynard Keynes (1936) in his *The General Theory of Employment, Interest and Money* laid out the theoretical groundwork for early thought on post-scarcity from a broader point of view. His ideas would later be classified as Keynesian economics. Keynesian economics focus on aggregate demand as the volatile component of the market economy, whose fluctuations lead to recession and inflation. Their main argument lies in the cooperation of governments and central banks whose economic policy responses to these fluctuations can and should stabilize economic output, unemployment, and inflation (Chernomas, 1984, p. 1020). Keynesian contemporaries, neoclassical economists focused on the individual's behavior and its effects on the overall market, aiming to construct a single formula leading towards peak satisfaction through the utilization of available resources (Clark, 1998, p. 32). Their viewpoint was, however, that of unlimited human wants and limited resources, directly contradicting Keynes' idea of abolishing the economic problem (Chernomas, 1984, pp. 1009-1010). Neoclassical economics completely disregards the short-term causes of fluctuation, while Keynesian economists overlook any long-term origin of economic growth and the natural rate of unemployment (OpenStaxEconomics, 2016). The two approaches - Keynesian and neoclassical economics,

were later incorporated by the economist Paul Samuelson into "neoclassical synthesis", also referred to as neo-Keynesianism or neoclassical-Keynesian synthesis, which then proceeded to dominate the economic worldview throughout the rest of the century (Clark, 1998, p. 98). Neo-Keynesians placed their belief in neoclassical models claiming the existence of an equilibrium state from which the growth of economies becomes gradual (i.e. Solow) (Mankiw, 2009, p. 35). For them, Keynesian models gave a better insight into economies at any given moment (Mankiw, 2009, p. 35). This economic approach married Keynesian ideas of fiscal and monetary policies for the short term, with those of equilibrium without state intervention in the long run ("Neoclassical Synthesis," 2017). Post-Keynesian economics on the other hand, with foundations in the concept of effective demand, propose a reliance on aggregate demand both in the short and long run (Arestis, 1996, p. 118). Finally, the neoliberal perspective focuses on the state and its obligations towards the individual (von Mises, 1962, p. 37), facilitating free markets and free trade, which in turn should lead to an "efficient allocation of resources" (Thorsen & Lie, 2017, pp. 14-15). This study will use the aforementioned theories as the foundation for uncovering historical aspects of post-scarcity economics.

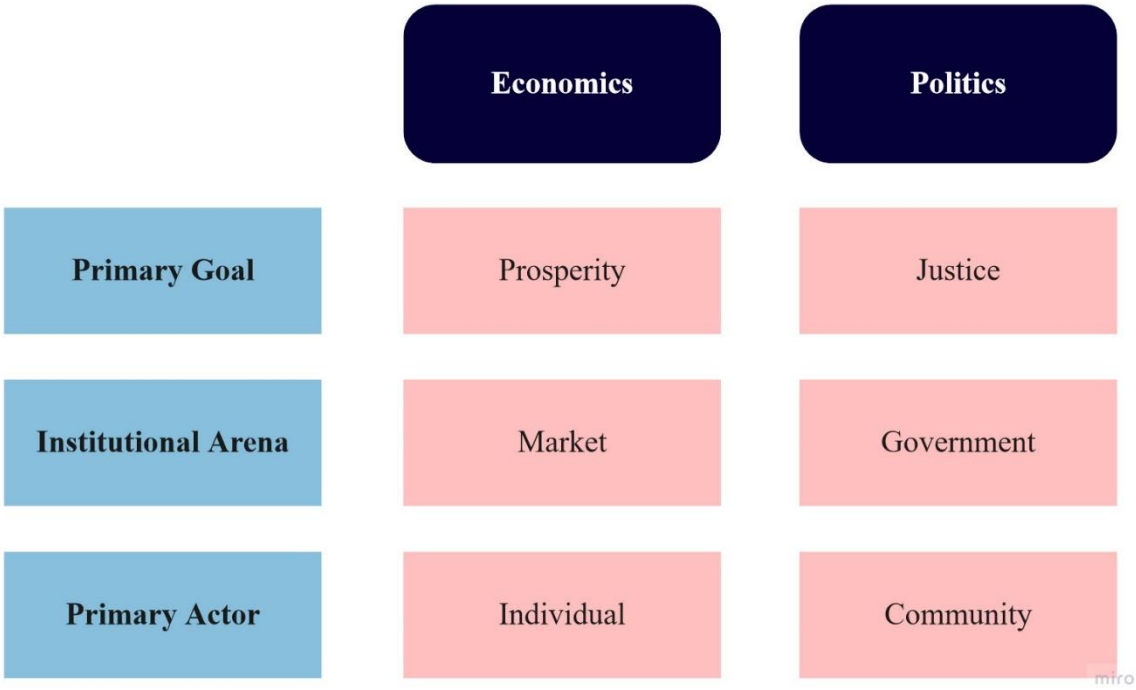

Figure 3: Distinction between Politics and Economics (Clark, 1998, p. 4)

Likewise, works of fiction included in the study illustrate divergently conceived fictional universes and their views on post-scarcity. The primary issue to be singled out in works of fiction is the authors' ability to identify the intricacies of a society experiencing

post-scarcity. Therefore, the aim of the sample is to showcase the economic state of post-scarcity societies, that have mainly arrived at it through technological advancement. Additionally, the chosen works need to depict societies that have dealt or are dealing with the economic problem, for the purpose of comparison and with the aim of finding discrepancies between fictional and real-world fixes and obstacles. Further, as the study is focusing on the exploration of theories from the start of the 20th century, it has been decided that the sample of science fiction works will also be extrapolated from the same time period.

Considering the previously named norms, a table listing all of the science fiction works mentioned and examined in the *Economic Science Fictions* (Davies, 2018a) anthology of essays has been created (see Appendix 1). For a finalized list of adequate works to be identified, they were examined through three criteria, namely, whether there is a clear focus on technological advancement, whether the author(s)/creator(s) dedicate a comprehensible portion to a certain macroeconomic aspect, and whether the depiction of the society is utopian or dystopian. The decision to mark a certain criterion with a "yes" or a "no" was made either through reading summaries of the works or extrapolated directly from the relevant essay in *Economic Science Fictions.* The presence of detailed depictions of technological advancement, in the examined works, is important as the thesis is considering the likely ways in which technology will lead to worldwide abundance. Further, since the spotlight of the study is on the macroeconomic perspective of the overall idea of post-scarcity, it is essential for the considered works of fiction to have this notion woven throughout their content. For identifying solutions and fixes to contemporary economic problems in fiction, sci-fi works were classified either as utopian or dystopian. Namely, utopias are depicted as societies where "norms and individual relationships are organized on a more perfect principle than in the author's community" (Suvin, 1979, p. 35). They demonstrate how the world could be improved through either technological, human, or natural transformations, making it a relatable vision of future prosperity (Williams, 1978). Thus, an author imagining a utopian society aims to illustrate a world better than their own (Bambini, 2015, p. 7) Dystopias highlight the flaws of society, while utopias mean to criticize them through applying fixes and amending those flaws. The reader, thus, has to arrive at a cognitive relationship between what our society lacks and what the utopic one has achieved (Bambini, 2015, p. 7).

This clearly ties in with the study's intention to discover those authorial works depicting a society that has succeeded in overcoming its flaws; thus, a utopian perspective is

of the essence for further research. Those works fulfilling the mentioned criteria are marked in green in the table (Appendix 1) for ease of identification. They are as follows,

- *Star Trek* – franchise created by Gene Roddenberry,
- *The Dispossessed* by Ursula Le Guin,
- *The Mars Trilogy* by Kim Stanley Robinson,
- *Down and Out in the Magic Kingdom* by Cory Doctorow
- *Neptune's Brood* by Charles Stross, and
- *The Culture Series* by Iain M. Banks.

The Dispossessed by Ursula Le Guin, although highly concentrated on depicting economic aspects of its utopian society, is mainly focused on comparing a capitalist society against one that rests on communist ideas. *Down and Out in the Magic Kingdom* by Cory Doctorow is set in a post-scarcity setting; however, it mainly focuses on examining the interhuman relations in a society where death had been abolished. The novel does brush up against economic ideas. They are, however, not prominent enough to be considered as a sample for this thesis. *Neptune's Brood* by Charles Stross covers all of the necessary criteria except for the fact that the novel's protagonists are androids, thus removing the human element necessary for psychological and sociological examinations of the effects of post-scarcity versus scarcity.

The remaining works of fiction were chosen as adequate samples for the study through this purposeful sampling technique. *Star Trek*, focusing on The United Federation of Planets, which is a society where humanity's needs are abundantly satisfied by bypassing usually prohibitive laws of physics along with assumptions about ethics; the *Culture* series, which frames post-scarcity as a logistical, technological, and organizational challenge assuming hedonism as a moral baseline; and lastly, the *Mars* trilogy, which, perhaps the most similar to our contemporary society, depict a slow transition into a post-scarcity society through the development of high automation, with some remnants of capitalism still present by the end of the trilogy. These three works, due to their inherently different approaches to the same subject, offer a comprehensive range for comparison.

Figure 4: Sci-fi Sample - Location on the Scale from Capitalism to Post-Scarcity

The *Mars* trilogy is relevant to the study in its entirety. *Star Trek*, a franchise consisting out of several separate TV shows and films, is not wholly applicable to the thesis purpose. This study will focus on three series best representing post-scarcity notions, namely *Star Trek'*s twenty-fourth century (produced in the 1980s and 1990s) – *The Next Generation, Deep Space Nine,* and *Voyager*, with occasional reference to theatric releases where they deal with relevant topics set in the same timeframe. The remainder of the franchise mostly takes place during the twenty-third and twenty-second centuries (*TOS*, *Discovery*, *Enterprise*) when the later ideas of post-scarcity were not yet fully established, which is why they are being omitted from the analysis. The recently produced *ST* shows, *Picard* and *Lower Decks*, although set in the 24th century focus mainly on individuals and their stories, thus showcasing little to no economic insight. Finally, the *Culture* series, consisting out of ten novels set in the same universe and revolving around different Culture citizens and their adventures. As such, not all of them contain the elements necessary for economic interpretation, therefore the exact novels that this thesis will be dealing with are as follows,

- *Consider Phlebas* (1987),
- *The Player of Games* (1988),
- *Use of Weapons* (1990),
- *The State of the Art* (1991) – short story collection, and
- *Excession* (1996)
- *Look to Windward (2000)*.

3.3 Data collection strategy & analysis

The data in this study is collected via the document analysis technique. The aim of this approach is to review and evaluate already existing printed and electronic materials. The data will be examined and interpreted for the purpose of reaching an elicit understanding, and as a result, developing theoretical knowledge (Corbin & Strauss, 2008 as cited in Bowen, 2009, p. 27). Most documents are found in online libraries. The current COVID-19 pandemic makes it difficult to visit libraries and obtain physical copies of books and journals. However, the researcher has procured several relevant books and essays, which will be used during data collection. The full list of examined works can be found in the reference list.

Document analysis is especially useful when dealing with a single phenomenon (Bowen, 2009, p. 29). In the case of the current study, that phenomenon is the act of hypothesizing on post-scarcity economies, making this method particularly applicable. Since

the study also involves research between economic theory and fiction, through a historical lens, document analysis is the only practical approach in conducting data collection (Bowen, 2009, p. 29). The aim behind this approach is understanding the historical development of post-scarcity theory and gaining insight into potential knowledge gaps that can be filled through the research (Bowen, 2009, p. 30). Data types used in this study are journal articles, books, essays, theses, and works of fiction. Moreover, the examination of these materials provides a comprehensive insight into conceptual commonalities and differences between economic theory and science fiction.

As previously mentioned, the data analysis strategy used in this research is content analysis. Initial steps of the analysis have already been conducted by defining the research question and selecting research materials (Flick, 2014, p. 174). Qualitative content analysis is done by means of assigning codes to research material (Flick, 2014, p. 170). The initial coding strategy utilized in the research is simultaneous coding, which indicates assigning several different codes to a single piece of data (Saldana, 2019, p. 80). The reason for using simultaneous coding is the aim of the study itself, which is the examination of two different fields and their comparison; therefore, data are being marked with one or two code categories, in cases when they correlate to theory/fiction. There are two main categories of data identified, with several subcodes. Namely, the two categories are as follows, *Fiction* and *Theory.* Further on, the current coding strategy is the following:

1. *Fiction*
    a. *Science Fiction on Post-Scarcity Economy*
        i. *Star Trek*
        ii. *Culture*
        iii. *Mars*
2. *Theory*
    a. *Economic Theory on Post-Scarcity Economy*
        i. *Aggregate Demand*
        ii. *Economic Problem*
        iii. *Planned Economy*
    b. *Technological Advancements & Predictions*
        i. *Access to Technology*
        ii. *AI*
        iii. *Other*

c. *Socio-Psychological Aspects*

i. *General*

ii. *Social Hierarchy / Status*

After examining the entire data sample utilizing simultaneous first cycle coding, the aim was to proceed to the second cycle of coding where a new set of codes will be determined resulting from data gathered in the first coding cycle. The software used for the first coding cycle was ATLAS.ti, while subsequent coding took place in a Word document.

Eclectic coding was employed as a means of transitioning from the first to the second coding cycle. Eclectic coding is done for the purpose of reorganizing and reassembling the data and generating a better study focus (Saldana, 2019, p. 187). It is most appropriate for studies with a variety of data forms, which makes it applicable to the research at hand (Saldana, 2019, pp. 188–189). It entailed going through the coded data and finding patterns, connections, and grouping several codes into single ones. The aim of the second coding cycle is to reorganize existing codes into a more unified scheme (Saldana, 2019, p. 188). The previously marked citations were grouped into a document according to the first coding cycle, while certain terms and words were color-coded with the aim of visually recognizing overlaps. After having conducted eclectic coding, the researcher focused on finding parallels between the most important categories and subcategories by utilizing axial coding (Saldana, 2019, p. 218). Axial coding is also appropriate for studies with a variety of data and is used in situations when there is a need for extrapolation of interactions between various categories and subcategories of data (Saldana, 2019, p. 218). The aim is to reduce the number of initial codes and to create major categories for the purposes of achieving the best fit (Saldana, 2019, p. 218). The current study utilizes three axial codes, as illustrated in Figure 5. After careful examination of the coded data through eclectic coding, it was decided that separating information into three categories named in the theoretical framework is the best course of action and allows for a thorough examination in line with the research questions. This was done by creating the three major categories of data, reexamining the extracted citations, and grouping them into those three major code categories, while also making sure they form a coherent narrative that can be used for further analysis.

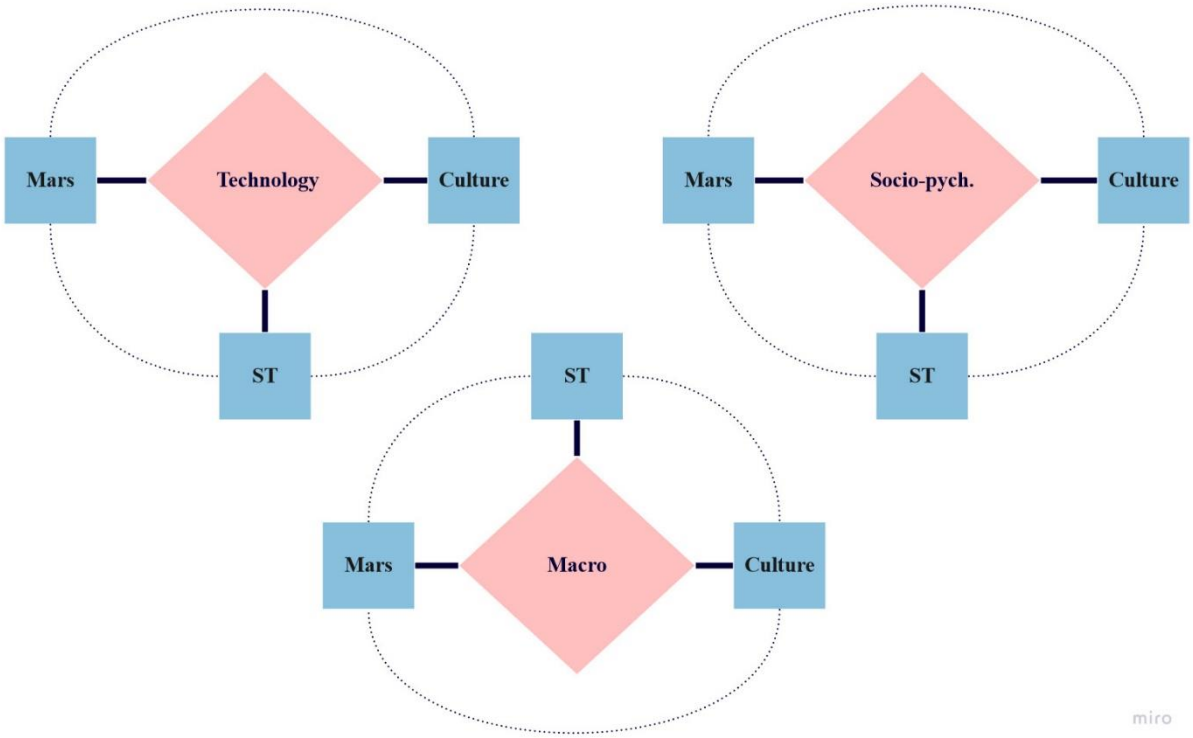

Figure 5: Second Cycle Coding - Axial Codes

4 Findings

The current section aims to provide an analysis of the gathered information. The subchapters are divided into three parts by the fictional universe they belong to, and which were chosen for the purpose of research. Each of the sub-chapters leads to the summary of overlaps between fiction and theory in relation to post-scarcity societies.

4.1 Mars

4.1.1 Overview

Robinson's *Mars* trilogy (1992-96) is a story of Mars colonization set in the 21st century, making it the closest-to-home work of fiction out of the three examined universes in the thesis. The story is told through the eyes of several settlers over the span of two centuries. The books were published as follows, *Red Mars* (1992), *Green Mars* (1995), and *Blue Mars* (1996). While Earth is going through a phase of ecological disaster and overpopulation, Martian society is depicted as progressive and egalitarian. What makes *Mars* especially interesting for research is that it does not depict an already achieved utopian state at the beginning of the trilogy. *Red Mars* (1992) starts with the first colonists arriving on Mars and slowly builds on the already existing Earth-like social and economic systems in order to achieve its final state of post-scarcity. This chapter will explore exactly how Robinson creates this journey, how it reflects the contemporary economy and the ways in which his Martians manage to overcome the economic problem.

Throughout the trilogy, the newly established Martian society manages to attain longevity and establish a post-scarcity society at the same time while Earth is overrun by complete depletion of natural resources, transnational corporate dictatorships, and war. The main focus of the work is on the transformation of Martian society through numerous conflicts. The narrative revolves around scientific and political intrigue, taking place alongside terraforming efforts on Mars and the emergence of a new human society in a hostile world. The first book – *Red Mars,* is initially set in 2026, as the first UN colonists arrive on Mars, with Earth's transnational corporations footing the bill. As the colonists proceed to establish themselves on Mars, the lack of any legal framework and governance, barring the Mars treaty, becomes evident, slowly resulting in a gold rush following the discovery of numerous precious metals. The Mars treaty was signed several years prior to their departure from Earth and contained only rudimentary regulations. Eventually, Earth's transnational

corporations and nations start demanding a return on their investment, to be paid by an ever-increasing extraction of Mars' resources for use on Earth. The pressure caused by escalating resource demands morphs the Earth-Mars relationship into something akin to that between feudal monarchs and peasants in the eyes of the Martian colonists. This attitude shift prompts the Martians to start clandestine revolutionary plans aimed at loosening the UN's grip on Mars and revising the Martian treaty currently in place. After a massive flood of immigrants between 2026 and 2061, the first Martian revolution breaks out in 2061. The rebellion itself is later depicted as an isolated act by a fringe Martian terrorist group and Mars is proclaimed as "not a nation but a world resource" (Robinson, 1992, p. 602). In spite of the first revolution resulting in failure, Robinson's Martians are not deterred from pursuing their goals. In the second book - *Green Mars,* a second resistance movement forms, 60 years following the first landing. Finally, in the third book - *Blue Mars,* the Martians become independent and evict the transnational corporations from Mars. Organizational structures which emerged within the underground movements behind these revolutions spanning two centuries, together with historical lessons taken from the period, serve as a blueprint for the eventual codification of Martian society. The obstacles they faced and the solutions they came up with are examined in the next sections.

Robinson's *Mars* trilogy is referred to as the "most complete utopian exercise in modern SF" (Baxter, 2015, p. 24-25). It depicts a revolt not just against Earth governance, but against the fundamental principles of capitalist democracy (Baxter, 2015, p. 24-25). Unlike *Red Mars* and *Green Mars,* which focus on colonization and terraforming respectively, *Blue Mars* goes on to explore the complex affairs and negotiations between Earth and Mars. Specifically, Mars' rejection of capitalist democracy, as well as any long-term implications which arose from previous agreements. The majority of economic examples examined are taken from *Blue Mars,* while both *Red Mars* and *Green Mars* are used as a reference for context. Some of the most astonishing features of the newly established Martian constitution are the amount of power given to the environmental court and natural capital preservation, alongside the invention of an economic system that will "provide for everyone in an equitable way" (Robinson, 1996, p. 64), or what the author initially calls a mixed economy.

According to Robinson, economic activity can be seen as operating under a "system of laws" (1996, p. 142), and if laws provide rights for everyone, it means that every individual should be allowed to carry those rights into their workplace. Robinson goes on to criticize capitalism by describing it as no different than feudalism "in which capital replaces land, and

business leaders replace kings" (1996, p. 143). Therefore, humanity is obliged to end this hierarchical system where rulers contribute little, while workers bear the brunt of workplace freedom deprivation. According to him, democratic capitalism was guilty of being all too capitalist and not at all democratic, "in which one percent of the population owned half of the wealth, and five percent of the population owned ninety-five percent of the wealth" (Robinson, 1996, p. 143). However, Robinson's Martians still rely on an Earth-like system in formulating their constitution. He refers to this as a "residual/emergent complex of overlapping paradigms" (Robinson, 1996, p. 482). The bulk of every socioeconomic system is comprised of elements taken from the system immediately preceding it, while also incorporating elements from systems that are found in even older links in this emerging historical chain (Robinson, 1996, p. 482). The most prevalent systems utilized in Martian history are mostly cooperative anarchically tilted ideologies such as 'Bogdanovism' while 'eco-economics' and 'gift-economy' are some of the more commonplace economic alternatives (Jameson, 2005, p. 451). Bogdanovism sprung out of the martyrdom of Arkady Bogdanov, one of the First Hundred, who advocated for an independent and communal Mars. Eco-economics was hammered out by a pair of the First Hundred and who based it on assigning value to caloric consumption with the aim of increasing ecological efficiency. Finally, the gift economy rests on the idea that all necessities are distributed equally, while any remaining goods are circulated through gifting.

Martians spend fifty years carefully testing out methods and systems that lead to a proto-post-scarcity economy. The eventual emergence of markets is not denied, nor is the possibility of competition; however, everyone should own their own work and whatever can be earned through it, while any innovations are owned both by those who create them and later given away for "the common good of the future generations" (Robinson, 1996, p. 145). There are no large corporations, and businesses are owned only by their owners, while guilds and co-ops are organized with the aim of trade regulation. Property as such is abolished, and exchanged with tenure rights worked out by a land commission (Robinson, 1996, p. 155). Members of the cooperative guilds would be chosen as members of economic commissions from "various professions and industries" (Robinson, 1996, p. 155) and a version of eco-economics is introduced into the constitution. The co-ops would not be allowed to surpass one thousand members; therefore, any large enterprises would comprise out of several co-ops (Robinson, 1996, 296). Company management would have to undergo a yearly review, producing management structures rooted in meritocratic consensus (Robinson, 1996, p. 296).

A Martian currency purposefully resistant to Terran inflation was established by the economic commission. Due to the inexistence of a Martian stock market, the "full force" of Terran investments falls on the currency itself, thus causing its inflation in the Terran money markets, while it remained "just money" on Mars (Robinson, 1996, p. 297). During one of the negotiations, a character voices his view on how the newly formed Martian system functions, which clearly outlines the most important notions of the newly established constitution,

> Economic rationality is simply not the highest value. It is a tool to calculate costs and benefits, only one part of a larger equation concerning human welfare. The larger equation is called a mixed economy, and that is what we are constructing here. We are proposing a complex system, with public and private spheres of economic activity. It may be that we ask people to give, throughout their lives, about a year of their work to the public good, as in Switzerland's national service. That labor pool, plus taxes on private co-ops for use of the land and its resources, will enable us to guarantee the so-called social rights we have been discussing— housing, health care, food, education— things that should not be at the mercy of market rationality. Because *la salute non si paga*, as the Italian workers used to say. Health is not for sale! (Robinson, 1996, p. 144)

However, the ultimate fate of the aforementioned economy lies beyond the timeline encompassed by the novels. Robinson admits these changes in economic principles to be an ongoing process that will last for a number of years with an uncertain endpoint if any (Robinson, 1996, p. 746). Despite the still-developing nature of the mixed economy proposed, it is noted that Mars has no murder, no hunger, everyone has a home to live in and nobody is "scared for their kids" (Robinson, 1996, p. 761), indicating the initial steps towards a fully post-scarcity society, where everyone's basic needs are accounted for.

4.1.2 Obstacles and Solutions

The first and foremost obstacle identified is the deep-seated human habit towards capitalism, as it is rooted in traditions and social standards. Much of humanity's current economic systems and ethics are "scarcity-generated social tensions" (D'Adamo, 2015, p. 96), and although there is a rational foundation for achieving post-scarcity, humans are unable to envision it, except in utopian fiction (D'Adamo, 2015, p. 90). Robinson attempts to show how humans can and should break loose of the made-up moral and ethical standards generated through scarcity-induced social tensions (D'Adamo, 2015, p. 96). The conflict between Earth and Mars remains central to the plot. It is a classic representation of the colony and the colonizer, where the local authority is attempting to eliminate the domination of a foreign

power (Abbott, 2003, p. 43). This is cried bluntly out by character Arkady Bogdan in *Red Mars*,

> And so in reality, the islands are part of the trans-national order. They are paid for, they are never truly free, there is never a case of truly pure research. Because the people who pay for the scientist islands will eventually want a return on their investment. And now we are entering that time. A return is being demanded for our island. We were not doing pure research, you see, but applied research. And with the discovery of strategic metals the application has become clear. And so it all comes back, and we have a return of ownership, and prices, and wages. The whole profit system. (Robinson, 1993).

Arkady's views spread and later lead to experimentation with alternative economic systems. This highlights a dynamic in which local communities and their aspirations are rarely in alignment with global ones (Abbott, 2003, p. 43). Globalism entails cooperation and interdependence, while local communities are intertwined via heritage and tradition and as such do not allow for a holistic system (Abbott, 2003, p. 43).

Robinson challenges established social conventions and imagines a society in which a cooperative nation on a massive scale is not only possible but thriving (Abbott, 2003, p. 30). By doing this, he questions the foundation on which capitalism rests. He takes a risk by negating capitalism and introducing an alternative utopian vision with a carefully outlined structure (Horn, 2018, p. 58). So, why does it matter that *Mars* is a utopian vision? As initially mentioned, stories about utopian societies provide a glimpse into scenarios where crises can have positive outcomes, along with providing insight into the times and context in which they were written (Robinson, 2018). In an allegoric sense, these stories allow for fresh perspectives in examining contemporary real-world societies (Robinson, 2018). In order to emphasize this notion**,** Earth is purposefully introduced as the embodiment of capitalism. It offers a mirror image to utopian Mars and gives the reader a tangible reference system, further reinforced by having the First Hundred be half American and half Russian. This, again, directly reflects the global political situation of the 90s, when the books were written and published. This way Earth is the Dystopia of the trilogy and Mars the Utopian counterweight in narrative terms, where any economic disparity is abolished over the course of the stories. The First Hundred are not initially aware of their ideological status, it is only after the first capitalist demands are made on them that they realize their position, or as Arkady notes during their trip to Mars, "I don't think we should pay any attention to plans made for us back on Earth!... I think we should make new plans. I think we should be making them now." (Robinson, 1993, p. 81). Exactly this idealistic thinking is what sparks the birth of Bogdanovism and later leads to a free Mars. Arkady's views are not met with enthusiasm straight ahead; however, Martian

attitudes shift as the novels progress, and they start demanding rights, changes, and more overall freedom, eventually leading to the establishment of the post-scarcity system.

Over the course of the trilogy, several new technologies are invented which then propagate and influence further societal development. It is maintained that humanity passes a transition or threshold to a new level of technological competence roughly every half-century (Robinson, 1996, p. 482), which in the course of the story happens four times, although it is not described in detail. Technology, finally, allowed Martians to take control of their own economy and development without relative reliance on trade, and with the opportunity for "general communality" (Bambini, 2015, p. 48). Robinson thus points to a socioeconomic alternative advocating a loosely defined system of self-sufficiency pivoting around production (Bambini, 2015, p. 48). Initially, settlers possessed self-replicating and actuating machinery which allowed for near-complete automation of numerous tasks and industries. However, these machines are presented as commonplace and without major influence on social dynamics. The most prominent invention breaking this mold would be the space elevator – also acting as one of the prominent plot devices. The elevator is described as already completed and functioning in the first book,

> The cable will be manufactured by robots mining and processing the carbon in the asteroid's chondrites… At that point, the cable will be in areosynchronous orbit itself, barely touching down here, its weight suspended between the pull of the planet's gravity and the centrifugal force of the upper half of the cable, and the terminal ballast rock… A few hundred elevators at least will be attached to the cable, and loads will be lifted into orbit using a counterweight system. There will be lots of material to load down from Earth as usual, so energy requirements for lifts will be minimized. It will also be possible to use the cable's rotation as a slingshot; objects released from the ballast asteroid toward Earth will be using the power of Mars's rotation as their push, and will have an energy-free high-speed take-off. (Robinson, 1993, p. 306)

Despite Mars' divergence from Terran political and economic norms and stances, the society there is initially still dependent on Earth for a number of resources. The elevator was conceived of as a means of expediting inter-planetary colonization. Eventually, its existence is central to both conflicts on Earth, and Martian revolutions, as well as the ultimate outcome of all three stories. It enables the narrative elements of mass immigration and is the physical manifestation of Earth's leverage in dealing with Mars. Initially, it both provides Mars with much needed resources and allows for quick travel between the two planets. Later, in the attempt to mitigate Earth's overpopulation, citizens are sent to Mars without Martian consent, while extraction of valuable minerals for use on Earth continues. This emphasizes Mars' colony role and prompts each individual revolution, resulting in a progressive shift towards a post-scarcity society. Habitation of Mars, their attitude towards Earth, and their need for

change would not be possible in the absence of the space elevator. Yet, it remains important after this point on as a means of resource exchange among the now fully inhabited solar system.

Finally, Robinson admits that the negotiations towards full independence and self-regulation in terms of applied economic systems are going to be long and strenuous. He also does not shy away from the fact that his system is a "mélange" of various economic systems (Robinson, 1996, p. 189) as seen through his creative lens. Character Nirgal outlines the road towards post-scarcity in *Blue Mars*, "It's the physical manifestation of democracy, here at last. Health for all. And when that happens the explosion of positive human energy is going to transform the Earth in just a matter of years" (Robinson, 1996, p. 482). However, through adversity Martians became wiser and better prepared to champion their own views on economics and politics. "In the cooperative democratic economy, everyone saw the stakes were high; everyone felt responsible for their collective fate; and everyone benefited from the frenetic burst of coordinated construction that was going on everywhere in the solar system" (Robinson, 1996, p. 484-485).

	Obstacle	**Plot Device**
Technological	Resource exchange with Earth	Space elevator
Macroeconomic	Economic disparity	Planned economy
		Eco-economics
		The gift-economy
Socio-psychological	Perspective towards set value systems	Shift of mindset
		Physically isolated community
		Gerontological therapy

Table 1: *Mars* - Overview of Identified Obstacles and Solutions

The final plot device introduced would be "gerontological therapy", invented by the settlers. This therapy sometimes referred to as 'the longevity treatment' or simply 'the treatment', is invented sometime during the course of the first book and allows for complete regeneration of broken DNA strands, as well as improvement of "cell division accuracy" (Robinson, 1993, p. 287). In essence, it allows for anyone who takes it on a regular basis to maintain their physical appearance through aging and prolong their life to an unknown number of years, i.e., by the end of the trilogy, the main characters are all over 200 years old. Although they do start experiencing memory issues towards the end of the novels, they are all still capable of remembering the first revolution by the time of the second one, and they resolve any memory issues by the time the third one comes around. This means that their

memory is intact and useful for participation in revolutionary politics. The longevity treatment enables settlers to learn from the past firsthand and prevents them from repeating past mistakes, be they political, economic, or cultural in a broader sense. During negotiations following the second revolution, one of the First Hundred notes how the second generation of Martians seem very naïve despite being clever (Robinson, 1996, p. 138). “They had no idea how unlikely their independence was, nor how possible it was for it to be taken away from them again.” (Robinson, 1996, p. 138). Once the First Hundred arrived at Mars, they were physically isolated from Earth, while also being removed from any historical baggage resulting from habitual reliance on monetary and similar systems. Returning to the utopian trope, this allowed for the ability to create their own rules and regulations without the direct influence of Earth’s hierarchical systems (Bambini, 2015, p. 46). So, the foundations were laid for new immigrants and upcoming generations to pursue their own utopian vision, eventually leading the entire society from colonial or capitalist to a post-scarcity one.

It has already been established that Robinson’s Martians are not experiencing the full benefits of post-scarcity, but that is certainly the direction they are headed in. Scarcity is still present to a certain degree but circumvented through utilization of the space elevator and exchange of goods within the solar system. However, what constitutes the foundation for the development of the post-scarcity society is the general egalitarian attitude taken by the Martians, as well as their focus on social relationships rather than social status and hierarchy. A type of planned economy is utilized for the purpose of making sure that each individual is granted basics for living. However, everyone is also expected to give back to society through different communal work. The lifespan of humans has been significantly increased allowing for this shift in mindset to happen in the first place.

4.2 Star Trek

4.2.1 Overview

Star Trek is a franchise created by Gene Roddenberry in the 1960s, who had the vision to show how humanity could work on its own betterment through equality and overall tolerance (Baxter, 2015, p. 26). This vision gave birth to the entirety of the *ST* universe, along with the United Federation of Planets. *ST* as a franchise is home to numerous races and cultures; however, not all of them are relevant for this research. As the main scope of the study revolves around post-scarcity, so will the *ST* section revolve mainly around the

Federation. The Federation is "an expansionist federal government based on the US model" (Baxter, 2015, p. 26). It was first mentioned in the *A Taste of Armageddon* episode of *The Original Series* (Pevney, 1967), but not fully fleshed out until much later in the franchise. This chapter explores the functioning of the Federation, its foundations, and ways in which Federation citizens have overcome the economic problem. Due to the vast extent of the *ST* canon, this thesis will be drawing examples from the televised canon shows and films, while not considering novels and games.

Unlike *Mars, Star Trek's* Federation already operates in a state of post-scarcity. Notably, *ST* never goes into a deep discussion of its economic system, but the viewers are expected to reach their own conclusions based on droplets of information spread throughout the entirety of the series' run. This study mainly focuses on three series set in the 24th century and airing during the late 80s and throughout the 90s, namely *The Next Generation, Deep Space 9,* and *Voyager. TOS,* the first broadcasted series, dealt extraordinarily little with economic issues and wrestles with a significant number of contradictions in the matter which is why it is being omitted from the research. *Discovery,* being set in the 23rd century along with *TOS* is likewise omitted from the research. *Enterprise,* set in the 22nd century, does not deal with post-scarcity issues and is not referenced in the study. On the other hand, *Picard* and *Lower Decks* although set in the 24th century, barely focus on depicting economies of abundance, rather focusing on individual characters and their journeys, and are thus left out. The movies are mentioned in cases where information relevant to the study topic is referenced. By the time the study relevant three shows started airing, Rodenberry had a somewhat broader idea of what the Federation's economy should entail - a post-scarcity system embracing an egalitarian and altruistic outlook towards its citizens and broader. *TNG* follows the crew of the Federation flagship, the USS Enterprise, in its exploration of the Milky Way's Alpha Quadrant. *DS9*'s plot revolves around a space station adjacent to a wormhole leading to the Gamma Quadrant. *VOY* tells a story of a ship lost in the Delta Quadrant, far away from home, seeking its way back. Each series' characters encounter numerous other species and cultures with a diverse spectrum of societal and economic systems. These serve as a point of reference for comparison. They mostly accentuate some aspects of humanity versus Federation citizens and their society, which are depicted as a virtuous standard to be measured against.

The series drops various hints at how the Federation's post-scarcity economy is administered throughout the three series' run. What is obvious from the start is the abundance

of goods and resources, removing the need for any sort of a monetary system and/or need for allocation of goods (Saadia, 2016, p. 31). Namely, it is indicated that money has become obsolete (Nimoy, 1986), while the economic system appears to revolve around the replicator technology, coupled with the abundance of energy necessary for its operation (Baxter, 2015, p. 26). Labor is either abolished or has become interchangeable with leisure, there is no crime or poverty, everyone is healthy and material wealth has become irrelevant (Saadia, 2016, p. 14). Unlike other economic systems, *ST's* economics - often called 'trekonomics', is neither centrally planned nor is it market-driven (Webb, 2019, p. 28). *ST*'s characters appear to own both small-scale personal possessions as well as land, exemplified by Sisko's restaurant (Livingston, 1996) and the Chateau Picard (Landau, 1990). Federation citizens have the freedom and right to choose what their careers will be and where they wish to reside (Grech & Grech, 2015, p. 44). If they so desire, they may also remain unemployed. Although depicted as a post-scarcity economy, the Federation still occasionally encounters famine, mainly caused by disruption of interstellar transportation infrastructure analogous to current day trade lanes, like the one on Bajor during the Dominion war (Kolbe, 1999). There is no currency, as mentioned in several instances in the series and films (Conway, 1988; Nimoy, 1986); however, a variety of money is still occasionally used, as per example of Dr. Crusher buying goods at the Farpoint station (Allen, 1987), Jake needing to borrow money in order to buy his father a gift (Dorn, 1997) and Jadzia asking Worf to borrow currency from him as a result of her gambling hobby (Vejar, 1997). This, however, means that although the Federation managed to evolve their society to the point of not needing currency, the universe around them is still filled with races using money, and they need to adapt once outside their own borders. As for the societal hierarchy, it is more than obvious that some individuals are granted higher positions in the society that come together with certain perks, as per the example of Patrick, a psychiatric patient who gets special treatment after pretending to be an admiral and wearing an admiral's uniform (West, 1998). However, this is only notable in Star Fleet, which is a military hierarchical organization implying certain prestige based on rank. There are however no notable instances of similar events happening outside of this hierarchical construct, meaning among civilians. Finally, although the Federation does not trade internally, it does engage in commerce with other races, as seen in *TNG: The Price*, where Federation representatives bargain for access to a seemingly stable wormhole using a currency called Federation Credits (Scheerer, 1989). The existence of currency in the no-

currency Federation is primarily justified as a means for trading with Federation outsiders, but never fully explored in the series.

4.2.2 Obstacles and Solutions

Suvin (1979, p. 10) refers to narrative mechanisms where the distant future presented in fiction is not only a familiar notion observed through a different lens, but altered to such a degree as to have become something entirely different as 'defamiliarization'. *ST* makes use of defamiliarization by predicting the elimination of poverty, which leads to a major change in the human condition, resulting in an entirely altered behavior and worldview (Saadia, 2016, p. 135). Individuals with different backgrounds, and corresponding perspectives of poverty, sufficiency, and plenty of experience different economic conditions (Sheehan, 2009, p. 2) as such are bound to the social boundaries imposed through their experiences. This goes as far as to explain the interrelatedness of human inequality and economic systems (Sheehan, 2009, p. 4). Saadia (2016, p. 125) goes deeper into the subject by illustrating how poverty devours those it affects by way of constant mental stress induced by the imperative of prioritizing certain basic needs over others. Further, he indicates how poverty impacts the cognitive development of infants on a biochemical level, thus prepping future generations for a never-ending cycle of indigence. *ST* recognizes this notion as an obstacle towards any sort of a shift and abolishes it entirely, "Poverty was eliminated on Earth, a long time ago. And a lot of other things disappeared with it - hopelessness, despair, cruelty..." (Conway, 1988).

Taking this outlook into account, it becomes clear how bizarre the Federation is and how far removed from a contemporary frame of reference it is. Its citizens desire no material wealth and social status among civilians does not seem to matter (Saadia, 2016, p. 31, 135). By naming the cycle of poverty as an initial obstacle towards post-scarcity due to its crippling effects on peoples' attitudes and outlook, *ST* immediately sets forth to propose its second hurdle. That being, similar to *Mars*, the human ability to shift their perspective and value systems. Just like Robinson's Martians, humans in the Federation underwent significant periods of strife and emerged at a mature spot in their societal development, when they are introduced to the viewer. However, unlike in *Mars*, viewers do not follow along for this shift in attitudes. The transition is only pictured in a few instances where ST's historical divergence causes conflicts and uprisings, i.e., the Eugenic Wars and Bell Riots. Various characters suggest that the society found a communal way of peaceful coexistence, but only after periods of prolonged widespread suffering. Additionally, this resulted in a shift of population mindsets, where the acquisition of material goods was no longer necessary for the purposes of

advertising one's social status (Saadia, 2016, p. 31). Although it is often assumed that technology was the sole driving force towards post-scarcity, one also has to take into account that entire value systems needed to shift in order for egalitarianism to be introduced in the first place (Saadia, 2016, p. 42). The citizens of the Federation mostly act as if surrounded by absolute abundance, and as if the possibility for any sort of paucity in relation to their necessities was unthinkable. (Saadia, 2016, p. 127). Therefore, the second most prominent hurdle on humanity's way towards post-scarcity is most certainly the type of value systems societies employ and how far the citizens are prepared to renounce social hierarchies and their positions within them. However, even in the utopian world of *ST* where everything is available to everyone, individuals still encounter difficulties in adapting and embracing the system. Wesley Crusher, as well as Jake Sisko, both seem initially burdened by the weight of expectations placed on them in the context of limitless possible career and lifestyle avenues (Scheerer, 1994; Vejar, 1988), along with Dr. Bashir's father who seems to be hopping from one occupation to another without ever settling sticking to any one of them in a meaningful manner (Livingston, 1997).

After identifying the most prominent obstacles extrapolated from the *ST* universe, we can proceed to investigate those plot devices used as alleviating factors in reaching post-scarcity. The first and foremost factor that needs to be mentioned is technology, or more precisely the replicator. Replicators are devices with the ability to produce just about goods one might desire (Grech & Grech, 2015, p. 40), they utilize a sort of matter printing, along with having abundant energy for the task (Baxter, 2015, p. 26). Matter, in the series, is represented as independent of any sort of accounting unit, it exists regardless of its state, whether liquid, solid, or gaseous (Saadia, 2016, p. 37). This allows it to be stored, and transformed into any single thing, as long as its pattern is available to the replicator. Thus, they seem to represent the ultimate answer to the economic problem. However, Saadia (2016, p. 155) makes a note not to mistake the replicator with the catalyst for abundance and wellbeing for humans in the show. He also observes it to be an endpoint of previous sociological development (Saadia, 2016, p. 155). The replicator was conceived as a means of delivering or producing resources on a much larger scale than previously imaginable. Its existence allows for the eradication of menial labor and the overall flattening of the social hierarchy – material possessions stop being a means of gaining social prestige.

As mentioned, the existence of the replicator leads to the obsolescence of labor as one of the foundations of a scarcity-driven economy. Since replication technology seems to be in

the public domain in the Federation, assuming that each household owns at least one, leads to the conclusion that supply and demand have ceased to exists, and the concept of markets along with them (Saadia, 2016, p. 58). The only labor required in this case is the maintenance of the devices themselves, which appears to be the obligation of their owners. Additionally, by the 24th century, any sort of physical labor is also eliminated through technological advancement, machines perform all of those menial, repetitive, and time-consuming tasks, allowing humans to focus on their education and individual betterment (Saadia, 2016, p. 66-67). In some cases, technology is able to take over work usually performed by humans, such as the holographic Doctor in the *VOY* series who was initially designed as an emergency AI but takes over the care of the entire Voyager crew in absence of a human doctor, proving that technological advancement in *ST* may be moving towards machines gaining the ability to perform high skill jobs as well.

Finally, *ST* introduces a measure of value through one's reputation. Sisko's restaurant does not generate any money, but through the services it provides, value is attributed based on the desirability and quality of those services among the population, much like today's stock market value depends on reputation (Piketty, 2014, p. 49). Saadia (2016, p. 49) compares it to a universal Yelp where everyone gets to rate and bad comments never disappear. Thus, one may conclude that reputation replaces economic wealth in the world of *ST* (Milanović, 2018, p. 21). Just like material poverty is a prominent contemporary issue, so can reputation poverty be in *ST*. The most notable example of a reputation deprived person would be the character of Barclay, who gets addicted to a holodeck program in the attempts of establishing a social life, which he cannot obtain in the real world due to his shyness (Bole, 1990), showing once again that *ST*, although a utopian society has outliers in its society that do not fit into the idealised world presented to viewers.

	Obstacle	**Plot Device**
Technological	Finite resources	Replicator technology
Macroeconomic	Poverty	Elimination of currency
		Elimination of labor
Socio-psychological	Established value systems	Shift of mindset
		Reputation as currency

Table 2: *ST* - Overview of Identified Obstacles and Solutions

ST is placed in the middle of the post-scarcity scale, meaning that they do experience abundance in larger terms, but instances of scarcity are still possible as a result of wars, or other disruptions. Their society is completely egalitarian and has access to most of their desired goods and services. Medicine has evolved to a point where any disease is very rare;

however, life expectancy is similar to that of contemporary humans, unlike in *Mars* and *Culture*. The Federation is shown to have achieved post-scarcity even before the introduction of the replicator technology, meaning that technological advancement only made it simpler, but was not the initial driver. The initial driver of post-scarcity in ST is a general shift of mindset, along with an implementation of a planned economy. Goods and resources are distributed among citizens equally, nobody has too much, and nobody has too little.

4.3 Culture

4.3.1 Overview

Iain M. Banks's *Culture* series is made up of nine novels and one short story collection. Unlike humans in *Mars* and *Star Trek*, the Culture's humans are not in any way or shape connected to Earth and its civilizations, nor did they evolve from Earth's contemporary society. As a matter of fact, Earth is mentioned as a place they covertly visit in the short story *The State of the Art*. The Culture is depicted as a separate, technologically advanced and galaxy-spanning society. Its structure is complex, and it is elaborated on in great detail throughout the books. Some of the most notable aspects will be mentioned in the following section of the study. The Culture is portrayed as a fully mature post-scarcity society with little regard towards territorial dominion or accumulation of wealth (Banks, 1987, p. 451). Their production capacity is limitless and thus the population's needs and wants are fulfilled at all times (Banks, 1987, p. 451). The Culture sees it as their task to bring other cultures and societies under their wing, which serves as a justification for meddling into their development, either openly or covertly,

> …the Culture—could prove statistically that such careful and benign use of 'the technology of compassion' (to use a phrase in vogue at the time) did work, in the sense that the techniques it had developed to influence a civilisation's progress did significantly improve the quality of life of its members, without harming that society as a whole by its very contact with a more advanced culture. (Banks, 1987, p. 451)

Most of the *Culture* books are set on these peripheries of galactic society where the reader gets to examine interactions between less advanced societies and the Culture. This provides for an interesting contrast between civilizations that are more inclined towards practices such as capitalism, theocracy, or authoritarianism and the Culture itself, as the proposed ideal society. Fuchs (2020, p. 177) goes on to describe them as an 'anarcho-communist' society with no state and with an automated economic system. This means that a unifying internal force, which provides a measure of coherency within and belonging to the Culture is

expressed through adherence to its standards of morality. Administration is entirely handled by the Minds, i.e. godlike sentient AI systems. An example of the Culture not being a nation in a more traditional or contemporary sense is them not having a symbol or any other means of visual identification,

> It would have helped if the Culture had used some sort of emblem or logo; but, pointlessly unhelpful and unrealistic to the last, the Culture refused to place its trust in symbols. It maintained that it was what it was and had no need for such outward representation. The Culture was every single individual human and machine in it, not one thing. Just as it could not imprison itself with laws, impoverish itself with money, or misguide itself with leaders, so it would not misrepresent itself with signs. (Banks, 1987, p. 149)

The series' books are only vaguely connected beyond being set in the same fictional universe. Each portrays different characters and is set in a different time period. Life in the Culture is depicted as fairly static and boring in comparison to other less advanced societies, due to very little change or progress occurring, as per examples of characters describing the Culture in comparison to other civilizations, "Compared to them, the Culture moves at a snail's pace!" (Banks, 1991, p. 194) and "I abandoned a paradise I considered dull" (Banks, 1991). This is exactly why the books deal with either Contact or the Special Circumstances division of Culture since they operate at the loosely defined spatial boundaries of that society where 'special circumstances' occur and necessitate taking action, which may even lead to a Culture-internal change in the long run. Contact is a small section of the Culture responsible for interactions with other civilizations, while SC exists for the purpose of more covert operations, i.e. secret interventions in other societies where a more calculated approach is necessary,

> Special Circumstances had always been the Contact section's moral espionage weapon, the very cutting edge of the Culture's interfering diplomatic policy… It had about it too an atmosphere of secrecy (in a society that virtually worshipped openness) which hinted at unpleasant, shaming deeds, and an ambience of moral relativity (in a society which clung to its absolutes: life/good, death/bad; pleasure/good, pain/bad) which attracted and repulsed at once, but anyway excited. (Banks, 1987, p. 30)

The Culture recognizes no social hierarchy or structure. Society is made up of heterogeneous species enjoying prolonged lifespans and sentient machines, ranging from AI drones of roughly humanoid intelligence to godlike AI consciousnesses (the Minds), the latter of which in essence run the society (Latham, 2019). Citizens' lives are entirely centered around leisure and the exploration of individual appetites. Thus, Latham (2019) defines them as an "anti-capitalist utopia with enlightened egalitarian leaders." The economic reality of the Culture is depicted through an ultimate technological state of a materialistic post-scarcity

society (Bambini, 2015, p. 53). Everyone is granted access to anything they could ever need or wish for, but the Culture does not recognize any type of private property besides an individual's thoughts and memory (Banks, 1996). These are the only areas of one's being that are not to be intruded upon, and even considering doing so is seen as a faux pas,

> Any publicly filed report or analysis was theoretically available to anybody, but your own thoughts, your own recollections - whether you were a human, a drone or a ship Mind - were regarded as private. It was considered the ultimate in bad manners even to think about trying to read somebody else's - or something else's - mind. (Banks, 1996)

As can be noted in the citation, there are no actual laws preventing the Minds or anyone else from reading one's mind, it is just considered rude and will lead to a permanent social stigma on the offender. The reason for that is the Culture's lack of laws and a recognized legal framework. Instead of enforcing laws, there are just "agreed-on forms of behaviour; manners" (Banks, 1994). Actual governance is handed over to the Minds, with the notion that no other sentient being is capable of performing predictive efficiency or efficacy computations on such a high level or massive scale. The agreed-on forms of behavior come into play due to living and surviving in space, where ships are expected to be self-sufficient and thus the desires of their inhabitants should not "conflict significantly with the requirements of the controlling body" (Banks, 1994). On the other hand, housing is, for example, depicted as entirely utilitarian, as per example of Gurgeh, a character in *The Player of Games* complaining how his house has no value due to the fact that anybody can easily reproduce it if they wish to do so (Banks, 1989, p. 24), which in turn portrays how insignificant its value is.

In terms of resources, the Culture seems to have mastered the extraction of any necessary materials directly from space, with the example of building Orbital structures by "simply removing the sort of wandering debris (for example comets and asteroids) which the average solar system comes equipped with" (Banks, 1994). "… the aesthetic effect of the Culture's endlessly and magically created "stuff" is really more about the elimination of hierarchy and the cheap (and fair) distribution of goods" (Bambini, 2015, p. 58). This idea of a post-scarcity society lacking any form of economic disparity is thus a form of cognitive estrangement to the contemporary concept of the social state (Bambini, 2015, p. 58). Although seemingly having access to abundant matter and energy, the Culture prefers not to be "too conspicuously extravagant with matter and energy, either (so inelegant to be wasteful)" (Banks, 1989). In *Use of Weapons*, it is explained how Culture citizens prefer living in orbital habitats, instead of terra-forming existing planets (Banks, 1990). Their view

on terraforming is that planets should be left to function in their natural state, meaning that they prefer to leave what we would refer to as natural capital as-is, instead of tampering.

As for currency, much like humans in *ST*, the Culture does not utilize any sort of money, for them, money is a sign of scarcity and poverty, which they have overcome (Banks, 1991). Despite lacking a medium of exchange, fulfilling everyone's wishes is one of the highest functions of the Culture's civilization (Banks, 1994). Labor is equivalent to having a hobby or playing, both for machines and for humans (Banks, 1994). Automated jobs are performed by machines with the lowest levels of sentience (Banks, 1994). Finally, all Culture citizens are entirely aware of their interdependence for the purposes of surviving in such a hostile environment like outer space (Banks, 1994).

4.3.2 Obstacles and Solutions

The following section focuses on obstacles and solutions found in the *Culture* series. Unlike humans in *Mars* and *ST*, the Culture and its citizens have attained post-scarcity during a time long before the events covered in the books, and the narrative reveals quite little of what their society used to look like before. Different scarcity-burdened civilizations and cultures are introduced as a point of reference. Therefore, instead of concentrating initially on potential obstacles, as in previous chapters, this section will extrapolate them through close observation of the story's solutions.

The most crucial plot device solving the general economic problem is AI, more specifically - the Minds. They are at the core of the series in terms of painting an economic backdrop and enable the entire narrative to play out in a post-scarcity context. Each individual ship-housed Mind is also depicted as a capsule containing the whole of the Culture. A single General Systems Vehicle (largest Culture vessel) is home to one Mind and millions of machines and people, while also representing the entire Culture,

> All that the Culture knows, each GSV knows; anything that can be done anywhere in the Culture can be done within or by any GSV. In terms of both information and technology, they represent a last resort, and act like holographic fragments of the Culture itself, the whole contained within each part. (Banks, 1994, p. 8-9)

Much like the elimination of poverty is an example of defamiliarization in *ST*, so is the presence of these Minds in *Culture.* Their existence is a prerequisite for narrative the intricacies of the shown universe, and they are almost solely credited with facilitating the Culture's development into a hedonistic, albeit morally inclined state of being. At one instance, the Mind called *Lasting Damage*, gives a brief description illustrating their overall power level,

> "…I am a Culture Mind. We are close to gods, and on the far side. 'We are quicker; we live faster and more completely than you do, with so many more senses, such a greater store of memories and at such a fine level of detail." (Banks, 2000, p. 317)

How and why did Minds come to be then? The space-dwelling species forming the Culture initially required mutual support for pursuing autonomy from their previously existing power structures (Banks, 1994, p. 2). Banks (1994, p. 2) thus implies how contemporary and established structures or systems of power cannot survive in space for a long period of time, at least without an inevitable outbreak of some form of anarchy. Therefore, the said species required an intelligence capable of long-term calculation and forecasting (Banks, 1994, p. 3). The Minds are, accordingly, their leaders and logisticians on a galaxy-faring scale. Other than being powerful logisticians, their built-in design includes a wish to live, to experience, to understand, and to pursue their own version of a uniquely rewarding lifestyle (Banks, 1994, p. 5). What stems out of the necessity of their existence in the novels is the proposal that humans are incapable of performing essential computation and resource planning on a galactic scale or even smaller economies with comparable degrees of complexity, as for it to lead to a comfortable and peaceful existence for all, making this the initial extrapolated obstacle. This is further emphasized in a conversation between a humanoid and a drone in *Look to Windward*, relating to the extent of control their Orbital Mind possesses over them,

> "'Yeah, well, somebody's got to run it.'…'I mean, you wouldn't want a person in charge of stuff like that, would you? That'd be scary. That would be like the old days, like barbarism or something.'" (Banks, 2000, p. 234)

A similar conclusion is made by a visitor to the Culture, Major Quilan of Chel, claiming humans to be a savage race who handed over the running of their society to machines because they were unable to trust themselves with the vast science and technology they had access to (Banks, 2000, pp. 125-126). Through bestowing all power upon the benign Minds the humans of Culture get to dispose of their own biased outlooks and indulge in a careless existence (Brown, 2001, p. 632).

This leads to the second solution/obstacle explored in the series – the presence or absence of a planned economy. Banks (1994, p. 4) was of the opinion that a planned economy is certainly more productive than the one being left to govern itself, which is exactly why he introduced the Minds as the near-omniscient decision-makers of the Culture's planned economy. Through relying solely on the computational power of the Minds, the necessity for stumbling around in the dark ceases to exist,

> The market, for all its (profoundly inelegant) complexities, remains a crude and essentially blind system, and is - without the sort of drastic amendments liable to cripple the economic efficacy which is its greatest claimed asset - intrinsically incapable of distinguishing between simple non-use of matter resulting from processal superfluity and the acute, prolonged and wide-spread suffering of conscious beings. (Banks, 1994, p. 4)

For a planned economy to be implemented, the world's citizens would have to engage in continuous cooperation with determining their mutual goals and applying them diligently (Banks, 1994, p. 3). Therefore, the implication is that humans are neither capable nor willing to perform such duties. The Minds are crucial both for the creation and continuation of a post-scarcity society. All other plot devices stem directly from their inconceivable computational and operational capacity.

Looking back at the need for cooperation, Banks (1994, p. 3) indicates how the Culture's goals are not material, but moral. It is exactly this all-encompassing sense of morality that allows Culture to live in a post-scarcity state. The Culture's pursuit of a universal greater good is explained more closely in *Use of Weapons*,

> And these people lived in peace, but they were bored, because paradise can get that way after a time, and so they started to carry out missions of good works; charitable visits upon the less well-off, you might say; and they always tried to bring with them the thing that they saw as the most precious gift of all; knowledge; information; and as wide a spread of that information as possible, because these people were strange, in that they despised rank, and hated kings... and all things hierarchic... even Ethnarchs. (Banks, 1990, p. 33)

Therefore, after reaching ultimate existential bliss on a civilizational scale, the Culture machines and humans took it upon themselves to better the rest of their galaxy. Sometimes their interventions would be direct, while other times they required a delicate touch and gradual introduction of new values. Why exactly the Culture's machines and AI citizens would partake with humans in such a grand undertaking is not entirely clear. There is a hint at a possible explanation in *Look to Windward,* which states that most AIs reflect the values and visions of their creators in some way,

> So AIs, especially at first, tended to reflect the civilisational demeanour of their source species. Even when they underwent their own form of evolution and began to design their successors - with or without the help, and sometimes the knowledge, of their creators - there was usually still a detectable flavour of the intellectual character and the basic morality of that precursor species present in the resulting consciousness. (Banks, 2000, p. 126)

The general assumption is that the initial creators of the Culture and the Minds were several benevolent and peaceful civilizations, seeking overall comfort for their peoples. An outsider to the Culture in *Look to Windward,* notes how the Culture citizens are obviously very proud

of the extent of their democracy (Banks, 2000, p. 332). However, they would also need to be prepared to share their inventions and achieved comfort with the rest of the species they encounter. Therefore, a certain egalitarian value system, also serving as a plot device, is needed for establishing a society on such altruistic principles.

After examining the broader aspects of a society as the Culture, it is also important to refer to its citizens. Drones and humans alike have complete control of their lives, as long as their wishes are in the realm of morality and possibility, and sometimes even beyond. Both are considered equal beings and live comfortably,

> They socialise, they have work-hobbies, they play in more gentle forms, they read or watch screen, they go to entertainments. They sit around grinning in one of their glanded drug states, they study, they spend time travelling-' 'Ah-hah!"-apparently just for the sake of it or they simply ... potter. And of course many of them indulge in arts and crafts.' (Banks, 2000, p. 113)

As indicated, labor has been eradicated, and work cannot be distinguished from hobbies and games (Banks, 1994, p. 4). Any menial work is performed by non-sentient machines or machines with an exceptionally low level of consciousness, so nobody feels exploited (Banks, 1994, p. 4). Therefore, this simultaneously points to an obstacle and a solution to the post-scarcity question, where exploitation or cruelty is the obstacle, and lack of labor or consciousness the solution respectively. This is further emphasized with the concept of a holiday being somewhat alien to the Culture. It is implied that holidays in the Culture are times when you stay at home, instead of the usual traveling,

> What's this about holidays?'
>
> 'Ziller was-'
>
> '-What he was saying. Opposite meaning. Once, holidays meant the time when you went away.'
>
> 'Really?'
>
> 'Yes, I remember hearing that. Primitive stuff. Age of Scarcity.'
>
> 'People had to do all the work and create wealth for themselves and society and so they couldn't afford to take very much time off. So they worked for, say, half the day, most days of the year and then had an allocation of days they could take off, having saved up enough exchange collateral-'
>
> 'Money. Technical term.'
>
> '-in the meantime. So they took the time off and they went away.' (Banks, 2000, p. 13-14)

The previous quote points to another plot device - the elimination of currency. The Culture does possess physical currencies acquired through trade with other civilizations, much like the Federation in *ST*; however, internal trade does not exist. An example of outsider

trading would be when Uagen Zlepe offers the Jhuvuonian Trader vessel an amount "equivalent to the worth of their vessel" (Banks, 2000, p. 287) if they provide him with passage to the Culture space. Additionally, this implies that the character intuitively skips over even attempting to somehow quantify value in terms of currency. In rare situations, Culture citizens would start competing and bartering among themselves, with the ultimate goal of attaining a good or service to which the scarcity they are so unused to suddenly applies. The most prominent example of this is in *Look to Windward,* where a famous composer is set to premiere a symphony, with a limited ticket pool, so citizens exchange sexual and procreative favors, alter their appearance or gender as a means of acquiring a ticket for the event (Banks, 2000, p. 352). Similarly, to *ST,* there are instances where the Culture citizens utilize reputation as a sort of currency. Namely, a few instances of famous individuals are mentioned throughout the series – the most notable being Gurgeh in *The Player of Games* who is famous for his game-playing skills which grant him a somewhat "elevated" status in his hometown (Banks, 1989).

It is important to note that none of the previously named media of exchange used for acquiring concert tickets are either particularly unusual or exploitative for citizens of the Culture. Additionally, the presence of such scarcity-induced behavior is described as sporadic and small scale enough to not actually be relevant to the Culture's economy in a broader sense. Beyond having the freedom to choose the course of their lives, they are also able to consciously change their appearance, gender, get pregnant, or induce drug glanding, along with being genetically manipulated to live for as long as they wish to. An average Culture individual has an optimized immune system, their senses have been enhanced, and genetically transferred diseases have been eradicated (Banks, 1994, p. 7). Their nervous systems are set in such a way that they control automatic processes and are able to recover from otherwise lethal wounds (Banks, 1994, p. 7). Therefore, similarly to the *Mars* trilogy, Banks introduces the ability to (indefinitely) extend one's lifespan, hence eliminating the passage of time as an economical factor.

Finally, circling back to the Minds, their moral inclinations, and their logistics-oriented role in Culture society, it is important to emphasize how much of Culture's post-scarcity state rests on the interdependence of its members and their technology. The only beings not directly benefiting from this relationship are the Minds, who in essence do not depend on humans or other sentient beings in any capacity, but take care of them out of, presumably, egalitarian reasons. The humans are, on the other hand, entirely dependent on

each other and the Minds as their caretakers. The Mind Lasting Damage explains why and how a portion of its capabilities is devoted to protecting humans from any possible harm they might encounter,

> I fully intend to spend the rest of my existence here as Masaq' Hub for as long as I'm needed or until I'm no longer welcome, forever keeping an eye to windward for approaching storms and just generally protecting this quaint circle of fragile little bodies and the vulnerable little brains they house from whatever harm a big dumb mechanical universe or any consciously malevolent force might happen or wish to visit upon them, specifically because I know how appallingly easy they are to destroy. I will give my life to save theirs, if it should ever come to that. (Banks, 2000, p. 317)

Banks (1994, p. 2-3) emphasizes this further in his essay *A Few Notes on the Culture*, where he claims that any relationship towards the property, or social relationships in a hostile environment such as outer space, imply a completely different "mutuality of dependence". The crew and/or inhabitants of vessels and orbitals, would at all times be completely "aware of their reliance on each other and the technology which allowed them to live in space" (Banks, 1994, p. 7).

	Obstacle	**Plot Device**
Technological	Economic problem	AI - Minds
		Infinite resources
Macroeconomic	Logistics	Planned economy
	Exploitation	Elimination of labor
		Elimination of currency
Socio-psychological	Material goals	Egalitarian value system
		Genetical alteration of humans

Table 3: *Culture* - Overview of Identified Obstacles and Solutions

The Culture, as noted previously, is at the far end of the post-scarcity scale. Their society knows no material constraints and has full access to goods, as well as services. Humans are able to genetically alter themselves and obtain whatever they may desire. The existence of this completely post-scarcity and egalitarian society is explained through their almost all-powerful AI overlords, the Minds. The Minds are the ultimate plot device that enables all of the remaining ones. Without them, there would be no abundance of resources, planned economy, or ethical imperative.

4.4 Parallels between Science Fiction and Economic Theory

The following section of the study aims to explore the previously interpreted works of fiction through the lens of the theoretical framework, as per the utilized coding techniques. It is divided into three subchapters, each focusing on one of the three main viewpoints indicated

in the framework, starting with technological advancement, macroeconomic aspect, and, finally, social psychology.

4.4.1 Technological Advancement

Industry 4.0, emerging from advances in robotics, AI, and low-cost production brought about questions of humanity's ability to keep pace with its own technological progress (Mizerák, 2019, p. 120). More precisely, are leaps in technology alone sufficient to lead humanity to post-scarcity? This section of the study explores how economic theories reflect on the overlap between the human and the technological, through the lens of sci-fi.

Technology has continuously allowed for ever-greater market flexibility and the lowering of prices. Several economic theories stress its ability to bring growth and progress (Greenwood & Vandenbroucke, 2005; Keynes, 1963). Does this mean that a point of no scarcity by means of infinitely decreasing prices is inevitable? If yes, how would humanity deal with it? The examined sci-fi works demonstrate that ideas on such developments are neither entirely alien outside of economics, nor are they uncommon. Looking back onto Anderson's (2009, p. 12) economy of "free", he notes the shift of certain goods from the physical to the digital space. This shift leads to a negligible production or rather duplication cost, which should be directly reflected in the price. What he means by this is that companies will often give out digital goods or content for free, hoping that this will attract paying customers further down the line. However, if one entertains the idea that anything digital might as well be "free" in one way or another, the question of where this notion is headed arises. By attempting to marry the idea of "what is" with that of "what might be" we dive into the world of sci-fi. Aligned with Anderson's idea of the digital "free", *ST* stipulates that all matter can be scanned and stored "digitally", then "downloaded" through a personal computer, and ultimately reconstituted with the fictional replicator. Then, does the post-scarcity of the digital space, in any way, foreshadow post-scarcity in the physical world? The Culture enjoys the same luxury through access to unlimited resources through harvesting space debris and technology able to transform them into any necessary goods. Finally, Robinson's Martians use technological advancement as a means of reaching outer space and connecting planets with the aim of resource exchange. Unlike in the previously mentioned works, their access to resources is not infinite; however, technology, more specifically the space elevator, allows them to start treading towards a post-scarcity world, where resources are easily attainable, at least within the solar system. They possess the technological capacity to create fertile plains from arid deserts through terraforming (Abbott, 2003, p. 38).

Theory stipulates that technological progress is leading towards an age marked by beings possessing beyond-human levels of intelligence (Vinge, 1993, p. 12). On the one hand, Pettman (2019, p. 29) even goes as far as to claim that humans have already reached their "posthuman" state and rely on algorithms for suggestions on how to feel and form opinions. On the other hand, Industry 4.0 forecasts automation of entire professions by 2050 on the grounds of AI development (Skilton & Hovsepian, 2017, p. 23). Pettman's statements reflect the situation in the *Culture* series, where humans are entirely reliant on their AI "masters" for fulfilling their wants and needs. Similarly, the Culture also depicts the automation of numerous menial jobs, which are performed by non-sentient machines. This tendency towards seeking out perspectives and solutions from beyond human cognition is present even today, as individuals rely more and more on algorithms for the creation of a better society (Shapiro, 2018, p. 38). For example, AI is already utilized in optimizing energy consumption of data centers (Skilton & Hovsepian, 2017, p. 250). The prognosis of increasing reliance on AI is no less relevant to the remaining works, in spite of featuring most prominently in the *Culture* series. In *ST,* humans rely on machines and their computing power just as much; even though they do not possess the same amount of intelligence or self-awareness as the Minds do. Robinson does not shy ways from introducing certain levels of AI either, exemplified by John Boone's ship AI whom he regularly talks to. The latter two works present an image of AI much closer to the one available today. Both are described as computer systems with incredible information processing capability, while humans still have the final word. Intelligent and creative thinking is left to humans, while statistical analysis is performed by AIs. However, Banks believes that reaching a post-scarcity state is only possible by relinquishing control to AIs; thus, he reflects Licklider's (1960) theory of a "man-computer symbiosis" - where humans are merely the machines' helpers, instead of the reverse being true. Turner (2006, p. 123) goes a step further by claiming that cybernetics as a science reveals the aggregate functioning of humanity and their surroundings, including machines – again emphasising the "man-computer symbiosis" that is already emerging today.

AI does not necessarily only mean having a computer overlord, or an algorithmic decision-making companion. An example of contemporary developments from the realm of AI research are self-driving vehicles. All three works of fiction examined here already approach self-driving vehicles as a given. It is never particularly emphasized nor deliberated on. The presence of supercomputers almost automatically means that ships, cars, or any other means of transportation are able to drive without the supervision of a person. In *ST*, as well as

Mars, there are manual overrides, while *Culture*, of course, hands any sort of driving, save perhaps for leisure purposes, entirely to AIs. Shapiro (2018, p. 39) goes as far as to predict that self-driving cars will evolve into self-owning cars in just several years. He argues that a vehicle operating at peak performance would have to be self-sufficient if it is to operate twenty-four hours a day,

> "Given the widespread availability of self-driving cars in a coordinated transport system, people will not want to own a car anymore, and they will want the cost of a ride to be as low as possible. It will not be a new set of large corporations either who will own the cars, but rather the cars who will own themselves. Each car will manage its own finances, customer service responsibilities, and maintenance." (Shapiro, 2018, p. 39)

Therefore, cars are going to become a public good through a system that is referred to as private ownership today (Shapiro, 2018, p. 39). A parallel can be drawn between both *ST* and *Culture*, where their AI systems are responsible for determining the optimal amount of resources to be utilized. The difference here is that theory refers to a specific device, i.e., a vehicle, which would be taking care of its own functioning. In a way, this is a step closer to relinquishing control to beings capable of more precise computation and might indicate an inclination towards allowing other aspects of life, i.e., economics, to be managed by AI systems.

Problem	**Fiction**	**Theory**
Finite resources as an obstacle	• replicators • mining debris out of space • space elevators • terraforming	• movement of goods from the physical to the digital space • 3D printers, Genie
Natural capital depletion	• Space exploration • mining debris out of space	• Space exploration
Optimization; resource management	• the Minds • AI technology	• Predictive algorithms • self-driving cars
Man-computer symbiosis	• Data, • the Minds • drones	• Electronic persons
Menial work	• Non-sentient machines	• Machines
Time as currency	• Elimination of disease and life prolongation	• Decoding the human genome

Table 4: Parallels between Sci-Fi and Theory (Technological Advancement)

Another aspect of AI to consider are "electronic persons", as the category is referred to in EU robotics-related legislation (Skilton & Hovsepian 2017, p. 239). Skilton & Hovespain

(2017, p. 70) note that cognitively advanced machines have been part of the general community for the last two decades. The character of Data in *ST* is not only a cognitively capable individual but serves as a part of humanity teaching humans about themselves (Shapiro, 2018, p. 40). In a way, he serves as a reflection of human emotions, ethics, and creativity, simply by not possessing those traits (Shapiro, 2018, p. 40), or as Pettman (2019, p. 25) defines it, "the human is the animal that relies on technology in order to realize its humanity." Similar to robots being declared "electronic persons", Data is judged to be a sentient being with the right to make his own decisions. In *Culture*, it is not only the hyper-intelligent Minds that are thought of as being independent sentient individuals, but also every drone with an agreed-upon level of intelligence beyond the "animalistic" one of machines designed for more menial labor. Thus, sci-fi, in a way, reflects the possibility of electronic persons becoming more than programmed machines and being able to live independent lives as individuals. Benevolent "electronic persons" are primarily a trope encountered in utopian science fiction, i.e. post-scarcity fiction, and as such indicate at a potential move in a similar direction in the real world, especially taking into account different types of machine learning already in existence, i.e., AIs learning and adapting to their environment (Skilton & Hovsepian, 2017, p. 121).

One aspect of higher levels of artificial intelligence that should not be overlooked is the implied speed at which AI can improve its own problem-solving capabilities. Humans cannot develop the boundaries of this ability for themselves faster than natural selection would allow (Vinge, 1993, p. 12). Theory predicts that once AIs have taken over progress, the speed of development will substantially increase (Vinge, 1993, p. 12). When observing humanity's history, it is notable that everyday life started changing with increased frequency around the start of the eighteenth century (Keynes, 1963, p. 2). Prior to that, there was very little change in the standard of living (Keynes, 1963, p. 2). This lack of progress was mainly due to the inability to accumulate capital and the absence of important technical improvements – fire, language, domestication of animals, agriculture were all already known (Keynes, 1963, p. 2). It is at the start of the 18th century that humanity went through the 1st industrial revolution, wherefrom all the others followed over a relatively short span in human history. The introduction of machines into near every aspect of life led to an increase in the speed of technological progress over the past two centuries, reinforcing the idea that machines, and AI as one of their likely developmental avenues, increase the probability of progress overall.

Looking back on individual technological inventions mentioned in sci-fi, there is one more comparison to be made. Namely, the similarity between *ST*'s replicators and several contemporary inventions. Replicators are by far more advanced than a 3D printer; however, the use of 3D printers is becoming more commercialized and thus available to every household. What this means, in the long run, is unclear, but what it currently presents is a device conceptually very similar to its fictional counterpart. A certain set of parameters and characteristics, or "a pattern", is fed to a machine, which then automatically produces an item, part, or tool with the raw materials provided. In terms of scale, more recent iterations of 3D printers are compact enough to pass as household appliances (Saadia, 2016, p. 66). Ignoring the vast disparity in levels of technological sophistication and complexity, a replicator essentially operates along the same lines and is even shown as an appliance and often treated as such in *ST* as well. 3D printers are still far from having the ability to replicate just about anything by knowing its pattern, but they are one step closer. Similarly, a device called Genie is able to reheat and rehydrate stored ingredients which results in a full meal in just 30 seconds (Saadia, 2016, p. 65). The Genie has already gotten the nickname of a "real-life Star Trek replicator" (Saadia, 2016, p. 65). Demonstrating once again that, although fiction might seem distant and unattainable, it is much closer than one might assume.

Natural capital available to humans is continuously experiencing depletion. Human life is, for all intents and purposes, confined to a single planet and dependent on its finite resources. This is the first and most obvious resource obstacle on any trajectory to post-scarcity. Therefore, how can humanity continue to pursue such a course when faced with scarcity right out of the proverbial starting gate? Technology is often presented as the primary potential source for a solution to this problem (Saadia, 2016, p. 80). The first steps have already been made by setting foot on Earth's natural satellite, and placing a considerable amount of infrastructure into orbit, specifically referring to Earth's artificial satellite network used for navigation and telecommunications. The next logical step would seem to be venturing out further into space, and thereby rendering scarcity at home a relatively moot point, according to fiction. Exploration of the galaxy/solar system seems to lead all three of the aforementioned sci-fi works towards unfathomable amounts of resources. While on Earth, a number of organizations keep claiming that the next frontier for humans is space exploration (Abbott, 2003, p. 30). Would space exploration then lead to a source of unlimited energy, and what would that mean? Having an inexhaustible source of energy, along with an inexhaustible source of resources, would most certainly change the very fundamentals of economics as a

science (Hawking, n.d., as cited in Milanović, 2018, p. 31). These two instances are what, along with several other technological inventions, lead to a post-scarcity economy in our sci-fi sample. *ST'*s humans are able to explore other worlds, mine resources, even convert energy back to matter, and keep their citizens satisfied through no visible scarcity. The Culture uses debris found in space as a source of infinite resources and has long solved its energy problems through technology, again allowing for a society purely based on post-scarcity principles. Robinson's Martians are still on their way towards full post-scarcity, however, they have also learned to use technological advancement for traveling between planets and exchanging newly developed or existing resources between different colonies. Returning to the issue of Earth, and Earth's natural capital depletion, technology is the one thing keeping the hope alive that fossil fuel industries will be replaced through further inventions and innovative solutions to increased consumption, such as car-sharing (Skilton & Hovsepian, 2017, p. 247). However, it is not only the demand for fossil fuel that is presumed to decrease with the invention of new technologies; it is prudent to assume that new ways of resource management are also possible, thus allowing for increased sustainability, recycling of goods, and their potential equal allocation (Bruns, 2000, p. 8). Sci-fi authors assert that such resource management through technological advancement can be beneficial, with the example of Culture Minds, who are capable of careful examination and computation, thus allowing for the fairest possible resource allocation on a staggering scale of complexity. At the present level of development, humans are still far from managing all aspects of Earth's resources and much less of undertaking terraforming of other worlds (Nicholson et al., 2019, p. 5). This has not prevented continued attempts at environmental control, which can potentially lead to an ability to control planetary environments (Nicholson et al., 2019, p. 5). In any case, technology will be at the heart of whatever invention helps to bring the world on a more sustainable road (Nicholson et al., 2019, p. 8).

It is important to note that all three works demonstrate some sort of gene manipulation. In *ST* it has been forbidden to enhance humans, due to potentially disastrous consequences, while Mars and Culture humans proceed to freely extend their lives, and even consciously control their metabolism through built-in drug glands. In reality, humans have only managed to decode the human genome in the past 30 years (Skilton & Hovsepian, 2017, p. vii). So far, there is little to indicate advancement will make anything close to what is found in sci-fi possible within the foreseeable future.

Herkert & Banks (2012, p. 113) claim that technological progress is inevitably going to cause the world to be more connected and function more sustainably. Konior (2019, p. 58) goes on to agree with this point by stating that it will create an even playing field for all. The sci-fi carefree world of abundance is also shown to be a byproduct of technological progress. Therefore, Industry 4.0 is to lead to the creation of more capital, which will, in turn, allow humans to accumulate more and drive economic growth, thus leading to additional technological advances and potentially even social change (Skilton & Hovsepian, 2017, p. 6), i.e. post-scarcity. History has shown that humans are capable of seeing the unimaginable and turning it into reality through technological innovation (Davies, 2018b, p. 22).

> "For the first time in history, technology has reached an open end. The potential for technological development, for providing machines as substitutes for labor is virtually unlimited. Technology has finally passed from the realm of invention to that of design—in other words, from fortuitous discoveries to systematic innovations." (Bookchin, 1986, p. 117)

4.4.2 Macroeconomics

Scarcity is the main argument justifying capitalism and it is perceived as a constant rarely brought into question (Xenos, 1989, p. 26). The necessity of scarcity is perceived as a widely accepted discourse and as the most appropriate solution to all economic dilemmas (Mehta et al., 2019, pp. 223-224). Therefore, one might wonder whether technological advancement is indeed the answer to achieving post-scarcity, or if the solution is more complex than initially perceived? This section of the study deals with different macroeconomic aspects through the views of post-scarcity theorists, thus, juxtaposing them with their sci-fi parallels. Having focused on technology as one of the aspects influencing change in the previous section, this one redirects its focus on issues such as aggregate demand, politics, the growth of the population followed by finite resources, climate change, and stress regarding food supply (Skilton & Hovsepian, 2017, pp. 23–24). All of these factors are leading the transformations of micro- and macroeconomics towards the direction of sustainability, automation, and rising consumption. (Skilton & Hovsepian, 2017, pp. 23–24).

The dominant contemporary economic problem is that of unlimited wants and finite resources (Sheehan, 2009, p. 35). Scarce goods conform to certain laws in terms of price movement being dependent on the demand (Robbins, 1932, p. 106). Economics as science teaches that the aggregate demand of all economic actors leads to a material improvement for all, meaning that competition among producers of the same good leads to innovation (Saadia, 2016, p. 34). Subsequently, innovative products become substitutes for already existing

goods, thus leading to price reduction and higher access to goods – material improvement for all (Saadia, 2016, p. 34). Therefore, with constant aggregation, high-priced goods of today will inevitably become cheap in the long run, either because production costs are lowered or a substitute has been introduced (Saadia, 2016, p. 79). This process happens to almost all goods, resulting in economic growth born of fluctuations in aggregate demand and output, along with an ever-rising consumption (Sheehan, 2009, p. 15). Therefore, when talking about productive or innovation power, one is actually referring to the power of satisfying demand(Robbins, 1932, p. 48). As one's ability to satisfy demand fluctuates, so does one's power (Robbins, 1932, p. 48). At times, the economic power of certain players is so effective that governments need to intervene in order to prevent inflation as a result of increased aggregate demand i.e., fiscal policy (Sheehan, 2009, p. 38). To solve this problem, Robinson, in the Mars trilogy, envisions a post-scarcity future where there is infinite supply and infinite demand, thus, eliminating the potential power of individual economic players (D'Adamo, 2015, p. 84) and interventions of governments. The Culture has a similar setup, where goods are incredibly cheap to produce and are distributed all around, allowing them to eliminate the aspect of hierarchy entailed by one's ability to acquire a specific good (Bambini, 2015, p. 58). The situation in *ST* is not much different – having the replicator available to each and every individual, acquisition becomes pointless, and the only collectible items are those rare ones from the past, as per example of Picard's figurine statue from an extinct civilization and Sisko's baseball card.

This is where the question of plausibility rises, not in terms of resources, but in terms of macroeconomic systems. Despite theoretical speculation about the future of economics, one of its most dominant characteristics is inequality (Sheehan, 2009, p. 4), also identified as a major obstacle in both *ST* and the *Mars* trilogy. Namely, certain social groups have surpassed sufficiency already in the 18th century, which only led to an increase in appetites (Sheehan, 2009, p. 27), i.e. conspicuous consumption. What followed is an amplification of advertising and promotion of consumption (Sheehan, 2009, p. 27) which is an ongoing phenomenon. Keynes advocated for control of aggregate demand and employment as a path towards post-scarcity. According to him effective demand and full employment are realized only when consumption and investment are in an optimal relationship, meaning that the "current investment provides an amount of demand just equal to the excess of the aggregate supply price of the output" (Keynes, 1936, p. 22). In case consumption and rate of investment lead to a deficiency in demand, the loss of real wage – level of employment equilibrium is

inevitable (Keynes, 1936, p. 23). This is exactly what brings the level of employment to a deadlock before reaching full employment is achieved (Keynes, 1936, p. 23). Although not completely equal, Banks' Culture utilizes a similar type of control – for survival in space, humans are entirely dependent on their controlling body to provide them with "employment" and "goods", thus, in a way determining both the aggregate demand and the supply (Banks, 1994, p. 2). However, unlike in Culture where consumption and accumulation are shown as constants, those tend to shift in the contemporary society thus causing the previously mentioned disbalance between demand and employment (Chernomas, 1984, p. 1011). Robinson solves this issue by making sure that each of his Martians is taken care of on the most basic of levels, while still having to contribute to the larger society in one way or another. *ST'*s Federation, along with having replicators, eliminates involuntary labor thus circumventing the issue of supply and demand. Taking a step back to economic theory, Keynes was of the opinion that the economic problem would be solved in the near future (Chernomas, 1984, p. 1010) as a result of abundance becoming the norm instead of being a privilege (Saadia, 2016, p. 154) similarly to what is encountered in both *ST* and *Culture*. However, it is important to note that both of those universes achieve their status through technological inventions and significant political changes. For Keynes, control of consumption was the key to a post-scarcity society (Chernomas, 1984, p. 1010). This contradicts the belief that technology might solve all economic problems – politics is at the heart of economics and no amount of engineering will make it disappear (Chang, 2018, p. 40), thus supporting the initial argument that any answer to a post-scarcity society is much more complex than simple innovation.

As a result of goods and resources never being in infinite supply, individuals and societies alike must make decisions regarding their allocation (Saadia, 2016, p. 14). Some economists believe that the future belongs to planned economies, where states are the ones deciding on resource distribution (Davies, 2018b, p. 15). Theorists further suggest that economics should be rethought, and brought to an automated state where everyone receives a universal income (Godhe, 2018, p. 259; Willems, 2018, p. 73). Keynes's outlooks go on to support this notion by refuting capitalism as the main culprit against achieving a post-scarcity society (Chernomas, 1984, p. 1008). According to him, state intervention is needed for achieving any sort of egalitarianism, ultimately resulting in a planned economy (Bambini, 2015, p. 57). Additionally, his conviction was that experts in charge need to be egalitarian guardians of democratic values (Lewis, 2011, p. 81) if post-scarcity is ever to be achieved.

Robinson firmly asserts this in his *Mars* trilogy through the introduction of a carefully planned economy which reaches to the smallest of details (Horn, 2018, p. 55). Similarly, *ST* shows a prototype for a society where wealth is equally distributed and a planned economy is viewed as the norm (Milanović, 2018, p. 28). Banks affirms this through in his essay on the *Culture* series, stating how a planned economy is the most productive economy (Banks, 1994, p. 3), which is clearly visible in the course of the series, where the Minds take care of allocation and distribution of resources, with no input or knowledge from humans. As long as sentient beings are not considered one of those resources, no more appropriate system is possible (Banks, 1994, p. 3). Leaders of societies in each of the three sci-fi universes are always represented as just and moral, thus reaffirming Keynes' belief of guardians upholding democratic values. Bambini (2015, p. 21) goes on to affirm this by indicating how the government is responsible for the prevention of exploitation. Going back to Keynes, it is evident that he believed how economic disparity will not correct itself, and that a planned economy is the most effective way to confront social problems and scarce resources (Bambini, 2015, p. 58). However, for a planned economy scheme to work out, a mutual goal and continual determination of all participants is necessary (Banks, 1994, p. 3), much like shown through the Martians' cooperation, the Federation's ever-present moral and ethical values, and the benevolent and moral nature of the Culture's Minds.

Problem	**Fiction**	**Theory**
• Limited resources, unlimited wants • Inequality, poverty • Allocation of goods	• Control of aggregate demand in combination with planned economy (*Mars*) • Planned economy with almost infinite supply (*ST* & *Culture*)	• Control of aggregate demand, i.e. government intervention • Planned economies with/without elimination of labor and currency • Abundance

Table 5: Parallels between Sci-Fi and Theory (Macroeconomics)

Disparity is still a dominant characteristic of the human condition (Sheehan, 2009, p. 4). The economic theory stipulates that individuals and companies will inevitably come to decisions purely based on self-interests, thus causing the aforementioned competition and lowering of prices (Saadia, 2016, p. 34). However, Piketty argues that the rate of growth of income and output exceeded by a rate of return on capital directly undermines democratic values societies are based on, thus leading to an oligarchical state, where a small percentage of the population maintains control over the largest wealth (Piketty, 2014, p. 514). According

to him, the drift towards an oligarchy is real and working-class citizens are continuously put into situations where the rich get favorable treatment, despite the overall wealth of the world increasing (Piketty, 2014, p. 514). The same view is further highlighted through the Atkinson-Stiglitz theorem claiming that the majority of the world's growing wealth goes to the wealthiest, escalating inequality further (Stiglitz, 2013). Banks emphasizes the same issue in his short story *A State of the Art*, by directly commenting on Earth's economic system,

> "On Earth one of the things that a large proportion of the locals is most proud of is this wonderful economic system which, with a sureness and certainty so comprehensive one could almost imagine the process bears some relation to their limited and limiting notions of either thermodynamics or God, all food, comfort, energy, shelter, space, fuel and sustenance gravitates naturally and easily away from those who need it most and towards those who need it least." (Banks, 1991b).

ST's Federation solves these issues through the invention of replicators, which manage to resolve any mismatches between supply and demand, which leads to the elimination of markets as we know them. Unlike in today's world where imbalances are most often settled through price-fixing mechanisms (Saadia, 2016, p. 68),

> The big deal is this: because of the replicator, nobody in the Federation has to work ever again. Nobody. Ever. The compulsion to work in order to survive has vanished. And furthermore, because of the replicators' ubiquity, the necessity for markets has vaporized as well. Imbalances in supply and demand have largely become moot. The entire edifice of society as we know it has been upended. (Saadia, 2016, p. 59)

Along with labor elimination, sci-fi societies this thesis is dealing with no longer utilize currency, indicating further that goods have become abundant and the need for their allocation and distribution has dissipated (Saadia, 2016, p. 30). The Culture would regard money as "a crude, over-complicated and inefficient form of rationing" (Banks, 1987), in *ST*'s Federation it has become obsolete and labor is performed only as a means of leisure (Saadia, 2016, p. 14), while Robinson's Martians clearly state at the beginning of the trilogy that money no longer matters (Robinson, 1993).

Next to the potential introduction of new policies, universal income, and control of aggregate demand, there is one aspect of macroeconomics that is not as easily managed – natural capital. In the end, bringing humanity to a post-scarcity state hinges on already depleting natural capital (Saadia, 2016, pp. 76–77). At the end of the day, technology is still the best way humanity has found in dealing with the limitations of the natural world (Saadia, 2016, p. 80). Even if getting off Earth was a possibility tomorrow, it would still not be a permanent solution to resource scarcity, the effort needed to mine resources out of space at this point in history tremendously outweigh any potential benefits (Canavan, 2012, p. 2). Therefore, relying on solutions such as physically reaching places in outer space that would

allow humanity to proceed with an increase in consumption is rather low, despite sci-fi authors claiming otherwise. Bambini (2015, p. 67) argues for state regulation of all venerable materials, again making a reference to planned economies. This leaves humanity with the option to halt economic growth and redistribute the capital that is available (Sheehan, 2009, p. 34), similar to what Robinson's Martians do on Mars with their limited amount of resources, or how *ST*'s Federation citizens redistributed wealth in order for everyone to have enough and nobody too much.

4.4.3 Social Psychology

There is a fundamental difference between thinking in terms inherent to abundance and thinking in terms of scarcity. Contemporary human thought patterns are rooted in terms of scarcity thinking (Anderson, 2009, p. 159). Every person, from a very young age, becomes familiar with the notion of scarcity in one way or another, making it, to a certain extent, the foundation of individual thought patterns (Saadia, 2016, p. 76). Anderson (2009, p. 40) further confirms this by noting how those resources that become abundant are no longer perceived as such, due to the lack of decision-making pressures surrounding them (Anderson, 2009, p. 40). As such, material scarcity provides the justification for the development of a number of social systems and norms like nuclear families, private property, the state, etc. - again due to the necessary allocation of resources (Bookchin, 1986, p. 11). More specifically, the idea of a nuclear family stems, in part, from the historical need of one parent being employed and providing, with the second parent taking care of the household and offspring, making them dependent on each other. Additionally, the nuclear family facilitated a stable route for generational wealth by standardizing inheritance customs to some degree and further assuring concentration of capital over time. The slow disappearance of this norm is even visible in our society today where individuals are becoming more independent and the need for a nuclear family is becoming more of a choice than a necessity. Scarcity, thus, represents much more than a mere lack of resources, it encompasses social relationships and fosters cultural differences among humans (Bookchin, 1986, p. 13). This is plainly shown in Robinson's *Mars* where scarcity-based values shape the society and interhuman relationships for the majority of the trilogy further confirming how much of humanity's moral make-up is constituted of scarcity generated tensions (D'Adamo, 2015, p. 89, 96). Martian children born into abundance perceive relationships differently and are primarily motivated by world exploration and social interactions (D'Adamo, 2015, p. 92), even fixed notions of a nuclear family and private property are foreign to them. Robinson envisions an end to the economic

problem, followed by changes in social constructs and psychological values, mainly relationships and self-advancement, as affected by the presence of post-scarcity (D'Adamo, 2015, pp. 84, 92). *ST* also depicts how in a state of abundance humanity can focus on sharing and learning as the uttermost ideal of society. In the Federation, the social bond is the epitome of societal wealth (Saadia, 2016, p. 42). Banks affirms this by having his Culture be primarily rooted in developmental transformation rather than only technological advancement ("Why the Culture Wins: An Appreciation of Iain M. Banks," 2017). Godhe (2018, p. 247), thus, poses the question of why then is humanity treading on the already familiar trajectory when it could be entertaining ideas of new and never before seen social constructs. As per all three sci-fi examples and previously mentioned theories, it is obvious that humanity's deeply entrenched social values are what is preventing any sort of meaningful change; i.e. a significant shift in the perception would need to happen for post-scarcity to become plausible, on a global scale. However, presuming that the shift does happen, the question of finite resources remains, barring sudden unpredictable innovation and development.

One way in which Robinson emphasizes the plausibility of his utopian post-scarcity is through giving Martians an entire planet that is physically isolated from established social values. What humans do in *ST* is that they partially substitute the utility of money or currency for reputation. To them, what is remaining is the desire to be accepted and loved by others (Saadia, 2016, p. 83). A similar notion is already familiar to us through the development of social indicators and social accounting as non-monetary measures of value in the business world (Davies, 2018b, p. 21). Unlike actual currency, reputation is to be maintained and is not something one can lose forever or go into debt with (Saadia, 2016, p. 35).

How then do we differentiate between reputation as currency and the need for social status recognition? Contemporary society views the acquisition of wealth, rather than reputation, as a sign of social status or one's position in the social hierarchy (Saadia, 2016, p. 31). Therefore, as Keynes (1963, pp. 6–7) noted, once there is no more of this accumulation of wealth, what we are left with are moral principles and human qualities that determine our "social standing". This shift is first and foremost a social process that needs to happen on an individual, and later, communal level (Bookchin, 1986, p. 66). This is where post-scarcity comes in because once it provides abundance to all, there will be no more need for conspicuous consumption (Bookchin, 1986, p. 17). The Federation does exactly this by allowing its citizens to think from the standpoint of abundance thus having their universe unbound by economic necessity, leading to a society where consumption, social hierarchy,

and profit-seeking no longer make sense (Saadia, 2016, p. 127), but having a good reputation that allows you to foster good relations with your peers does make a lot of sense. In contrast to the contemporary situation where personal status is of greater value than benefiting marginalized groups who need it most, thus leading to an even greater level of marginalization (Mehta et al., 2019, p. 224).

As Bookchin (1986, p. 41) notes "only by a supreme act of consciousness and ethical probity can this society be changed fundamentally." The aforementioned change in consciousness can also be referred to as Reich's Consciousness III rejecting authority and invoking the collaboration of citizens (Ulrich, 1971, p. 522) which is, again exactly what happens in all three of the sample fiction works. In *Mars*, post-scarcity means the redrawing of the fundamentals of human society through hard labor (D'Adamo, 2015, p. 83). In *ST* we already encounter those values, and in *Culture* as previously mentioned they are aware of their own interdependence and thus live harmonious lives.

The socio-political dimensions of scarcity continue to enable marginalization of the poor, along with introducing measures directly influencing their lives for the purpose of political achievements (Mehta et al., 2019, p. 224). One of the ways fiction authors found a way around this is by granting their humans longer lifespans. Through introducing the gerontological treatment in the *Mars* trilogy, Robinson allows his humans to witness the evolution of their society, thus avoiding making the same mistakes twice. This also removes time out of the social equation, as it is no longer prevalent for individuals to focus on their noticeably short lifespans. They are given the opportunity to build a world that they will want to live in several hundred years down the line; thus, allowing the presence of a general egalitarian worldview, along with post-scarcity aspirations - keeping in mind the utopian undertones of the work. The Culture citizens, on the other hand, are able to extend their lives indefinitely, come back from being dead, etc.; therefore, the passage of time has little effect on their social behavior, allowing for a highly hedonistic way of life.

Problem	**Fiction**	**Theory**
• Established value systems • Focus on material goals • Social status/hierarchy	• Shift of mindset • Physical isolation • Prolonged lifespan • Reputation as currency • Egalitarian value systems	• Shift of mindset • Giving up on one's social standing • Consciousness III

Table 6: Parallels between Sci-Fi and Theory (Socio-psychological)

All things considered, both theorists and fiction authors give focus to the established value systems as one of the main obstacles in reaching a state of post-scarcity. Theorists go on to suggest that changes in society would be necessary for the shift of mindset to happen. The emphasis is mostly on giving up on one's rapacious material goals and superior social standing for the purpose of the greater good. However, the mentioned concepts are so deeply rooted in our thinking that there is little to no possibility of such changes occurring. It is only through the implementation of plot devices that fiction authors are able to introduce settings in which this global shift of perspective is about to happen or has already happened.

5 Discussion

Unlike theoretical thoughts which speculate on methods necessary for achieving a post-scarcity state with deeper roots, in reality, fiction authors have at their disposal a vast playfield for conjuring post-scarcity worlds limited only by imagination. The most common way of achieving this in fiction is through narrative mechanisms or so-called plot devices. It usually works in a way that the author establishes one plot device as a means of explaining abundance, while secondary plot devices are introduced for the purpose of advancing the story. Therefore, fiction, and more specifically science fiction, is of considerable importance for imagining and considering new aspects of economics and the world in general. The aim of this thesis is to identify and extrapolate those plot devices in a sample consisting of the *Star Trek* franchise, the *Mars* trilogy by Kim Stanley Robinson, and the *Culture* series by Iain M. Banks. Further, authors' propositions for solutions to the economic problem are juxtaposed to present-day obstacles with the aim of discovering potential overlaps and implications emerging from them. As stipulated by the theoretical framework, all findings were divided into three main topics, namely technological advancement, macroeconomics, and social psychology, and further discussed in terms of specific samples. The focus was on firstly identifying the narrative devices used by the authors and secondly extrapolating the actual obstacles they needed to overcome in order to showcase societies living in a post-scarcity environment.

Robinson's Martians and *ST*'s Federation citizens both seem to be battling the finity of their resources through inventions of devices that allow greater access to goods. Namely, the Martians invent the space elevator for ease of resource exchange in the solar system, while the Federation is enriched through replicator technology and the ability to produce anything with access to a few relatively abundant materials. The Culture on the other hand does not seem to have any issues with resource acquisition at the point in time where the reader encounters them. Their Minds have already solved the economic problem by mining debris out of space and having the ability to produce just about anything. How this was achieved is never discussed in much detail. According to the examined theory, technology will play a decisive role in terms of battling resource depletion and finding alternatives. A number of devices resembling those in sci-fi already exist, as per the example of the 3D replicator, and Genie. Additionally, technology has allowed for greater access and distribution of goods through the existence of the internet and AI is well on its way to surpassing human intelligence. However, despite the emergence of the so-called Industry 4.0, any speculation about post-scarcity

remains exactly that. Substitutes are produced and technological advancement occurs faster than ever, while most theorists agree that technology has the highest probability of leading humanity towards a post-scarcity economy.

In terms of macroeconomic elements, all three samples name similar solutions, while the initial obstacles do differ to a certain extent. A planned economy, resulting in the elimination of currency and labor, and/or introduction of alternative economic systems are named as the chief solutions for achieving a post-scarcity state. Much like Keynes and his contemporaries predicted, the only solution to disparity, poverty, and allocation of resources seems to be the introduction of a planned economy, and free access to goods that come with the connotation of status relinquishment. What this entails is getting out of capitalism as the taken-for-granted system and allowing technological advancement to introduce ways of satisfying human needs and wants. Since markets are a social construct, much like in fiction, for the real world to start operating in the direction of post-scarcity the focus should not be only on the availability of resources but also on politics and ethics that would allow implementation of planned economies, thus eliminating economic disparity present in the current system.

Surprisingly, what seems near-universally identified as one of the most fundamental obstacles in achieving a post-scarcity state is the human mind itself. Society, in fiction and theory, has been bread on scarcity-based values with mainly material goals through our lifetimes. Robinson's Martians manage to overcome their perspective towards value systems through being first physically isolated, which does not seem to be a plausible option in the globalized world nowadays, and second, by going through a society-wide shift of mindset, enabled through purely fictional avenues. Similarly, citizens of the Federation have experienced a massive shift of perspective on their path towards post-scarcity and have switched to a reputation-based social hierarchy, where social interrelationships are exchanged for previously material social markers. Finally, the whole of the Culture base their beliefs on a common and central set of ethical values and put great stock in making such a perspective possible even well below the abundance threshold. By exchanging material goals with moral ones, the Culture, similarly to the Federation, no longer seeks material wealth but focuses on fostering individual freedom. It is important to note that both Robinson's Martians and Banks' Culture feature humans whose lives have been near indefinitely extended, thus allowing them a different perspective on time and the purpose of life itself. History has demonstrated that although many social groups surpass sufficiency, they always tend to desire more (Sheehan,

2009, p. 27). Therefore, the most important shift that needs to happen is the one in the realm of human consciousness, i.e. evolution to the third level of consciousness - invokes harmonious collaboration of all citizens (Ulrich, 1971, p. 522).

The majority of the results found while examining fiction agree with the research. One surprising aspect is how much, both fiction and theory rely on the human psyche as the foundation in any sort of evolution or advancement. Therefore, the findings entrench the idea of post-scarcity even deeper into theoretical speculation, rather than bringing it closer to practice. Although practical use can be imagined, it is highly unlikely for each and every individual on Earth to surrender to global cooperation.

The focus of the thesis is directed mainly at utopian narratives and examination of optimistic theoretical approaches, resulting in a limitation due to not taking into account dystopian narratives and pessimistic theories. Further limitations are observable in the fact that most theoretical works are based on speculation and little practical backing is present. However, as humanity continuously evolves both in terms of technological advancement and social constructs, it is important to indulge in hypothetical thinking, which provides insights into potential future changes. As proven by numerous fictional inventions that become reality, i.e., *ST*'s own 'tricorders', hand-held communication and computation devices – smartphones of today, H.G. Wells predicting the existence of sliding doors and the atomic bomb, Isaac Asimov's flatscreen TV's, 3D printing machines and self-driving cars, etc. Using imagination as a tool in testing out theories allows for the examination and exploration of ideas that are currently only possible in fictional settings.

Since the thesis divides its focus between three separate subtopics, a suggestion for further research would be a creation of a new theoretical framework for each of the three subtopics and examining them in-depth. During the research phase, it has been recognized that each of the subtopics is vast and could have a separate study dedicated to them. Such research could go deeper into the patterns identified while implementing more real-life and fiction examples.

6 Conclusion

The thesis was thought of as a generic qualitative study conducted through document analysis. The approach was inductive as no initial suppositions were stipulated and the study would only gain its final form after the conduct of the analysis. The author went into the research with an assumption that the bulk of the results would stem out of technological advancement, while socio-psychological aspects were given less focus. However, throughout the analysis, it became apparent that, first, all three of the identified elements (technology, macroeconomics, social psychology) are necessary for speculations about post-scarcity, and second, that the socio-psychological elements might just be the most prevalent ones.

The methodology utilized has proven to be effective in answering the research questions as well as identifying further implications. The following section of the study looks back at the research questions and aims to summarize the findings.

1. What obstacles to a post-scarcity economy do science fiction authors identify?

Science fiction authors identify several obstacles to a post-scarcity economy. From the standpoint of technological advancement, the most commonly perceived obstacle is the lack of resources or lack of access to those resources. In macroeconomics terms, economic disparity and poverty have been identified as the most prominent obstacles to reaching post-scarcity. Finally, from the realm of social psychology, the discussed sci-fi works focus on the scarcity-based norms and value systems, along with the societal focus on material goals instead of ethical ones.

2. What plot devices do science fiction authors use to circumvent their perceived obstacles?

A number of different plot devices are identified as solutions to the economic problem. They have been divided into three categories, namely technological, macroeconomic, and socio-psychological. Technological plot devices include inventions allowing for widespread distribution of resources and goods, more specifically the space elevator. Further, the development of AI systems capable of high-level computation in relation to resource allocation has been identified (the Minds), along with devices capable of converting matter and energy into any desired object i.e., replicator technology. Macroeconomic elements identified mostly relate to an introduction of planned economies, eventually resulting in the elimination of labor and currency. In all three of the sci-fi works the author focused on using similar macroeconomic methods in reaching post-scarcity. They entail the introduction of systems that bring about an egalitarian distribution of goods, as well as opportunities. Sci-fi

humans are able to dedicate their lives to leisure and self-improvement, while machines are usually the ones taking over menial work.

3. What obstacles to a post-scarcity economy do economists identify?

Similar to science fiction, in terms of technological advancement economists identify the finity of resources as one of the biggest obstacles. The finite amount of resources on Earth is emphasized numerous times. It closely ties in with the concept of natural capital depletion and the potential discovery of substitutes. Theorists go on to highlight economic inequality along with poverty as a further obstacle. Stemming out of the previously named issues is also that of the human state of mind, i.e., individuals' thirst for material wealth and status accompanied by a disregard for or neglect of those without access to goods and services.

4. What solutions do economists propose for the obstacles they identified?

Technology is represented as the single most plausible solution to the economic problem; however, any potential technological innovations which could move economies towards post-scarcity are largely based on assumptions and cannot be extrapolated as certain answers. Some of the indicators pointing at technological development that could lead towards a post-scarcity scenario are 3D printers, predictive algorithms, self-driving cars, the existence of electronic persons, as well as the increasing number of machines taking over human jobs. Further, theorists place their hopes in planned economies, as well as an equal redistribution of existing resources. From a sociological and psychological standpoint, the building blocks of society would have to change. Humanity would have to diminish focusing on individual social standing and cooperate on a global level for post-scarcity to become plausible.

5. What parallels can be established between post-scarcity issues and their corresponding solutions for both post-scarcity economic theory and science fiction?

The parallels between theory and fiction are depicted in Table 7. Focus is given to those ideas and concepts most resembling one another with the aim of abridging the overall study results. In the real world as much as in the sci-fi universes, the finity of resources is presented as a problem. This issue is solved in sci-fi through numerous previously mentioned technological devices, while theory points out certain "similar" inventions as potential indicators of post-scarcity, such as 3D printers, predictive algorithms, and the prospect of space exploration. Further, from a macroeconomic standpoint both theory and fiction extrapolate poverty and economic disparity as obstacles. The solutions are rooted in a combination of aggregate demand control and implementation of planned economies, in theory and fiction alike. Finally, it is established societal value systems that are identified as

the most prevailing socio-psychological obstacle. Both fiction and theory authors lay down the idea that a global shift of mindset would need to happen for a post-scarcity scenario to become plausible in the first place.

	Theory	**Fiction**
Tech	Replicators	Movement of goods from the physical to the digital space; 3D printers, Genie
	Space exploration	Space exploration
	AI technology	Predictive algorithms
	Data, the Minds, drones	Electronic persons
	Non-sentient machines	Machines
Macro	Control of aggregate demand in combination with planned economy (*Mars*) Planned economy with almost infinite supply (*ST* & *Culture*)	Control of aggregate demand, i.e., government intervention Planned economies with/without elimination of labor and currency
Socio-Psych	Shift of mindset Consciousness III	Shift of mindset

Table 7: Parallels between theory and Sci-Fi

Based on these conclusions, practitioners should consider examining each aspect of the study in a greater depth for a better understanding of the implications of the current results. Exploring these implications may introduce new ideas into economic theory regardless of the post-scarcity aspect. The study provides valuable information and a reference system for future researchers, as well as fiction authors looking to base their work on established economic principles.

7 References

Abbott, C. (2003). Falling into history: The imagined wests of Kim Stanley Robinson in the "Three Californias" and Mars Trilogies. *Western Historical Quarterly*, *34*(1), 27–47. Retrieved from https://pdxscholar.library.pdx.edu/usp_fac/51/

Aguilar-Millan, B. S., Feeney, A., Oberg, A., & Rudd, E. (2010). The Post-Scarcity World of 2050-2075. *The Futurist*, (February), 34–40. Retrieved from https://www.researchgate.net/publication/216807965_The_Post-Scarcity_World_of_2050-2075

Allcott, H., Lockwood, B., & Taubinsky, D. (2018). Ramsey Strikes Back: Optimal Commodity Taxes and Redistribution in the Presence of Salience Effects. *AEA Papers and Proceedings*, *108*(1), 88–92. https://doi.org/10.1257/pandp.20181040

Allen, C. (1987). *ST:TNG Encounter at Farpoint*. [Television series episode]. USA: Paramount Domestic Television.

Anderson, C. (2009). *Free: The Future of a Radical Price* (1st ed.). New York: Random House Business Books.

Arestis, P. (1996). Post-Keynesian economics: Towards coherence. *Cambridge Journal of Economics*, *20*(1), 111–135. https://doi.org/10.1093/oxfordjournals.cje.a013604

Bambini, K. K. S. (2015). *Science Fiction and Economic Disparity A Study of Utopian Longings*. University of Oslo. Retrieved from https://www.duo.uio.no/handle/10852/44910

Banks, I. M. (1987). *Consider Phlebas* (1st ed.). London, UK: Orbit.

Banks, I. M. (1989). *The Player of Games* (1st ed.). London, UK: Orbit.

Banks, I. M. (1990). *Use of Weapons* (1st ed.). London, UK: Orbit.

Banks, I. M. (1991a). A Gift from the Culture. In *The State of the Art* (1st ed., Vol. 20, pp. 44–51). London, UK: Orbit - Little, Brown and Company (UK) Limited.

Banks, I. M. (1991b). The State of the Art. In *The State of the Art* (pp. 99–205). London: Orbit - Little, Brown and Company (UK) Limited.

Banks, I. M. (1994). *A Few Notes on the Culture*. London, UK. Retrieved from https://samuelfullerthomas.com/assets/a-few-notes-on-the-culture.zip

Banks, I. M. (1996). *Excession* (1st ed.). London, UK: Orbit.

Banks, I. M. (2000). *Look to Windward* (1st ed.). London, UK: Orbit.

Bansal, P. T., Smith, W. K., & Vaara, E. (2018). From the Editors: New Ways of Seeing Through Qualitative Research. *Academy of Management Journal*, *61*(4), 1189–1195. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bsh&AN=131176291&site=ehost-live

Baxter, S. (2015). The Cold Equations: Extraterrestrial Liberty in Science Fiction. In C. S. Cockell (Ed.), *The Meaning of Liberty Beyond Earth* (pp. 13–31). Springer US.

Beall, G. H. (2002). Exploratory Research Remains Essential for Industry. *Research Technology Management*, *45*(6), 26–30. Retrieved from https://doi.org/10.1080/08956308.2002.11671530

Bole, C. (1990). *ST:TNG Hollow Pursuits*. [Television series episode]. USA: Paramount Domestic Television.

Bookchin, M. (1986). *Post-Scarcity Anarchism* (2nd ed.). Quebec, Canada: Black Rose Books. https://doi.org/10.4324/9781351319324

Botelho, T. (2014). Reimagining the Body in Post-Singularity Techno-Utopias. *Spaces of Utopia: An Eletronic Journal*, *2*(3), 70–83. Retrieved from http://ler.letras.up.pt/site/default.aspx?qry=id05id174?=sim

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, *9*(2), 27–40. Retrieved from http://blog.powerdata.es/el-valor-de-la-gestion-de-datos/bid/405060/Qu-significa-la-integraci-n-de-datos

Brown, C. (2001). "Special circumstances": Intervention by a liberal utopia. *Millenium: Journal of Inernational Studies*, *30*(3), 625–633. Retrieved from https://www.researchgate.net/publication/30527024_Special_Circumstances%27_Intervention_by_a_Liberal_Utopia

Bruns, B. (2000). Nanotechnology and the Commons: Implications of Open Source Abundance in Millennial Quasi-Commons. *Constituting the Commons: Crafting Sustainable Commons in the New Millennium, the Eighth Biennial Conference of the International Association for the Study of Common Property*, 1–19. Bloomington, Indiana, USA. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.366.2661&rep=rep1&type=pdf

Burnham, K. (2015, June). Space: A Playground for Postcapitalist Posthumans. *Strange*

Horions, (22). Retrieved from http://strangehorizons.com/non-fiction/articles/space-a-playground-for-postcapitalist-posthumans/

Canavan, G. (2012). *Struggle Forever: Review of Kim Stanley Robinson's 2312*. Los Angeles: English Faculty Research and Publications. Retrieved from https://epublications.marquette.edu/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=1229&context=english_fac

Chang, H.-J. (2018). Economics, Science Fiction, History and Comparative Studies. In W. Davies (Ed.), *Economic Science Fictions* (1st ed., pp. 38–46). Cambridge, Massachusetts: Goldsmiths Press.

Chernomas, R. (1984). Keynes on Post-Scarcity Society. *Journal of Economic Issues*, *18*(4), 1007–1026. Retrieved from https://www.jstor.org/stable/4225503

Clark, B. (1998). *Political Economy: A Comparative Approach* (2nd ed.). Westport, Conneticut: Praeger Publishers. https://doi.org/10.2307/1060314

Cockell, C. S. (2015). Introduction: The Meaning of Liberty Beyond the Earth. In C. S. Cockell (Ed.), *The Meaning of Liberty Beyond Earth* (pp. 1–9). Edinburgh, UK: Springer US. Retrieved from https://www.researchgate.net/publication/300009387_Introduction_The_Meaning_of_Liberty_Beyond_the_Earth

Conway, J. L. (1988). *ST:TNG The Neutral Zone*. [Television series episode]. USA: Paramount Domestic Television.

Coyne, I. T. (1997). Sampling in Qualitative Research. Purposeful and Theoretical Sampling; Merging or Clear Boundaries? *Journal of Advanced Nursing*, *23*(9), 623–630. Retrieved from https://onlinelibrary.wiley.com/doi/epdf/10.1046/j.1365-2648.1997.t01-25-00999.x

D'Adamo, A. (2015). The People Beyond Mars: Using Robinson's Mars Trilogy to Understand Post-Scarcity. *Thesis Eleven*, *131*(1), 81–98. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/0725513615613459

Daoud, A. (2018). Unifying Studies of Scarcity, Abundance, and Sufficiency. *Ecological Economics*, *147*, 208–217. Retrieved from https://ideas.repec.org/a/eee/ecolec/v147y2018icp208-217.html

Davies, W. (Ed.). (2018a). *Economic Science Fictions* (1st ed.). Cambridge, Massachusetts: Goldsmiths Press.

Davies, W. (2018b). Introduction to Economic Science Fictions. In W. Davies (Ed.),

Economic Science Fictions (1st ed., pp. 14–35). Cambridge, Massachusetts: Goldsmiths Press.

Dorn, M. (1997). *ST:DS9 In the Cards*. [Television series episode]. USA: Paramount Domestic Television.

Ewing, J. (2016). Federation Trekonomics: Marx, the Federation, and the Shift from Necessity to Freedom. In J. T. Eberl & K. S. Decker (Eds.), *The Ultimate Star Trek and Philosophy* (1st ed., pp. 115–126). John Wiley & Sons, Ltd. Retrieved from http://reeljeffewing.com/wp-content/uploads/2017/10/Jeff-Ewing-Star-Trek-and-Philosophy.pdf

Flick, U. (2014). *The SAGE Handbook of Qualitative Data Analysis* (1st ed.; K. Metzler, Ed.). Los Angeles | London | New Delhi | Singapore: SAGE Publications Ltd. Retrieved from http://dx.doi.org/10.4135/9781446282243

Fuentes-Nieva, R., & Galasso, N. (2014). *Working For the Few*. Retrieved from https://oxfamilibrary.openrepository.com/bitstream/handle/10546/311312/bp-working-for-few-political-capture-economic-inequality-200114-en.pdf?sequence=19

Glasner, D. (2011). Where Keynes Went Wrong: An Unnecessary Revolution? *SSRN Electronic Journal*. Retrieved from https://www.researchgate.net/publication/228220083_Where_Keynes_Went_Wrong_An_Unnecessary_Revolution

Godhe, M. (2018). After Work: Anticipatory Knowledge on Post-Scarcity Futures in John Barnes's Thousand Cultures Tetralogy. *Culture Unbound*, *10*(2), 246–262. Retrieved from https://www.researchgate.net/publication/328625588_After_Work_Anticipatory_Knowledge_on_Post-Scarcity_Futures_in_John_Barness_Thousand_Cultures_Tetralogy

Goodbun, J., Till, J., & Iossifova, D. (2012). Themes of Scarcity. *Archit Design*, *82*, 8–15. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1002/ad.1421

Gort, M., Greenwood, J., & Rupert, P. (1999). How Much of Economic Growth Is Fueled by Investment-Specific Technological Progress? *Economic Commentary*, p1-. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=a3h&AN=1865801&lang=zh-cn&site=ehost-live

Grech, V., & Grech, P. (2015). Star Trek's Federation : A Keynesian Post-Scarcity Utopia.

SFRA Review, (313), 35–46. Retrieved from https://www.um.edu.mt/library/oar/bitstream/123456789/25492/1/keynes post scarcity.pdf

Greenwood, J., & Vandenbroucke, G. (2005). Hours Worked: Long-Run Trends. In *National Bureau of Economic Research Working Paper Series* (No. 11629). Cambridge, Massachusetts. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=807618

Gunn, J. (2005). The Readers of Hard Science Fiction. In J. Gunn & M. Candelaria (Eds.), *Speculations on Speculations: Theories of Science Fiction*. Lanham, Maryland, US: Scarecrow Press.

Herkert, J. R., & Banks, D. A. (2012). I Have Seen the Future! Ethics, Progress, and the Grand Challenges for Engineering. *International Journal of Engineering, Social Justice, and Peace, 1*(2), 109–122. Retrieved from https://www.researchgate.net/publication/280946869_I_Have_Seen_the_Future_Ethics_Progress_and_the_Grand_Challenges_for_Engineering

Hoeschele, W. (2014, April). Seven Key Elements of an Economy of Abundance. *Grassroots Economic Organizing*. Retrieved from http://www.geo.coop/blog/seven-key-elements-economy-abundance

Holley, K., & Colyar, J. (2012). Under Construction: How Narrative Elements Shape Qualitative Research. *Theory into Practice*, *51*(2), 114–121. Retrieved from https://www.researchgate.net/publication/254315599_Under_Construction_How_Narrative_Elements_Shape_Qualitative_Research

Horn, L. (2018). Future Incorporated? In W. Davies (Ed.), *Economic Science Fictions* (1st ed., pp. 47–60). Cambridge, Massachusetts: Goldsmiths Press.

Jameson, F. (2005). Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions. In *Contemporary Political Theory* (1st ed., Vol. 6). New York: Verso. https://doi.org/10.1057/palgrave.cpt.9300288

Jarva, V. (2014). Introduction to Narrative for Futures Studies. *Journal of Futures Studies*, *18*(3), 5–26. Retrieved from https://jfsdigital.org/wp-content/uploads/2014/04/183-A02.pdf

Keynes, J. M. (1936). The General Theory of Employment, Interest and Money. *Journal of the American Statistical Association*, *31*(196), 791. https://doi.org/10.2307/2278703

Keynes, J. M. (1963). Economic Possibilities for Our Grandchildren. In *Essays in Persuasion* (pp. 358–373). New York: Norton & Co. Retrieved from https://www.aspeninstitute.org/wp-content/uploads/files/content/upload/Intro_and_Section_I.pdf

Kolbe, W. (1999). *ST:DS9 Till Death Do Us Part*. [Television series episode]. USA: Paramount Domestic Television.

Konior, B. M. (2019). Apocalypse Memes for the Anthropocene God: Mediating Crisis and the Memetic Body Politic. In A. Bown & D. Bristow (Eds.), *Post Memes: Seizing the Memes of Production* (1st ed.). Punctum Books.

Landau, L. (1990). *ST:TNG Family*. [Television series episode]. USA: Paramount Domestic Television.

Latham, R. (2019). Reviews of Books. *Extrapolation*, *60*(2), 190. Retrieved from https://www.tandfonline.com/doi/full/10.1080/14753820.2019.1723972

Lewis, H. (2011). *Where Keynes Went Wrong: and why world governments keep creating inflation, bubbles, and busts* (1st ed.). Mount Jackson, US: Axios Press.

Licklider, J. C. R. (1960). Man-Computer Symbiosis. *IRE Transactions on Human Factors in Electronics*, *HFE-1*(1), 4–11. Retrieved from https://groups.csail.mit.edu/medg/people/psz/Licklider.html

Livingston, D. (1996). *ST:DS9 Homefront*. [Television series episode]. USA: Paramount Domestic Television.

Livingston, D. (1997). *ST:DS9 Doctor Bashir, I Presume*. [Television series episode]. USA: Paramount Domestic Television.

Mankiw, N. G. (2009). Macroeconomist as a scientist and engineer. *Voprosy Ekonomiki*, *2009*(5), 86–103. https://doi.org/10.32609/0042-8736-2009-5-86-103

Mehta, L., Huff, A., & Allouche, J. (2019). The new politics and geographies of scarcity. *Geoforum*, *101*, 222–230. Retrieved from https://www.researchgate.net/publication/329083722_The_new_politics_and_geographies_of_scarcity

Milanović, J. (2018). *Star Trek as the Final Frontier: Overcoming the Neoliberal Paradigm*. University of Zagreb. Retrieved from http://darhiv.ffzg.unizg.hr/id/eprint/10460/

Mizerák, M. (2019). Comparison of Transitional Theories to Post-Scarcity in Science-Fiction Literature. *European Journal of Business Science and Technology*, *5*(1), 107–123.

Retrieved from https://pdxscholar.library.pdx.edu/usp_fac/51/

Neoclassical synthesis. (2017). Retrieved from Policonomics website: https://policonomics.com/neoclassical-synthesis/

Newman, J. (2015, October). Star Trek Is Wrong: There Will Always Be Scarcity. *Mises Institute*, 6–8. Retrieved from https://mises.org/library/star-trek-wrong-there-will-always-be-scarcity

Nicholson, S., Kapuscinski, A. R., Locke, K. A., & Webster, D. G. (2019). Can technology save the environment? Lessons from Iain M. Banks' Culture series. *Elementa Science of the Anthropocene*, *7*(40), 11. Retrieved from https://www.elementascience.org/articles/10.1525/elementa.378/

Nimoy, L. (1986). *Star Trek IV: The Voyage Home*. [Motion picture]. USA: Paramount Pictures.

Norman, J. (2014). Ageing Culture: Senescence, Rejuvenescence and (Im)mortality in Ian M. Banks' Culture Series. *EnterText*, *11*(12), 115–138. Retrieved from https://www.brunel.ac.uk/creative-writing/research/entertext/documents/entertext110/7-entertext-ageing-norman-senescence-rejuvenescence-and-immortality-in-iain-m-banks-culture-series.pdf

OpenStaxEconomics. (2016). *Principles of Economics*. Rice University. Retrieved from http://cnx.org/contents/69619d2b-68f0-44b0-b074-a9b2bf90b2c6@11.330

Pettman, D. (2019). Memetic Desire: Twenty Theses on Posthumanism, Political Affect, and Proliferation. In A. Bown & D. Bristow (Eds.), *Post Memes: Seizing the Memes of Production* (1st ed.). Punctum Books.

Pevney, J. (1967). *ST:TOS A Taste of Armageddon*. [Television series episode]. USA: Paramount Domestic Television.

Piketty, T. (2014). *Capital in the Twenty-First Century* (2nd ed.). Cambridge, Massachusetts: The Belknap Press of Harvard University Press.

Pratt, M. G. (2009). From the Editors: For the Lack of a Boilerplate: Tips on Writing Up (and Reviewing) Qualitative Research. *Academy of Management Journal*, *52*(5), 856–862. https://doi.org/10.5465/AMJ.2009.44632557

Ramanayake, K. D. (2019). Critical Introduction of Solow Growth Theory. *Quest Journals Journal of Research in Humanities and Social Science*, *7*(1), 43–56. Retrieved from https://www.researchgate.net/publication/330968151_Critical_Introduction_of_Solow_G

rowth_Theory

Robbins, L. (1932). *An Essay on the Nature & Significance of Economic Science* (2nd ed.). St. Martin's Street, London: Macmillan and Co. https://doi.org/10.1111/j.1468-0335.2009.00792.x

Roberts, A. (2000). *Science Fiction* (J. Drakakis, Ed.). Routledge. Retrieved from http://books.google.de/books?hl=en&lr=&id=NxqEAgAAQBAJ&oi=fnd&pg=PP1&dq=science+fiction&ots=BNJ8kkv1pN&sig=eNNgfYpg_JQjjq9yG2ebRXi2RGA

Robinson, K. S. (1993). *Red Mars*. New York, United States: Del Rey.

Robinson, K. S. (1995). *Green Mars*. New York, United States: Del Rey.

Robinson, K. S. (1996). *Blue Mars*. New York, United States: Del Rey.

Robinson, K. S. (2018). Dystopias Now. *Commune Magazine*. Retrieved from https://communemag.com/dystopias-now/

Saadia, M. (2016). *Trekonomics: The Economics of Star Trek* (1st ed.). San Francisco: Pipertext Publishing Co., Inc.

Saldana, J. (2019). *The Coding Manual for Qualitative Researchers*. Los Angeles | London | New Delhi | Singapore: SAGE. https://doi.org/10.1016/B978-0-323-60984-5.00062-7

Scheerer, R. (1989). *ST:TNG The Price*. [Television series episode]. USA: Paramount Domestic Television.

Scheerer, R. (1994). *ST:DS9 Shadowplay*. [Television series episode]. USA: Paramount Domestic Television.

Schwab, K. (2016). *The Fourth Industrial Revolution*. Cologne/Geneva: World Economic Forum.

Shapiro, A. N. (2018). Gestalt-Ideas at the Interface Between Theory and Practice. *Interface Critique Journal*, *1*, 34–44. Retrieved from https://journals.ub.uni-heidelberg.de/index.php/ic/article/download/44741/41692

Sheehan, B. (2009). An Introduction to the Economics of Abundance. *Heterodox Economics Newsletter*, *1*(76). Retrieved from https://www.heterodoxnews.com/n/htn76.htm

Skilton, M., & Hovsepian, F. (2017). *The 4th industrial revolution: Responding to the impact of artificial intelligence on business* (1st ed.). Meriden UK: Palgrave Macmillan. https://doi.org/10.1007/978-3-319-62479-2

Song, R., Jang, S., & Cai, G. (George). (2016). Does advertising indicate product quality?

Evidence from prelaunch and postlaunch advertising in the movie industry. *Marketing Letters, 27*(4), 791–804. https://doi.org/10.1007/s11002-015-9377-7

Stiglitz, J. (2013). *The Costs of Inequality: Joseph Stiglitz at TEDxColumbiaSIPA*. [Video file]. USA: TEDx Talks. Retrieved from https://www.youtube.com/watch?v=GYHT4zJsCdo

Suvin, D. (1979). Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre. In 1st (Ed.), *World Literature Today* (Vol. 54). Westford, Massachusetts: Murray Printing Company. https://doi.org/10.2307/40135603

Thompson, C. (2000, October). Clive Thompson on Why Sci-Fi Is the Last Bastion of Philosophical Writing. *Wired*. Retrieved from https://www.wired.com/2008/01/st-thompson-26/

Thorsen, D. E., & Lie, A. (2017). *What is Neoliberalism?* Oslo, Norway: University of Oslo. Retrieved from https://pdf4pro.com/view/what-is-neo-liberalism-1ca490.html

Turner, F. (2006). *From Counterculture to Cyberculture: Stweart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. Chicago: The University of Chicago Press. https://doi.org/10.1093/acprof:oso/9780199390236.003.0002

Ulrich, J. E. (1971). The Greening of America. By Charles A. Reich. *Washington and Lee Law Review*, *28*(2), 521–525. Retrieved from https://scholarlycommons.law.wlu.edu/wlulr/vol28/iss2/18/

Veblen, T. (1899). *The Theory of the Leisure Class* (6th ed.). New York, United States: Oxford University Press Inc. https://doi.org/10.1007/978-3-658-08184-3_4

Vejar, M. (1988). *ST:TNG Coming of Age*. [Television series episode]. USA: Paramount Domestic Television.

Vejar, M. (1997). *ST:DS9 The Darknes and the Light*. [Television series episode]. USA: Paramount Domestic Television.

Vinge, V. (1993). *The coming technological singularity: How to survive in a post-human era*. Publication: NASA. Lewis Research Center, Vision 21: Interdisciplinary Science and Engineering in the Era of Cyberspace. Retrieved from https://edoras.sdsu.edu/~vinge/misc/singularity.html

von Mises, L. (1962). *The Free and Prosperous Commonwealth*. Princeton, New Jersey: D. Van Nostrand Company, Inc. Retrieved from https://ia800501.us.archive.org/26/items/freeprosperousco00vonm/freeprosperousco00vo

nm.pdf

Webb, R. (2019). *The Economis of Star Trek: The Proto-Post-Scarcity Economy* (5th ed.). Torraza Piemonte, Italy: Rick Webb.

West, J. (1998). *ST:DS9 Chrysalis*. [Television series episode]. USA: Paramount Domestic Television.

Why the Culture Wins: An Appreciation of Iain M. Banks. (2017). *Sci Phi Journal*. Retrieved from https://www.sciphijournal.org/index.php/2017/11/12/why-the-culture-wins-an-appreciation-of-iain-m-banks/

Willems, B. (2018). Automating Economic Revolution: Rober Heinlein's "The Moon Is a Harsh Mistress." In W. Davies (Ed.), *Economic Science Fictions* (1st ed., pp. 72–86). Cambridge, Massachusetts: Goldsmiths Press.

Williams, R. (1978). Utopia and Science Fiction. *Science Fiction Studies*, *5*(16). Retrieved from https://www.depauw.edu/sfs/backissues/16/williams16art.htm

Xenos, N. (1989). *Scarcity and Modernity*. London: Routledge. https://doi.org/10.4324/9781315112732

8 Appendix 1 - SF Sampling Strategy

SF Work	Type of Work	Focus on Technological Advancement	Macroeconomic Aspect	Utopian Depiction of Society
***Red Plenty* (2010)**	novel	yes	yes	no
***The Moon Is a Harsh Mistress* (1966)**	novel	yes	yes	no
***1984* (1949)**	novel	yes (partially)	no	no
***Bring the Jubilee* (1953)**	novel	no	yes	no
***Chrysalids* (1955)**	novel	no	yes	no
***Mortal Engines* (2001)**	novel	yes	yes	no
***Nausicaa of the Valley of the Wind* (1984)**	film	yes	no	no
***The Bone Clocks* (2014)**	novel	no	no	no
***Mad Max* (1979)**	film	no	no	no
***The Terminator* (1984 – 2019)**	film series	yes	no	no
***The Matrix* (1999 – 2003)**	film series	yes	no	no
***Player Piano* (1952)**	novel	yes	yes	no
***Brave New World* (1932)**	novel	yes	yes	no
***Gattaca* (1997)**	film	yes	no	no
***Mercenary from Tomorrow* (1968)**	novel	no	yes	no
***The Space Merchants* (1952)**	novel	no	yes	no
***Resident Evil* (2002 – 2016)**	film series	no	no	no
***Blade Runner* (1982)**	film	yes	yes	no
***Alien* (1979)**	film	yes	no	no
***Westworld* (1973)**	film	yes	no	no
***Mr. Robot* (2015 – 2019)**	TV series	yes	no	no
***Continuum* (2012 – 2015)**	TV series	yes	no	no
***Incorporated* (2016 – 2017)**	TV series	no	yes	no
***Star Trek* (1966 onward)**	TV series	yes	yes	yes
***The Dispossessed* (1974)**	novel	yes	yes	yes
***The Mars Trilogy* (1992 – 1999)**	novel series	yes	yes	yes

***Pacific Edge* (1995)**	novel	no	yes	yes
***Ubik* (1969)**	novel	no	yes	no
***Down and Out in the Magic Kingdom* (2003)**	novel	yes	yes	yes
***Elysium* (2013)**	film	yes	yes	no
***The Windup Girl* (2009)**	novel	yes	yes	no
***In Time* (2011)**	film	yes	yes	no
***Neptune's Brood* (2013)**	novel	yes	yes	yes
***Citizen of the Galaxy* (1957)**	novel	yes	yes	no
***The Handmaid's Tale* (1985)**	novel	no	yes	no
***Prometheus* (2012)**	film	yes	no	no
***Under the Skin* (2013)**	film	no	yes	no
***Inception* (2010)**	film	no	yes	no
***Forbidden Planet* (1956)**	film	yes	no	no
***2001: A Space Odyssey* (1968)**	film	yes	no	no
***Her* (2013)**	film	yes	no	no
***Ex Machina* (2015)**	film	yes	no	no
***The Common Sense* (2016)**	TV mini-series	yes	yes	no
***Black Mirror* (2011 onward)**	TV series (anthology)	yes	yes	no
***Upstream Color* (2013)**	film	no	no	no
***The Hunger Games* (2008 – 2010)**	novel series	no	yes	no
***Logan's Run* (1976)**	film	yes	yes	no
***Videodrome* (1983)**	film	no	no	no
***Never Let Me Go* (2005)**	novel	yes	yes	no
***Futurological Congress* (1971)**	novel	no	yes	no
***Neuromancer* (1984)**	novel	yes	no	no
***Akira* (1988)**	film	yes	no	no
***Do Androids Dream of Electric Sheep?* (1968)**	novel	yes	yes	no
***Armageddon* (1998)**	film	no	no	no
***War of the Worlds* (2005)**	film	no	no	no

***Children of Men* (2006)**	film	no	yes	no
***The Road* (2009)**	film	no	no	no
***28 Days Later* (2002)**	film	no	no	no
***Moon* (2009)**	film	yes	yes	no
***Avatar* (2009)**	film	yes	no	no
***Doctor Who* (1963 onward)**	TV series	no	no	no
***Revelation Space* (2000)**	novel	yes	no	no
***Star Wars* (1977 – 2020)**	film series	no	no	no
***The Culture Series* (1987 – 2012)**	novel series	yes	yes	yes
***Oryx and Crake* (2003)**	novel	no	yes	no
***Atlas Shrugged* (1957)**	novel	no	yes	no

Table 8: List of SF works & their criteria for the purpose of sampling.