

UNIVERSITY OF TARTU

Faculty of Social Sciences

School of Economics and Business Administration

Ozan Bal

**THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT: THE  
REASONS WHY ROBOTS ARE PERCEIVED AS A DESIRABLE REMEDY**

**MASTER'S THESIS**

Supervised By: Lecturer, Urmas Hõbepappel

Tartu, 2021

## **THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT**

I have written this Research paper/ Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

# THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

## Table of Contents

Introduction .....	4
Literature Review .....	6
Methodology and Theory .....	8
1. Introduction of The Japanese Population Crisis .....	10
2. Main Causes of the Crisis .....	13
2. Negative Effects and Outcomes of Aging and Demographic Decline in Japan, Reasons Why it is Considered a Crisis .....	18
3. Governmental Response to Demographic Decline and Possible Solutions .....	23
3.1. Pro-Natalist Policies .....	23
3.2. Counteracting Policies and Measures .....	28
4. Robots as a Countermeasure for Labor Shortage .....	34
5. Japan's Affinity for Robots .....	38
6. Robots Beyond Just Labor .....	39
Conclusion .....	47
List of References .....	49
Resümee .....	55

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

### Introduction

Since 1975, Japan's total fertility rate has never surpassed the level of 2.1, the replacement level. With one of the highest life expectancies in the world, Japan has faced and continues to face super-aging combined with a population which is decreasing for the past 10 years. Failing to grasp the magnitude of the problem early on, Japan has found itself dealing with a demographic crisis, with its population decreasing and increasingly consisting of the elderly. Although several other developed nations go through similar demographic trends, facing aging and low fertility, Japan's early start, and fast pace has made it the first among many, being the first country to fully start to experience the outcomes of such an issue. The way Japan deals with the situation will provide valuable lessons to other policymakers around the world, on what to do and what to avoid regarding how Japanese policies turn out. Japan, however, does not have this privilege.

In the combat against population crisis, the Japanese government is specifically attracted to one of the approaches, robots. Although Japan is an extraordinarily developed country in the field of robotics and has an outstanding robotics industry with a lot of unparalleled companies, many find robots hard to link with efforts against a declining population. Traditionally, robots are seen as a substitute for human labor. Keeping the issues Japan has with foreign labor and immigrants in mind, robots provided a great alternative. However, just being an alternate to foreign labor in the efforts against boosting the workforce does not explain the amount of attention robots receive as the push on their funding, research and development are not proportional to their use in this sense. The **question that this study aims to answers is why are robots trying to be used against combatting the population crisis in Japan?** Therefore, the occurrences where robots are described as the saviors of Japan from demographic decline are researched to identify reasons behind their preference in the struggle and to determine how they are perceived by their advocates. It is not the purpose of this paper to assess the feasibility and success of the use of robots with certain purposes on the overall fight against demographic decline but to single out why they are being used and to achieve what end in the first place.

To achieve this objective, the paper starts with an analysis of the Japanese population crisis. First, the main causes of the problems are pointed out and discussed. These are important features to be represented in the paper in order to later reference them when robots as a mechanism against demographic problems are addressed. The topics of overworking, cost of childcare, change in gender roles and employment dynamics, and lastly, the changing

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

perception of the family as an institution are reviewed. Later, the negative effects of the demographic decline in Japan are examined. These outcomes certainly make it clear that the problem is urgent and is too alarming to be left on its own. Some prominent ones are decline in the labor force, strains on eldercare and healthcare, decay of the Japanese countryside and low expected growth. They point out why Japan needs to solve the issue as soon as possible.

The paper continues with the assessment of the governmental policies implemented or designed to deal with the population crisis and its outcomes. Here, these are divided into two main groups, one being the pro-natalist policies, aiming to increase the fertility rate and the other being counteracting measures, aiming to mitigate or get rid of the negative outcomes of aging and population decline. Some notable pro-natal policies and famous governmental plans are inspected here where a discussion on the effectiveness of them combined with thoughts regarding the capabilities and boundaries of state intervention to personal life are included. Following that, some remarkable counteracting policies and measures, including non-implemented ideas are presented. Some examples are raising the retirement age, raising the consumption tax to pay for healthcare, increasing the employment of women and perhaps most importantly, immigration. Possible benefits, costs and obstacles against these measures are weighed in this chapter.

Due to robots being a major concern of this paper, and because of later findings, robots are not included in the counteracting measure sub-topic, where it is traditionally put, but are discussed separately. After their traditional understanding as a substitute for a declining workforce is evaluated, the paper moves onto explain the so-called special relationship Japan has with robots. Certain historical facts, socio-religious realities and popular culture's effects on the perception of robots are pointed out. With this background, the paper focuses on and presents the research on the reasons why robots are seen as the best remedy to the problem. Critical discourse analysis is conducted on three pieces of media and text where robots are presented and shown as saviors of Japan, on the "One Day of the Inobe Family" story published in the scope of Inobe 25 initiative, "Robot Town Sagami 2028" animated short published by a municipal government in the scope of the program carrying the same name and lastly a speech given by former Prime Minister Shinzō Abe. Out of these analyses, with a scholarly opinion on human-robot relations and social robotics incorporated, the findings are presented, and three main factors are argued as the chief factors behind Japan's push for robotics regarding the population crisis. A conceptual ground is given to these arguments by the structural

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

functionalist theory and the findings are argued to be in line with the framework the theory provides, ending the paper.

Keywords: demographics of Japan, aging, low fertility, population policy, robotics, human-robot relations.

Research classification codes (CERCS): S250, S170, S210

### Literature Review

The topic of population crisis in Japan has become a field of attention in the first decades of the 21<sup>st</sup> century. This is majorly due to the ongoing and possible serious outcomes that can devastate the Japanese economy and can disturb the social fabric of Japanese society. Therefore, many scholars of area studies, Japanologists, public policy experts and economists and social scientists from a variety of fields are attracted to answer certain questions regarding causes, consequences, and possible solutions for this problem.

The sources on the causes of the Japanese demographic problems are quite sufficient in explaining why the issue came into existence in the first place. Some scholarly work overviews several reasons meanwhile others focus on a specific issue that leads to low fertility. Yamauchi (2018) for example focuses on the issues regarding the working conditions and overworking phenomena while Fukai (2017) specifically aims his attention on the issue of the high cost of childcare in the scope of population crisis. Tsuya's (2017) study on the other hand emphasizes on the gender-employment dynamics relation with fertility. Overall, there is little conflict in the opinions presented on why Japan has low fertility.

There is a wide variety of resources available to study the effects of what population decline and aging are doing and will do in Japan. Although a significant majority of the scholarly work argues that at this pace, the demographic trends and movement of Japan creates a very negative output for Japan in many aspects of socio-economic life, there are also those who argue that population decline, even with aging, can bring better economic prosperity. However, Clark (2010) and Lee and Shin's (2019) empirical studies firmly state and project the negative effects of the problem on the Japanese GDP and growth. An academically popular topic regarding the negative effects of the crisis is the issue of eldercare. This is due to the urgency and how dire the eldercare problem is. Japan faces a hard time creating an effective system to provide care for the increasing elderly population which will only get worse as time passes by. There are a great number of sources in this field. On the other hand, the topic of the decline in the Japanese countryside is not given that much attention. The best is provided by

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Hori (2021) and Matanle (2014) regarding the situation in the Japanese countryside and how it is being affected by the demographic decline.

The focus of the paper continues with the governmental response to the problem and assessment of other possible solutions. Here, the solutions are divided into two groups, as pro-natal policies and counteracting measures. Many sources provide a historical overview of what has been done by the time the study is written. For instance, a chronological list is given by Suzuki (2006) providing the government plans and schemes that were designed and implemented up to 2006. The scholarly opinion is suspicious of the effects of pro-natalist policies as it is highlighted by Ma (2009), measuring the effectiveness of such policies on actual fertility rates is quite hard and may not give credible results. Although there is quite a lot of scholarly work on governmental policies combating low fertility, they are mostly prior to 2015, as new policies are scarcely the case of research due to many waiting to see the results of the policies firstly. There are also warnings like Sato & Beppu's (2016) where they attract attention to Japan's democratic nature and argue that there is a limit to state intervention to individual life, that its boundaries should not be tested.

On the topic of counteracting measures, the attention overwhelmingly is oriented towards the topic of immigrants. From the necessary numbers of immigrants needed (Tsuya, 2010) to Japanese immigration and foreign labor policy, there are plenty of resources. Many also discuss like Roberts (2018) why Japan has a hard time when it comes to immigration and foreigners and their integration. Although it is the case, contemporary articles also point out the recent push for taking more immigrants but many fail to explain the reality other than voicing that the labor shortage is becoming more serious in Japan, missing other possible explanations. Not being as popular as immigrants, other measures also are subject to academic attention providing essential knowledge about policies such as higher women employment and increased retirement age.

The issue of robots in the scope of the Japanese population crisis is almost completely studied as robots being solely having the role of substituting the declining workforce. Many evaluate how robots can be integrated into industries where there is an acute labor shortage. Coco (2018) for example looks for the field of eldercare and the use of robots as carers and concludes Japanese have a much better perception towards robot workers compared to Western societies. Certain studies like Adachi & Kawaguchi's (2021) find that introduction of robots as workers to a greater extent does not affect human workers negatively in terms of wages and

## **THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT**

employment. Meanwhile, Koudela (2019) voices concerns over further individualism and the greater absence of intra-human relations with the introduction of robots as labor in certain fields.

While looking for further reasons for robots being employed to deal with the demographic crisis, it was key to look for contemporary sources explaining human-robot relations. Šabanović (2010) explains how the makers of robots envision their products according to their own values and want them to exist in a manner in line with the makers' perspective and imagination. Focusing on Japan, Kovacic (2018) explains how in the Japanese case, robots are perceived as Japanese and how they are attributed "Japaneseness". A detailed study on Japanese robotics comes from Robertson (2018) where she points out how Japan creates identities, genders and constructs robots as traditional Japanese people, making them an attractive concept for the conservative government.

The review concludes that academia is too focused and stuck on robots vs immigrants debate on the topic of robots participation in the effort against the demographic crisis. Yet the focus on robots should be much more than that. Aspects of using robots more than just for replacing labor are vacant in the existing literature. Serious signals of robots being perceived and promoted as not only a countermeasure but a factor that can eradicate the causes of the problem in Japanese politics are not a topic that is studied and that is exactly the gap this paper wishes to fill. Therefore, with a hypothesis that there is more to robots than being just labor substitution, the research question is to find out why robots are thought of as a remedy to demographic decline in Japan.

### **Methodology and Theory**

This paper has applied to majorly qualitative methods of research. A quantitative method is put into use while the Japanese population crisis is being analyzed. Population projection is conducted by using the SPECTRUM software to compare results given by official Japanese organs, which showed no significant difference. Qualitative methods used in this research include the use of primary resources, secondary sources and critical discourse analysis. Primary resources include certain government policy papers, white papers, speeches of various officials and government media. Secondary resources are applied to grasp the principles of demographical movements, gather a large variety of scholarly opinion on the Japanese population crisis, its causes and effects, Japanese robotics, and human-robot relations. These include the review of statistical analysis, done by the National Institute of Population and Social



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Security Research-Japan and World Bank on certain data regarding total fertility rate, life expectancy, birth rate, death rate, age dependency ratio, etc. regarding Japan.

Critical discourse analysis is the most prominent method in this study which gave way to the findings. It is applied to three pieces of material. One is a fictional story published by the government in the scope of a bigger major governmental scheme, the other being an animated video published by a municipal authority regarding a special project and the last is a speech given by the former Prime Minister Shinzō Abe.

The method of critical discourse analysis is used because the method is designed to analyze how language and media are used to construct a discourse and is presented to the audience. What this study has aimed to achieve is to uncover what kind of reasoning the supporters of robotics against demographic problems have and why they believe robots will help them in dealing with the population struggle Japan is suffering from. Thus, via critical discourse analysis, the rhetoric they represent is uncovered. The pieces that are subject to this method are all items where robots are arguably presented as saviors, which are given by politicians or published in the scope of governmental programs, schemes or policies. Therefore, we employ this method onto pieces where robots are shown as a factor in demographic change, which is provided by people or institutes who are in the power of creating policy to understand why they think so.

The first piece of material used discourse analysis is the “One Day of the Inobe Family” short story. This short story was published in 2007 in the scope of the “Innovation 25” initiative in Japan spearheaded by the former PM, Shinzō Abe. The reason why this short story is chosen is because it is one of the first instances where the Japanese government presented a production where their vision on what robots will or should do in the future is shown. It is critical to do discourse analysis on this material as it is published by the central government, indicating it is showing the agenda of the government at the time and is one of the rare cases where the central government directly shows what it believes robots are for Japan. The second material is an animated video named “Robot Town Sagami 2028” published in 2016 in the scope of a special project carrying the same name. This video is selected because firstly, it is now the output of a local government (Kanagawa Prefectural Government) and unlike a short story with very few visuals, this animated video fully visualizes what local policymakers see robots as and how they are wanted to be utilized in the future. With such representation, it is essential to conduct discourse analysis on this video to subtract ideas behind the use of robots as they are deemed to be connected to the efforts against demographic decline.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

The last material subject to discourse analysis is a speech given on innovation technology and robots by the former prime minister Shinzō Abe in 2017. This speech is selected because it is given by the chief executive of Japan and one of the major promoters of robots where the subject is robots, technology and their future use in Japan and the world. Specific attention the author gives to Japan's problems makes the speech important for the paper as the analysis on it sheds light on what the paper tries to find out. When conducting discourse analysis on these materials from a constructivist perspective, first presuppositions and entailments are highlighted. Next, some indexicality is put on the material, being time, space, the epistemic right and the deontic right given by the author. Through this analysis, it is concluded what kind of discourse is constructed by the author and what is wanted to be transferred to the audience. In our case, we aim to find what kind of discourse supporters of robots construct and how they adapt it to the issue of population.

The major theory that is approached in this study is structural functionalism. The theory provides a good conceptual framework regarding the findings of this paper. Structural functionalism looks at society from a macro level and identifies how different structures have different functions which overall contribute to the smooth functioning of the society. When change is needed, structures attain new functions or new structures emerge to meet the need for new functions as old ones die out. The structural functionalist perspective is found beneficial in this paper to explain the findings as to when looked through it, the results of the analyses done fall on the premises the theory suggests. The general assertion presented is that robots as a structure have certain functions that are needed with the emergence of a new problem and make them desirable for use. The discussion concerning this is placed at the end of the paper after the findings are presented.

### 1. Introduction of The Japanese Population Crisis

The issue of an aging and declining population, more importantly, the decline of the working-age population is evident in many developed countries of the world such as Italy, South Korea, Singapore, and Portugal. Many more are projected to go through the same issue in the next decades. Japan's case, however, is the most severe. Japan's population has peaked in 2010 with the number at 128.070.000, according to the World Bank<sup>1</sup>, which is parallel with the Japanese Bureau of Statistics and OECD. From 2010, the population of Japan started to decline at a slow yet increasing pace and the 2019 data shows us that the current number is at

---

<sup>1</sup> The World Bank - Population, total - Japan <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JP>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

126.264.931. The number may not seem concerning to the uninformed eye, but when we look at the birth rate trends and the age levels of the current population, we certainly see an alarming and threatening near future for the populace of Japan.

There are two types of population change, either positive or negative. First is the natural change. This is simply the difference between the number of births and deaths in a single year so that we can calculate the natural increase or decrease in the population. The second is the global population movement where the people who move in or out in the chosen place are counted to correctly measure the number (Mason, 2001). With a low incoming and outbound populace that will either take or leave residence from Japan, the changes here are extensively natural. In theory, with international movement/migration out of the picture, for a population to stay stable or to minimally increase, the crude birth rate must be higher than the crude death rate. This means that the number of babies being born per thousand people must be either close to being the same or higher than the deaths per thousand people or the populace will face a decline. Total fertility rate (the fertility rate or TFR) on the other hand, is the number of children being born per woman and the number 2.1 per woman is acknowledged as the replacement level, the number that gives stability to the populace, again if international movement, emigration/migration is excluded (Poston & Bouvier, 2010). When we look at these rates (average birth per woman) in Japan, we can quickly see the problem, or arguably the outcomes of certain other problems that Japan has.

The total fertility rate in Japan, according to 2018 World Bank data is 1.42<sup>2</sup>, far below the 2.1 figure. The current birth rate in 2021 is 7.205, meaning that for every 1000 Japanese, 7.205 are born and the death rate is 11.085 carrying the same meaning, 11.085 death per 1000 people<sup>3</sup>. It should be kept in mind that the impact of the Covid-19 pandemic is not a part of the calculation of these numbers and is purposefully ruled out. These numbers are quite marginal as they show that the issue of a declining population is no longer a thing in the projections and graphs regarding future population trends but is in the contemporary context. The last time Japan's fertility rate was above 2.1 was in 1974. 2005 was the bottom year when the fertility rate was 1.26, the lowest in the history of Japan. The increase since then has brought hope yet it became obvious that the fertility rate could not go over 1.45 and made no headway since. It is also important to mention that not only the population is decreasing, the existing portion of the old people (60+ or 65+ regarding the model) is also growing consistently. This

---

<sup>2</sup> The World Bank - Fertility rate - Japan <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=JP>

<sup>3</sup> The World Bank - Japan Death Rate 1950-2021 <https://www.macrotrends.net/countries/JPN/japan/death-rate>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

means a double threat on the working population as the population is decreasing and also aging. Although the problem is not so visible in crowded metropolitan areas, the countryside is already being filled with dead villages or dying ones that have a handful of inhabitants. The projection made by the National Institute of Population and Social Security of Japan states;

“Based on the results of the medium-fertility projection, Japan is expected to enter a long period of population decline. The population is expected to decrease to around 110.92 million by 2040, fall below 100 million to 99.24 million by 2053, and drop to 88.08 million by 2065”<sup>4</sup>. (IPSS - Population Projections for Japan (2016-2065): Summary: II, A-1)

Table 1 shows us the best- and worst-case estimates of how the population will be in 2040, 2060 and 2065 by age group. The continuing part of the paper focuses on the analysis of major contributors and causes of the population crisis in Japan which will be followed by the possible and already existing outcomes of the problem.

Fertility assumption [ long-term total fertility rate ]		Medium fertility variant [ 1.44 ]	High fertility variant [ 1.65 ]	Low fertility variant [ 1.25 ]	Medium fertility variant projection in 2012 [ 1.35 ]
Mortality assumption [ long-term life expectancy ]		Medium mortality variant [ Male: 84.95 years ] [ Female: 91.35 years ]			Male: 84.19 years Female: 90.93 years
Total population	2015	127.09 million	127.09 million	127.09 million	126.60 million
	2040	110.92 million	113.74 million	108.33 million	107.28 million
	2060	92.84 million	98.77 million	87.63 million	86.74 million
	2065	88.08 million	94.90 million	82.13 million	[ 81.35 million ]
Young-age (0 to 14) population	2015	15.95 million 12.5%	15.95 million 12.5%	15.95 million 12.5%	15.83 million 12.5%
	2040	11.94 million 10.8%	13.72 million 12.1%	10.27 million 9.5%	10.73 million 10.0%
	2060	9.51 million 10.2%	11.95 million 12.1%	7.50 million 8.6%	7.91 million 9.1%
	2065	8.98 million 10.2%	11.59 million 12.2%	6.84 million 8.3%	[ 7.35 million 9.0% ]
Working-age (15 to 64) population	2015	77.28 million 60.8%	77.28 million 60.8%	77.28 million 60.8%	76.82 million 60.7%
	2040	59.78 million 53.9%	60.81 million 53.5%	58.85 million 54.3%	57.87 million 53.9%
	2060	47.93 million 51.6%	51.42 million 52.1%	44.72 million 51.0%	44.18 million 50.9%
	2065	45.29 million 51.4%	49.50 million 52.2%	41.47 million 50.5%	[ 41.13 million 50.6% ]
Old-age (65 and over) population	2015	33.87 million 26.6%	33.87 million 26.6%	33.87 million 26.6%	33.95 million 26.8%
	2040	39.21 million 35.3%	39.21 million 34.5%	39.21 million 36.2%	38.68 million 36.1%
	2060	35.40 million 38.1%	35.40 million 35.8%	35.40 million 40.4%	34.64 million 39.9%
	2065	33.81 million 38.4%	33.81 million 35.6%	33.81 million 41.2%	[ 32.87 million 40.4% ]

The figures for 2065 by 2012 projection (in brackets) are those in the long-range auxiliary projections.

<sup>4</sup> IPSS - Population Projections for Japan (2016-2065): Summary [http://www.ipss.go.jp/pp-zenkoku/e/zenkoku\\_e2017/pp\\_zenkoku2017e\\_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1\).](http://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2017/pp_zenkoku2017e_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1).)

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Table 1. IPSS, Summary of Projection Results

Source: IPSS - Summary of Projection Results [http://www.ipss.go.jp/pp-zenkoku/e/zenkoku\\_e2017/pp\\_zenkoku2017e\\_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1](http://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2017/pp_zenkoku2017e_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1)).

### 2. Main Causes of the Crisis

Explaining the demographic decline in Japan must be done beyond giving low fertility rates and high life expectancy. Special emphasis is given to the principles behind the population crisis in Japan in this paper since it is critical to assess the roots of a problem accurately when one considers to study proposed solutions for it. As we shall see later on in this work, defenders of the idea of using robotics as a solution to the population crisis argue that this method will target these causes specifically, in one way or another.

One of the first issues is overworking, a serious problem in Japan. The two coined terms *Karōshi*/過労死 meaning overworking related death, mostly due to cardiovascular or cerebrovascular diseases and *Karōjisatsu*/過労自殺 meaning overworking stress or mental disorder related suicide are terms many Japanese are familiar with. Corporatization and loyalty for one's company are regarded values with great importance. Starting with the post-war welfare era, overworking became an issue in Japan as working beyond work time became a norm. This is mostly seen in office workers and the philosophy behind it is about not damaging the company morale as leaving while everybody else is working will disrupt the company and secondly out of self-respect where one does not want to leave work while others in the office are working. It is important to note that longer work hours are associated with better job performance. We can easily establish and display a connection on how it is affecting the population crisis. If we look at Yamauchi's (2017) earlier work, we can see that the age group that overworks the most are those in their twenties and thirties, as young employees are more eager to prove themselves to their executives and companies. This means that, at the age of where most form families and consider a child, a significant portion of the newly employed people in Japan are busy with overworking. There is not enough time to consider a relationship that can end up as a marriage let alone considering having one or two children.

The cost of childcare in Japan has also become a headache for Japanese parents and parental candidates who are considering having a child. Three major factors in this context, daycare, housing and education are the primary concerns for parents. Daycare facilities are low

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

in numbers, housing for two-plus families is costly in metropolitan areas and education expenditures are soaring. The cost of these is making married couples hesitate from having children. It is argued by Oishi (2002) that the childcare industry in Japan forces one parent to be at home. The numbers of childcare service centers have been low considering the hundred and twenty-million strong population of Japan. Therefore, having a child means that one of the parties of the marriage has to take care of the child, this being predominantly the wife, where the household earning decreases due to the wife leaving her job. Combined with the price of moving to a house capable of housing a family with at least one child in a big city in Japan, the products needed for childcare and the years of cost of education, cost of childcare creates one of the causes of the population decline in Japan.

Another factor is the change in traditional gender roles that Japan has yet to fully adapt to as a society. Let's point out McDonald's (2000) argument regarding gender, about how attendance to the public sphere is increasing and being equal by both sexes, meanwhile, men and women's duties in the household and housework are changing at a very slow rate in the industrialized world. Perhaps there is no better example than the Japanese society to observe this phenomenon. In Japan, there was hardly any change in the roles of men and women regarding housework, home keeping and childcare while there was a huge leap in women's employment and career-making, meaning increased participation of women in the public sphere where they still kept and expected to perform as traditional Japanese women did at home. . If we look at Figure 1, data provided by Tsuya (2017) in her work regarding low fertility in Japan, we can see wives' and husbands' participation in housework (including childcare at home).

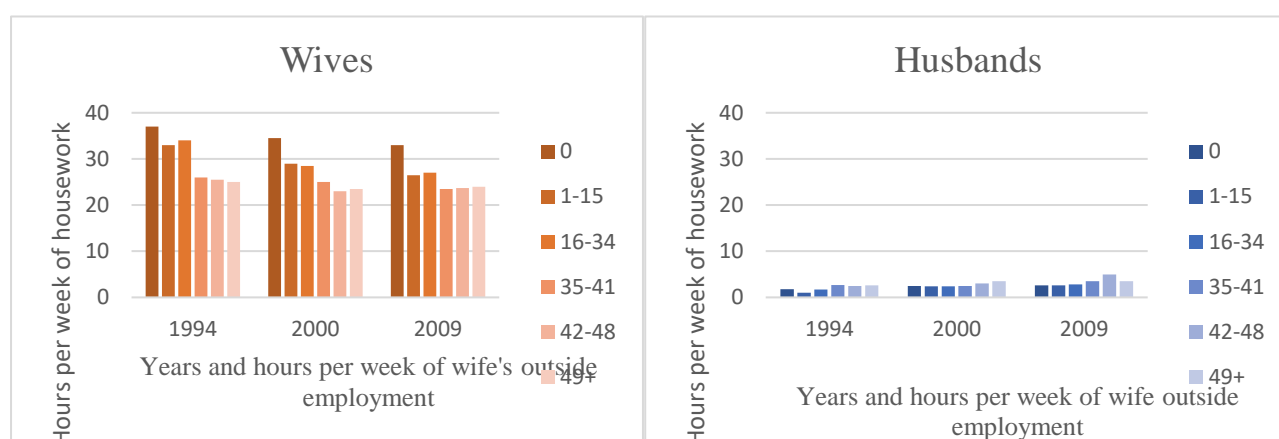


Figure 1. Year and Hours Per Week of Wife and Husbands Outside Employment

Source: Tsuya, O.N. (2017) Low Fertility In Japan—No End In Sight, AsiaPacific Issues, No 131. <https://www.eastwestcenter.org/publications/low-fertility-in-japan%E2%80%94no-end-in-sight>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

The difference is immense as women multiply the hours involved in housework by five times over men in almost all age groups. This reality is not only evident in Japan as the same type of events are also observable in South Korea, Singapore, and Taiwan. Kim (2018) points out that Confucian traditions and teachings that are carefully placed in many East Asian's psyche are very critical in this type of behavior and thinking as it gives a sharp definition of men as providers and women as homemakers. In dual-working families where housework is accepted as the responsibility of the women, a second child is a very rare case (Kato, 2018).

Overall, these factors affect both Japanese women's desire for marriage, via having children, and the employer's eagerness to employ women, for several reasons, ultimately carrying a negative impact on fertility and the population crisis in Japan. Women are aware that they would most likely be expected to do housework and spend most of the time needed to take care of a child alone if they have kids. This would mean a career suicide as doing most of the housework and trying to focus on a career meanwhile is a very challenging task. Expecting to overwork and to be expected to do nearly all of the housework, Japanese women have plenty of reasons to deter from marriage and to bear a child.

The last subject to be presented here is the transformation of family as an Institution and its perception. Traditionally, a typical Japanese family would consist of multiple children, parents and grandparents living together in a single household. Yet, this was the dominant theme that lasted until the 1970s. Before delving too much into this topic, let's point out an important statement given by Alva Myrdal (1941, p.4);

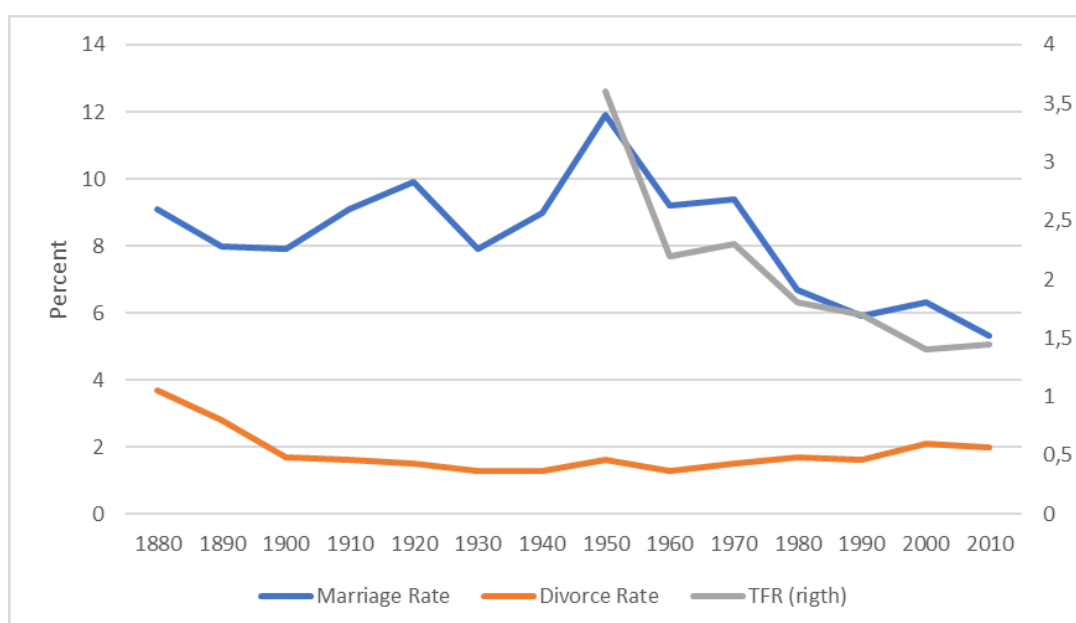
“The population crisis is only the external aspect of what is really a crisis in the family as an institution.”

This crucial statement helps us in having a better grasp of the contemporary population crisis in Japan. Several factors are affecting the Japanese to be more reluctant to forming families, let alone large ones. The change in perception of what a family is and what it should achieve is one of the causes of the population crisis as it leads to fewer marriages, higher divorce rates and lower fertility.

Roles and responsibilities that family as an institution had, have been co-opted by the state and society. These include medical care and care for the elderly. It was a norm in Japan as it was in much of the world, that the elderly would be taken care of by the children of the aged person. However, we see that preservation, safety and healthy wellbeing after retirement is now commonly thought to be achievable by financial means and early investment during

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

employment. This is best explained by Yamashige (2014) as he describes a framework where related market development causes weakening families, followed up by the expansion of government in the social sphere as families demand the expansion of state to help those who cannot access markets services due to financial means, which again in return weakens families. Naturally, welfare in this context gains importance to explain the previous statement. Welfare providing services that one would traditionally expect to get from one's child, decreased the need for having children. If we look at Figure 2, we can see that the decrease in fertility rate and marriage rate coincides with the following years when strong welfare has been an element in Japanese statecraft.



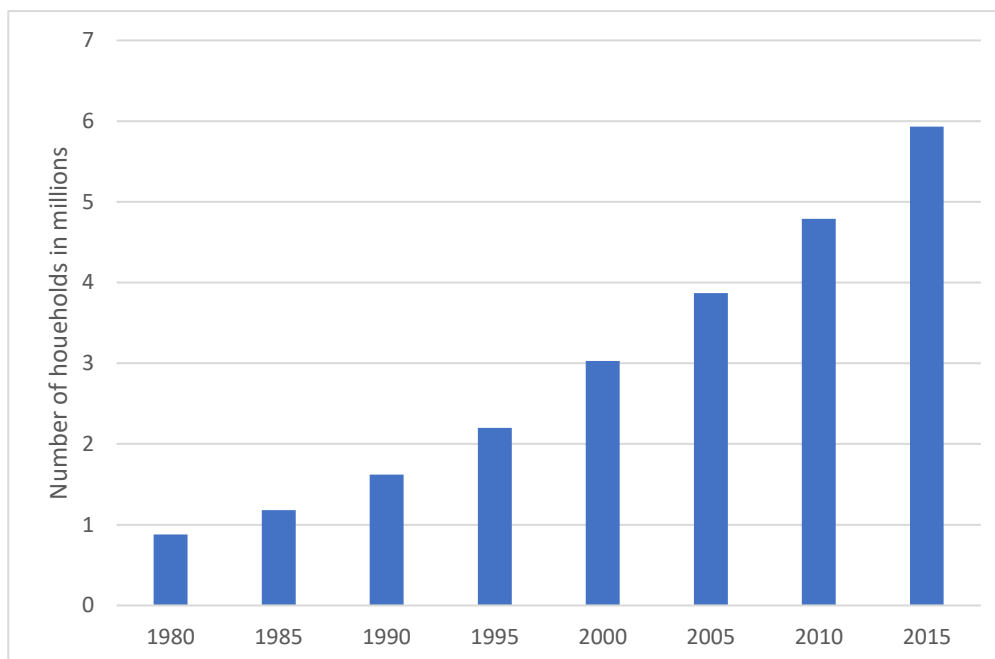
*Figure 2.* Fertility, Marriage and Divorce in Japan

Source: IPSS Statistics, 2014 – Yamashige (2014)

Figure 3 shows us the increased number of Japanese elderly who live in a one-person household. In 2015, it was 5.93 million. The number of elderlies who live by themselves is significantly lower in 1980, even when the increase in overall elderly numbers is noted.



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT



*Figure 3.* Number of private one-person households with elderly members in Japan from 1980 to 2015. (in millions)

Source: Statista Research Department - Number of elderly one-person households in Japan 1980-2015

We see that many Japanese elders of today have chosen both not to have children or to form families. In a case where marriage again is found favorable by the Japanese and the market and welfare is not seen as a substitute for family, we can expect an increase in marriage and fertility rates. Comprehensively, perception of the family as an institution that is no longer needed is resulting in lower rates of marriage, fertility and higher rates of divorce which is one of the primary causes of the Japanese population crisis.

We can summarize the main causes of the population crisis from the Japanese perspective, providing a clear image of how these factors combine and result in low fertility. Starting from an early age, one can find comfort in social isolation and withdrawal, not wanting to be exposed to strict societal norms in Japanese society and refusing to interact with the outside world. If one chooses to build a career, it is expected from the person to overwork and save little time for himself/herself. Time to spend on personal life gets scarce. If you are a woman, it is often expected from you to take care of the home, housework and childcare as it leaves small room for economic independence and pushes women for part-time employment. Meanwhile, various aspects of the cost of childcare are deterring you from having children. Having children is not intended, so the point of marriage starts to fade away. At last, the point of having or forming a family is starting to be meaningless as it brings a lot of strains and can

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

be substituted by financial options, welfare, and pension, especially concerning retirement. As we can see, the combination of these problems is the reality in Japan and are the leading causes behind the Japanese population crisis.

### 2. Negative Effects and Outcomes of Aging and Demographic Decline in Japan, Reasons Why it is Considered a Crisis

Rapid aging and continuous population decline have many implications and effects that are already underway. Population crises and declines of the past have been due to war, famine or epidemics and the outcomes uniformly highly differ from a natural decline related to low fertility which is the contemporary case. Population decline is not completely a harmful phenomenon, as there are hardly complete blacks and whites in life, and certainly has some positive effects, specifically concerning environmental issues and matters. Yet, the perspective of this paper is focused on the Japanese governmental and societal angle, studying the case in its socio-economic prospects, which presents an unpleasant picture. After all, as Julian Simon (1985) puts it, “population is the ultimate resource”.

Japan right now is the fastest aging country and has the oldest population in the world. Elderly care is one of the important aspects of aging and on such an astronomical level like in the case of Japan, brings certain problems with it. With Japan current population's quarter being elderly, and referencing the projection at the beginning of the paper, predicting that 40% of the total population of Japan being old in the near future, an immense need for elder care is needed and will be needed in a greater extent in the future. Care of the elderly has traditionally been the family responsibility. As it is discussed before, this reality has changed, and elders are now mostly living on their own, applying to financial methods of self-care such as benefiting from elderly-care facilities and pension or due to childlessness.

As we can guess, increasing rates of seniors and a decrease in the working-age population are stressing the methods of eldercare. Firstly, opening up new care centers for seniors is problematic due to the low number of workers working in this field. With current numbers, such facilities start to be insufficient in taking care of the aged population. It is also critical to notice that taxpayers who pay for the governmental services provided for seniors are also decreasing whereas the demand is increasing, putting further restraints over government spending. Unfortunately, these problems gave birth to another phenomenon named *Kodokushi*/ 孤独死 meaning lonely deaths. This term explains situations where a senior who is living alone dies due to an injury or health problem that is treatable and not deadly in most cases such as a

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

fall or a minor stroke, but because he or she is unable to call for help, as there is no one to help in the home.

As Dahl (2018, p.84) puts it “decay of “traditional” social bonds, such as family, neighborhood and company ties” is a major consideration behind the occurrence of such an incident. Many of those who go through lonely deaths are seniors with no children, having thought that it is better not to have children in their adulthood, or seniors whose child or children are too busy with their careers. Today, eldercare is also a concern for many middle-aged Japanese to think of the future and their care as they fear during their time as senior citizens, the situation will worsen as many are concerned with the collapse of the pension system with an increasing number of old people.

Without a doubt, the regions that are most remarkably affected by aging and population decline are the Japanese countryside. Villages and rural towns with all its population consisting of elderly people, or villages that are completely dead and abandoned are becoming common pictures. Low fertility is also evident in the Japanese countryside. As Fukuda (2020) points out, one must remember that aging and decline in Japan is not at the same pace in the entirety of the country and has effects in different proportions regarding regions and types of settlements. Many terms became subjects of daily use in Japan such as *Genkai Shūroku*/限界集落 explaining the circumstance of a village or a small town outside of great metropolitan areas where depopulation took a heavy toll, as the village or town consists dominantly of elderlies, has very little economic activities, has a handful or no young people and is expected to die out in the coming decades. A more extreme term, *Shōmetsu Shūroku*/消滅集落 explains a direr situation, a village that is completely vanished and has no longer have any occupants. It is estimated that close to a thousand villages and towns combined will be empty or will turn into ghost towns by 2040 and many more will be occupied totally by seniors. With low fertility and aging prominent in small towns and villages, fewer numbered young and working-age population chooses to migrate to metropolitan areas to find employment and better life options.

Since the old population dominates the countryside, vast volumes of agricultural fields are empty as the old no longer have the physical capacity to cultivate it. Hori's (2021) case study shows us that abandonment of rural property has serious damage on natural capital, natural capital meaning ecosystem services that derive from reserves of natural resources. This is followed by the empty house problem, abandoned houses where in most cases overgrown vegetation takes the ownership. The empty houses in the countryside are commonly not

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

inherited by the children, if the previous owner even had any, due to property tax expense, as well as the inheritor's knowledge about how hard they are to sell. The population crisis in Japan is causing provincial real estate markets to crash and fail, as they have no buyers left. Problems due to low population in rural areas are pointed out by Matanle (2014), such as the bankruptcy of family businesses that were active for decades, lower numbers of positions in administration-related employment in municipalities. Abandoned hotels restaurants and cafes and all kinds of services similar to abandoned houses are now common imagery in the Japanese countryside, physical proof of what demographic decline is doing to Japan. The current fertility and internal movement in Japan give no hope for the replacement of the people gone or will be gone in the collapsing rural communities that once enabled economic activities.

Another serious concern appears in the care services. We are talking about communities that are very old and are living in remote areas. Most of the villages and rural towns are located in mountainous regions. Transportation to or from these locations provides a challenge to ill and fragile seniors who need healthcare and eldercare. With depopulation, there are no longer need for hospitals in general as there are few who live in a rural settlement but there is still need for healthcare in cases senior face geriatric complications. Tanaka and Iwasawa (2010) show how this requires an unorthodox method to provide the needed services for a few elderly presiding in rural villages and towns. Since government and healthcare providers find logistical troubles in allocating resources to lowly populated distant hamlets, they must find ways to assist those who are in need effectively. Small numbers of those who are left are in need of disappearing services and infrastructure.

Covering these issues brings us to perhaps one of the most important and impactful outcomes of demographic aging and decline in Japan, that is labor shortage and decline of the working-age population. If we look back at table 1, we can see that even in the medium-fertility variant, the working-age population of Japan will decrease from 77.28 million to 45.29 million in 2065, a massive fall of 32 million-strong labor force. That is more than one-third of the current workforce. Figure 4 shows us the population pyramids of Japan in the year 2015 and projections for 2040 and 2065 according to the same medium-fertility variant and we can clearly see the decline in the working-age population as they move to 65+ with no youth coming to replace them. Such a shrinkage in the domestic pool of workforce certainly has repercussions for the Japanese economy and requires the Japanese to either adapt and accept the consequences of such a decline or to struggle against and yearn for solutions to expand the labor force.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

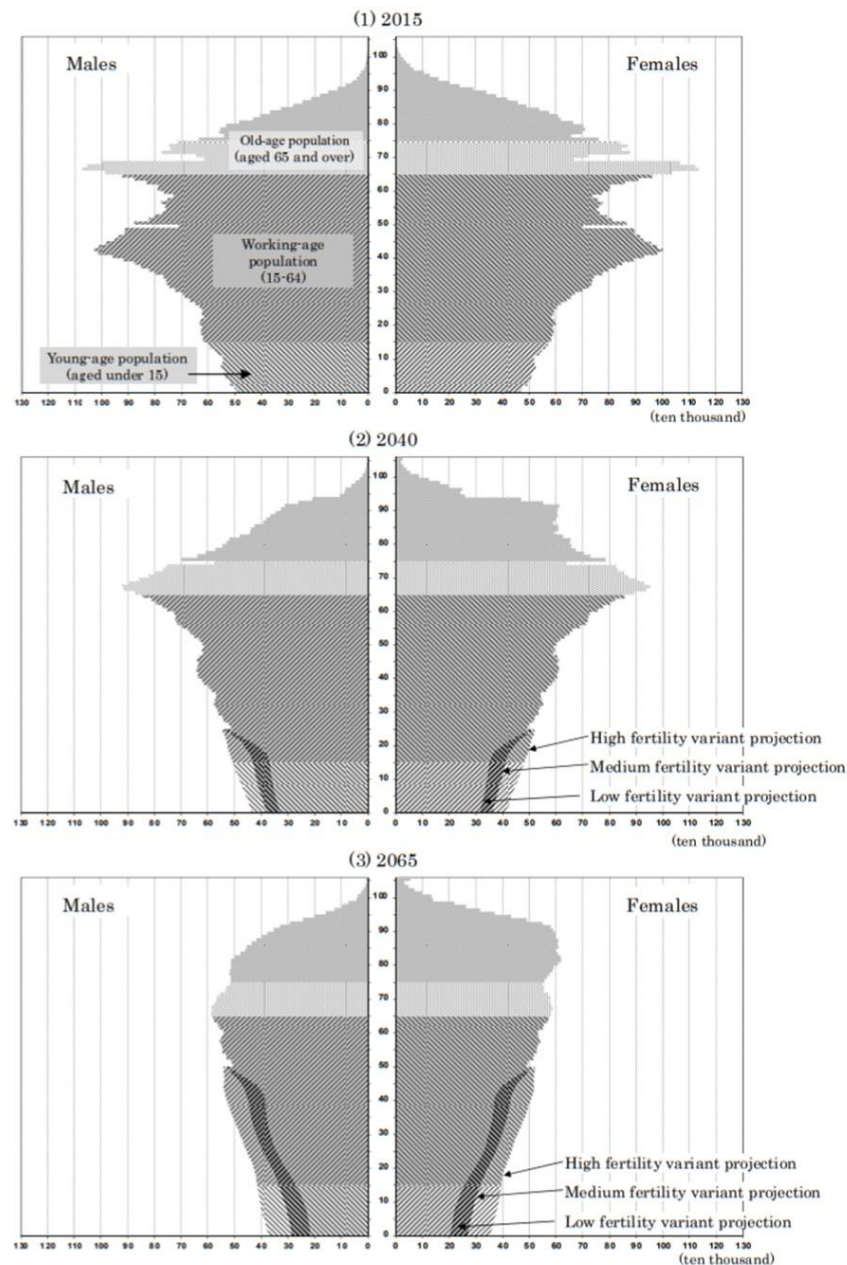


Figure 4. Japan Population Pyramid: Three Fertility Variant Projections (Medium-Mortality)

Source: National Institute of Population and Social Security Research, Population Projections for Japan (2017): 2016 to 2065 Appendix: Auxiliary Projections 2066 to 2115

[http://www.ipss.go.jp/pp-zenkoku/e/zenkoku\\_e2017/pp\\_zenkoku2017e.asp](http://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2017/pp_zenkoku2017e.asp)

The declining workforce is troubling and worrying considering the output-centered economy of Japan with no necessary young population to replace disappearing working-age people. Apriliyanti's (2018) research indicates how labor shrinkage negatively affects certain industries of Japan. Many argue like Apriliyanti, as it is also supported in this paper, that aging, and shrinking labor force has negative effects on the output of labor-intensive industries of

## **THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT**

Japan Aging of labor force just by itself is not observed to have significantly negative effects on capital-intensive industries. Many studies have argued that labor force shortage and decline hinder and thwarts economic growth. In theory, if there is not an increase in productivity by other means, the decline of a population means less productivity and less demand for goods and services. A growing population, market, and demand always attract investors, and these are factors of confidence for economic consumption. As Coleman and Rowthorn (2015) points out, investors and businessman hardly find optimism at engaging in financial activities in markets where there is demographic decline already underway or future expected decline meaning fewer customers and consumers of any kind. One plus might be regarding goods and products designed for the use of the elderly as it is an expanding market. With a gloomy economic vision over Japan, businesses and investors will be more inclined to hesitate and hold back and will be less enterprising in the Japanese context.

Such problems raise concerns on how the economic growth of Japan will be affected by the demographic decline. Clark (2010) and Lee and Shin (2019) argue population aging and labor force shrinkage will eventually have detrimental effects on economic growth and may even cause shrinkage. On their empirical studies conducted regarding aging in Asian nations such as Japan and South Korea, both short-run and long-run results show the overall decline in working-age populations coupled with aging will slow the GDP growth and may even contribute to shrinkage. It is argued that this phenomenon will show its effects starting in the 2020s and will become very evident towards the middle of the century. With such a labor shortage, Japan needs to find ways to replace disappearing working-age people. Its population decline combined with an economic one will also surely have effects on Japan's geo-political capacities. Its rivalries in the region and its international aspirations will have no benefit from a declining population, as its defense is getting more spending and attention each year.

GDP and economic growth, on one hand, Japan faces a more urgent concern as the pay-as-you-go pension system is under the danger of collapsing. The reason for this is the dynamics between payees and benefactors of the pension system. Tsuya (2010) argues that when the number of benefactors surpasses contributors, the pension system will no longer be able to operate as there will be a deficit. With such an aging society, the collapse of the Japanese pension system will be catastrophic. Public distrust towards Japanese pension is growing and it is observed that working-age people actively avoid paying for pension programs because they believe in their time of retirement, the pension system won't be able to pay them back in line with the investment, a system which was once regarded as a very generous one.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

### 3. Governmental Response to Demographic Decline and Possible Solutions

Population decline and aging are considered one of the top problems Japan is facing, both by the Japanese government and by the public. Many policies, governmental programs and schemes are underway to combat the population crisis and many more are in development with scholars and academics alike also suggesting possible ways out for the problem. The nature of these policies can be divided into two main groups. One major group is trying to find solutions to eradicate the causes of the problem, hence are aimed to get rid of work-related issues, decrease the cost of childcare, make forming families more attractive and enforce gender equality in order to make having children more viable and desirable, with the goal of increasing total fertility. The latter, on the other hand, is trying to deal with the outcomes of the problem itself. These include policies that are trying to increase the labor force, find ways to provide sufficient eldercare for all in need and manage the pension and social security system.

Due to the efforts and struggle against demographic issues starting late, it is considered these policies will have little to no effects in the near future against depopulation and aging. Referencing Komine (2009), this is mostly because recognition of low fertility as a problem comes too late and the effects of an aging and declining population are felt after a relatively long period of time. As a result, a sense of emergency does not emerge until it is too late and the problems arising from these issues are already underway. Japan's fertility rate was well beyond the replacement level since 1975 and it was known that there would be problems being born from it. Solid steps towards combating it only started in the mid-2000s with a handful of attempts before that. Another thing is there is no other state which went through a similar demographic decline before Japan. Therefore, Japan cannot learn lessons from others and lacks the so-called latecomer's advantage, unable to know what certain policies will result in, whether they would work or not, from other examples. Yet there is still faith to combat the demographic problem and to at least get rid of it in the long-term while trying to keep the damage of short-term outcomes at a minimum.

#### 3.1. Pro-Natalist Policies

Japan's policymakers' attention was directed towards fertility and demographics starting with the "1.57 Shock" of 1989, referring to the total fertility rate of 1.57 in 1989. The steadily declining TFR starting from 1975 was thought not as a concern by the government of Japan as it was expected to rise again, but further decline as Suzuki (2006) points out, was unexpected and TFR reaching to levels of 1.50s ignited search for pro-natal policies to increase fertility. Starting from the 1990s with increased intensity, Japan generated and implemented

## **THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT**

certain plans and programs to address this topic which was now considered to be an issue with TFR hitting the rock bottom at 1.26 in 2005, creating a bigger sense of urgency. New laws and plans were intruded such as the advanced childcare allowance law, childcare leave law, the Angel Plan, child welfare laws, the New Angel Plan, Children Plus One policy, Next Generation law and the New-New Angels plan, which are just some examples. Step by step, with the help of the scholars, causes for low fertility were being discovered therefore new amendments, laws and policies were directed towards eradicating the factors that were identified as chief components of the problem. This, however, will prove to be harder and more challenging than what policymakers of the time thought to be.

The Angel Plan was designed to be a five-year program, active from 1994 to 1999. The program sought to create legislation to allow working parents to have a better parental leave option to take care of children at home. Consultation for married couples was becoming vastly available to explain the new legislation and how parents or parental candidates would fully benefit from them. Child welfare was also increased. As the years passed by, certain factors causing low fertility became more noticeable. The New Angel Plan set in motion in 1999 was designed to help working mothers who either had to let go of their jobs when they had children where many women avoided being pregnant to conserve their careers. The issue of daycare centers was under the magnifying glass and more were promoted and advertised to open to give an incentive for working women to consider having kids. The new plan also increased parental leave pay to 40% of the wage (Suzuki, 2006), with child allowance expanding to pre-school children.

The period when these policies and plans entered the Japanese political theater was the period when the Liberal Democratic Party (LDP), the long governing party of post-war Japan, lost elections following the 1991 economic crisis and wasn't in office for three years. Although these pro-natal policies were first designed by the following non-LDP governments, soon after LDP formed the government again, population issues and policies concerning it became more intense. Many may think that it is natural that as the issue became direr, it required swifter and sharper action. However, the newly forming agenda of LDP envisioned a Japan that is more evident and capable in the world arena, diplomatically and militarily. A declining and aging population is an obstacle against these goals, so it is argued in this paper that solving the demographic problems of Japan became a prime objective for LDP.

Following the policies, Children Plus One project gave the proactive ground for local governments and companies to formulate and implement their own creative measures to



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

create a more family-friendly working environment. These bodies were also made responsible to enforce gender equality to not scare women away from having the idea of having both a family and a career. With the first Angel Plan failing and the second one having mixed results, with a wave of new legislation came the latest angel plan that is the New-New Angel plan at 2004, increasing the scope of the first two models. Although TFR continued to decrease, reaching an all-time low in 2005, it started to increase from this point on reaching 1.45 in 2015 and staying around that level towards 2018. It is not known that this increase is caused by the policies, or to what extent if it did. It is asserted by Ma (2009) that calculating the impact of pro-natal policies on fertility rate is a challenging task which often can result in misleading judgments as there is no stable method to establish causality. Contemporary data, however, do not show a progressive picture as it is hypothesized that TFR is around 1.36 in 2020, again showing a decline.

The multi-ministerial efforts of Japan with large amounts of the budget being allocated for the cause followed by tons of legislation, seem to have little to no effect on what it is trying to be achieved. Although Japan has successfully identified the main causes of the demographic decline, governmental policies have a hard time changing those factors. So far, the goals set in 2014 and 2015 for long-term TFR of 2.1 and short-term TFR of 1.8 respectively, do not seem feasible. We should also remember the extent of such policies and note that they cannot go further and directly affects individuals and their reproductive choices and rights. Japanese government's efforts have been so far directed to create a better environment for childrearing and were trying to indirectly affect the choices of parental candidates and couples. After all, Japan is a democratic country and as Sato and Beppu (2016) explain, there is a limit to state intervention to personal life, unlike the case in undemocratic and authoritarian states, in the cases of childbearing and rearing. There is a limit on what the government can dictate on the personal level. Pro-natal policies in democratic countries, therefore, have a natural disadvantage.

Another factor leading to the low impact of these policies on TFR is due to their clash with the social values of Japan. We can study this topic with an example. The contemporary Japanese Childcare Leave law gives the right for maternal leave for six weeks before the birth and eight weeks after it. Additionally, every employee who becomes a parent, both men and women, has the right to leave the job with a wage compensation close to 60-70%, until the child is one year old or one and a half years old if the child is not admitted to a nursery. Therefore, there is a 1-year parental leave which both parents can enjoy. The scope of this law

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

was increased over the years to not scare those who wanted to have children and also wanted to continue to work. When compared to other OECD countries and the globe, Japan's paternal leave is among the best with its emphasis on both parents and the number of weeks with compensation. However, this is on paper and when we look at how fathers and mothers benefit from the same law, we can see the problem. Lam's (2009) study pointed out that Japanese women who resorted to parental leave were 72.3% meanwhile only the incredibly low number of 0.5% of fathers used their parental leave right. The movement of the rate of men taking paternal leave can be seen in Figure 5 as it has risen to 3.16% in 2016 and 6.16 in 2018<sup>5</sup> which are still quite low yet shows the impact of contemporary struggle.

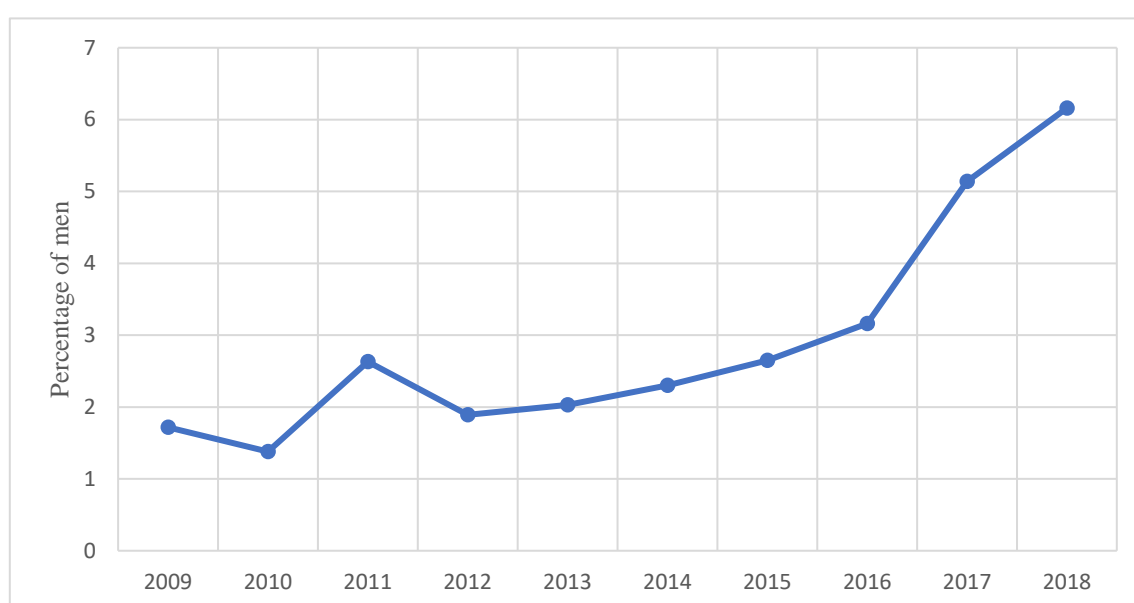


Figure 5. Share of men taking childcare leave Japan 2009-2018

Source: Statista Research Department, Percentage of men taking parental leave in Japan from 2009 to 2018 <https://www.statista.com/statistics/858415/japan-percentage-men-taking-parental-leave/>

The traditional belief of men as moneymakers is still evident. Although it is a right given by law, men still avoid taking parental leave and help childrearing. A substantial portion of mothers who took parental leave chooses to not go back to their jobs and remain as housewives (Lam, 2009). Thus, even though there is an equal legislative ground, it does not have an equally proportional impact on the real conditions. Women still are expected to take care of children by taking paternal leave where their husbands have the same right to temporarily leave

<sup>5</sup> Statista, Percentage of men taking parental leave in Japan from 2009 to 2018  
<https://www.statista.com/statistics/858415/japan-percentage-men-taking-parental-leave/>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

employment as they do but do not take it. This is not only because of men preferring not to do so but it is also about men trying to avoid being punished by their corporations and to secure their careers. Overworking is a norm in Japan as it is previously discussed in this paper. It is not rare that men who take parental leave are chastised by their companies with demotions or lowered wages because men who take parental are perceived as those who do not give the necessary importance and loyalty to their companies and employers. More and more lawsuits are appearing with fathers pressing charges to their companies and employers claiming unjust punishments for taking parental leave. The Minister of the Environment, Shinjirō Koizumi, to combat these norms, took parental leave while he was in office as a minister in 2020. He is considered to be a charismatic politician with a family that is deeply involved in politics, with his father being one of the former Prime Ministers of Japan. Many predict Koizumi as a future PM as he is a rising star in Japanese politics. This move of his is clearly designed to promote and normalize male paternal leave for fathers.

Overall, pro-natal policies in effect in Japan are becoming more intense but are also sending mixed messages. First of all, they lack the necessary funding to increase further in scope as the taxpayers and tax revenue in Japan is stagnating. With the increasing necessary budget to deal with the outcomes of the population crisis, money directed towards eradicating its causes has to be at a considerate level, which is a great handicap in problems related to demographic decline. Otherwise, evermore demanding fields such as the pension system which is under more strain as days passes will face collapse. The Japanese government cannot fully direct its budget capacity towards policies concerning fertility as Japan is already shouldering a huge amount of national debt.

A critical issue that wants to be addressed in this paper is the mixed signals of these policies. Surely, there are a lot of incentives provided by the Japanese government to direct people to form families and have children. However, there is little effort to eradicate the counter incentives for fertility and child-rearing that are causing the problem in the first place. This raises the question of whether Japan is really trying to get rid of particular social norms and values which are the fundamentals behind the demographic decline. Ultimately, many consider these to be crucial for Japanese identity and inseparable from it. This situation might have put Japan in search of ways to solve and cope with the problem also, paradoxically, by conserving the reasons causing it, which are characteristics of the Japanese society that Japan really does not wish to let go of. This curious endeavor can push Japan to find unorthodox ways to deal with its demographic problem. One of those unorthodox approaches is in fact robots which the

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

majority of the rest of the paper is focused on after counteracting policies and measures are discussed where the robotics solution is introduced.

### 3.2. Counteracting Policies and Measures

Counteracting policies are ways to tackle the outcomes of the demographic decline, which are previously discussed in this paper, without an emphasis on undertaking the roots of the problem. Therefore, they can be understood as coping measures and mechanisms. With pro-natal policies having little impact in the short term and their long-term success under scrutiny, Japan has changed its focus on finding measures to combat the effects of the demographic decline as it is almost guaranteed that the population will fall to a number around 88 million in 2065. Potential problems in such a scenario have been pointed out in this paper. These policies and strategies are designed to mitigate those issues.

As it was discussed before, the pension and healthcare systems of Japan are under threat. The old-age dependency ratio, meaning the ratio of economically static elderly people to working-age people, is continuously increasing in Japan, currently being around 47-48% according to World Bank data<sup>6</sup>. This number is expected to go well beyond 60% towards mid-century (Hsu & Yamada, 2017). Therefore, solutions must be adopted to counteract the increasing burden and cost of Japan's universal healthcare insurance and pension. Some ways are to make the elderly pay more for healthcare costs as they benefit from recipient reductions, paying only up to 20% or 10% regarding their age group starting from 70+. Another discussed way is to expand the consumption tax to compensate for the diminishing labor tax revenue due to the decrease in the labor force. Hsu and Yamada refer to the hardships of implementing such fiscal policies, however, as the elections in Japan are becoming ever more dependent on the votes of the elderly. This means that acts and policies which are disadvantageous towards the elderly can result in punishments in the next election for the governing LDP. Besides, increasing the income tax is favorable for no one. Counting the unwillingness of current generations to suffer economically for stability in the future, the Japanese government is in a tough spot making fiscal changes to make sure Japanese healthcare insurance and pension stay intact.

One of the other counteracting policies that come to mind is the postponement of the mandatory retirement age in Japan as the policy gets two birds with one stone by its nature. By increasing the mandatory retirement age to 65, firstly more people would be reintegrated

---

<sup>6</sup> Age dependency ratio, old (% of working-age population) – Japan  
<https://data.worldbank.org/indicator/SP.POP.DPND.OL?locations=JP>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

into the declining workforce and additionally, the strain on pension will be weighed down as the elderly would start to get at later with their continued employment. There is no mandatory “mandatory-retirement” in Japan, so to say, however, it has been a norm that employees’ contracts set a mandatory retirement at 60 as it was the traditional retirement age which was the last subject to change in the last quarter of the 20<sup>th</sup> century. Many argued like Clark & Ogawa (2009) and Bloom & Seike (2011) in the past that increased retirement age would help Japan to decrease the pace of the decline in the workforce. With increasing life expectancy in Japan, there is a perception that age 60 is the new 50, which is also becoming the belief in other high life expectancy countries. Clark & Ogawa (2009) argues that the Japanese elderly will be willing to work beyond 60 for several reasons such as the decrease in social security benefits and to get better payment for several more years instead of starting to get a pension. We can add the increasing fear of the elderly that pension system becoming unstable and the wish for remaining connected with the social life as factors for their wish to work more.

Apparently, the Japanese government and legislation also thought so and passed several legislations, primarily the Older Person’s Employment Stabilization Law to push forward the retirement age. New laws encourage and de facto pushes the retirement age to 65 as they make starting pension at 65 and even 70 more beneficial than starting earlier, make wage reduction for working after 60 to the same level as 65, and open the way to re-employment right after the retirement of the people aged 60 until they are 65. Many employers can continue to set the mandatory retirement age at 60 for their employees in their contracts however, as there would be fewer workers, they will be encouraged to employ until 65. It is believed that shortly, with a gradual increase, the age for retiring will become the age of 65, in the next five years. With this, Japan can benefit from its 60-65 age groups increased participation in the workforce, negating the decline in the labor force for a bit.

Another non-fully utilized factor that can boost the declining labor force other than the elderly, is the Japanese women. Japan has traditionally fared badly when it comes to gender equality. Compared to other OECD countries and many others around the globe, Japan found itself being placed on the last rows in categories such as the gender pay gap and female labor force participation. It is discussed in this paper before how women struggle in keeping full-time employment due to various reasons. On the scope of his grander scheme to boost the economic growth of Japan, former Prime Minister Shinzō Abe has introduced the idea of Womenomics in 2013. This idea was under the “third arrow”, that is structural reform, of the so-called “three arrows” of Abenomics, the former PM’s economic policies.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Womenomics is the idea that Japan's economy can grow further by the higher participation of women in the workforce, and this is achievable by providing a better work environment for women (Schad-Seifert, 2019). A primary goal of Womenomics is to make sure that Japanese women have no setback if they want to be employed and are awarded proportionally to their output. With such a motivation, Abe has planned to tackle two issues, to kickstart the stagnated growth of the Japanese economy and to negate the deteriorating labor force by utilizing more women in the Japanese workforce. Women in Japan have a low labor force participation rate, compared to men in Japan and compared to women in other OECD countries. Former PM Abe set some goals to increase this rate and to enable more women to be in leadership positions. If we look at it, from its introduction in 2013 to 2019, the female labor force participation rate has risen to 53.3% from 46.2%, compared to the contemporary male labor participation rate of 71.4%, according to the 2020 Statistical Handbook of Japan provided by the Statistics Bureau of Japan.<sup>7</sup> This is quite a success by the womenomics policies as an increase has been achieved where female labor force participation surpassed 50%. Yet concerns for the major causes against the further success of the womenomics plan remain.

One of these concerns is the firm corporate culture of Japan that is subject to little change over the ongoing years and increasing effort. Workplace ethics prioritize regular and stable employment, little to no flexibility and hierarchy in the workplace and awards its employees accordingly. Most women are unable to satisfy these conditions if they have children, therefore give up full-time regular employment after childbirth, as they know that they will be punished in the occurrence of their return to their workplace or to find that their path towards advancing their careers blocked. A sound criticism is voiced by Macnaughtan (2015) where she indicates how Japanese policy has been focusing on women so much that they indeed imply it is the duty of women to do the childrearing as they develop policy around the idea of how women need help in this task. We can argue that efforts on making sure that everybody understands and tries to revise the current workplace system and its decrees in Japan which is discriminatory and unjust towards not only women who are seriously disadvantaged in the circumstance of them forming families and having children but also to men who want to be more engaged in household activities but cannot due to corporate ethics, are forgotten or intentionally missed. This can be due to the Japanese society's reluctance to change, wanting

---

<sup>7</sup> Statistical Handbook of Japan 2020, Chapter 12, Labour <http://www.stat.go.jp/english/data/handbook/c0117.html#c12>, <http://www.stat.go.jp/english/data/handbook/pdf/2020all.pdf#page=139>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

to preserve Japanese values and lifestyle which is now under attack from domestic issues that are born from it.

As a piece of evidence for this statement, we can show the sturdy spousal tax system present in Japan. The spousal tax system in Japan enables married women to not pay income tax or social security if they earn annually under a certain amount with their husbands also benefiting from it by lowered income taxes as their wives attain a dependent status. This law established at the start of the 1960s has reinforced the position of men as moneymakers and women as homemakers by making it more advantageous for women to marry and work in lower-paying often non-regular jobs. Women wanting to earn more than that, if married, see it unnecessary as the increased wage will be leveled off with the increasing income tax imposed on herself and her husband, therefore, stopping many married women from climbing the corporate ladder before even starting. There were attempts to change this tax however, it requires a massive reconstruction of the overall employer compensation system (Macnaughtan, 2015). Japanese policymakers do not seem to be excited to go down that road. We can observe that Japan is not ready to shift completely its societal structure and order.

Among counterbalancing measures, perhaps the topic of immigration is the most debated in Japan with it being under the radar of a great number of scholars. With the working-age population continuously decreasing, Japan's need for immigrants to support its economy became evidently clear. However, Japan is not an immigrant-friendly country, or to better put it, traditionally hasn't been. Many historical facts play a role in this reality. Japan was a closed country for more than two centuries under the Tokugawa rule in line with the 鎖国/*Sakoku* policy, an isolationist policy which limited outside contacts almost to none from the 17<sup>th</sup> to 19<sup>th</sup> century with few exceptions. Japan being an island nation, with a homogenous population, both culturally and ethnically combined with a history of isolation, has made itself a very strict country when it comes to the topic of immigration. Homogeneity is often seen as a myth by scholars, with a substantial Korean and Chinese community combined with the Okinawans and the Ainu. Nevertheless, the homogeneity understanding dominates the Japanese psyche.

There are certain industries where labor shortage is being felt in an enormous extent, such as construction, agriculture, nursing, and eldercare. The direst situation however is in 3K jobs. 3K is a term enveloping the words 汚い/*kitanai*, 危険/*iken* and きつい/*kitsui* meaning dirty, dangerous and demanding, similar to the 3D expression in English. A decreasing workforce naturally brings a less intense competition with it and as a result, Japanese who look for doing

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

these 3K jobs are very few. Thus, Japan is in a way forced to find people to fill these gaps in the labor force very swiftly. However, its strict regulations over immigration for the sake of conserving its homogeneity creates an obstacle.

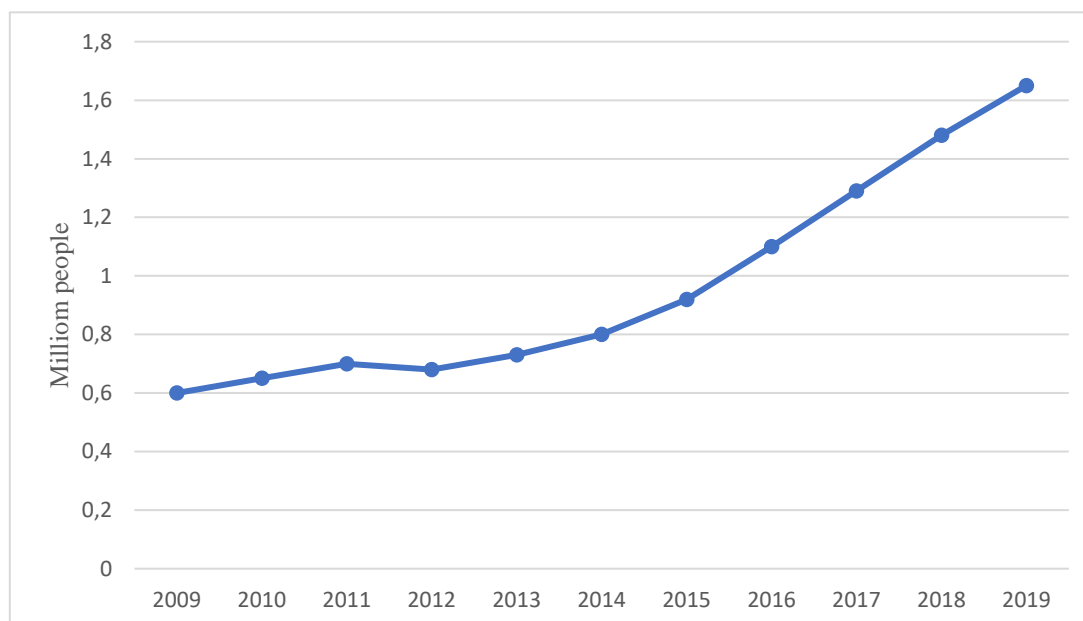
As the demographic problems of Japan became clearer and Japan remained to struggle in between ethnocentrism and globalization, the first attractive option of immigration was thought to be the 日系人/*Nikkeijin*, the Japanese diaspora who were ethnically Japanese but who did not hold Japanese citizenship. A significant portion of the *Nikkeijin* were living in Brazil and Peru, concentrated in the region. The reason for this reality was high numbers of Japanese migrating to Brazil and Peru during the Meiji Era as they were looking for economic opportunities with the country opening up. Their descendants, often choosing to marry people within the Japanese community of their respective migratory country, were a perfect candidate for the Japanese government looking for ways to bring in workers without damaging homogeneity. With a law granting permanent residence to the *Nikkeijin* being introduced and increased effort, the numbers of Latin American Japanese in Japan has risen to 372,375 from 2475 in a span of 23 years starting from 1985 (Hollifield & Sharpe, 2017). However, the idea of sharing common ancestry helping better integration did not prove to be true in this case. With little integration efforts, the *Nikkeijin* arguably became another minority in Japan, raising questions on how hospitable and open for integration Japan is for foreigners, whether they share common ancestry or not.

One thing for sure, Japan now needed immigrants more than ever, where there was no time to think about common ancestry. Going through the 21<sup>st</sup> century, however, Japan continued to state and develop policy around not taking unskilled labor and only taking skilled immigrants. The topic of immigration continued to be taboo as the politicians even avoided using the word “immigration” and denied that such policies were immigration policies when what they were implementing was exactly immigration policy (Roberts, 2018). Although Japan had no de jure immigration policy, the country could not hold any longer without an immediate influx of workers so certain backdoors were opened to enable low-skilled workers entry to the country. The so-called trainee program was broadened and certain fields such as construction, agriculture, fishery, nursing, and forestry were identified as fields where Japan is willing to share its expertise with foreign workers to let them take those skills back to their country. This however was on theory and the program was actually designed for and is de facto supplying low skilled workers to Japan, which were allowed to stay for a maximum of 3 years. Figure 6



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

shows us the increasing number of foreign workers in Japan over the years, reaching close to 1.7 million in 2019.



*Figure 6. Number of Foreign Workers in Japan*

Source: Nippon, Japan Data, Record 1.66 Million Foreign Workers in Japan in 2019, <https://www.nippon.com/en/japan-data/h00676/record-1-66-million-foreign-workers-in-japan-in-2019.html#:~:text=There%20were%201%2C658%2C804%20foreign%20workers,for%20the%20seventh%20consecutive%20year.>

Most of the foreign labor in Japan comes from neighboring regions, the majority being from China, Vietnam, the Philippines, and Indonesia as they are thought to be more compatible with local culture. The lack of regulation however combined with the anti-foreigner sentiment, caused many of these workers under trainee visas to suffer from human rights violations, discrimination, abuse and lowered payment from what was promised.

The major change that many deemed necessary, came in 2019 where former PM Abe introduced a new immigration policy, this time indeed accepting it as an immigration policy and opening the way for more foreign workers to come to Japan. The stay period has been extended to 5 years and a new specified skill visa is given to foreign workers working in the categories listed above. Although they are still not allowed to bring over their families, new legislation enables workers with advanced skills to go for long-term residence, also allowing low-skilled workers to advance to this stage if they meet certain conditions and are successful in various assessments. It was a bold move by the PM as his party, LDP's electoral base is

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

conservative. However, the PM was aware of the acuteness of the labor shortage problem. Perhaps his strong leadership has enabled him to make such a move, as he was a long-time governing prime minister where most prime ministers in Japan have much shorter terms. Still, the public opinion in Japan is shifting, with more and more favoring immigrants coming to Japan compared to the previous sentiment.<sup>8</sup> Although it is quite impossible for Japan to reach needed immigration levels that are estimated to be a remedy to Japan's labor shortage provided by the United Nations and scholars (Tsuya, 2010), the country pushes its insecurities in this issue and, willingly or not, accepts more foreign workers to combat its demographic decline.

The robotics topic comes into the picture here. Robots were seen as an alternative to foreign labor in Japan. However, this paper will argue that robots encompass a lot more than substitutes for a declining labor force. They are also perceived by many elements in the Japanese government as a critical solution to the overall population crisis that can preserve what Japan does not want to lose in the effort against low fertility and demographic decline. Therefore, the issue of robotics is studied separately from this section.

### 4. Robots as a Countermeasure for Labor Shortage

Before starting, it must be noted that it is not the task of this paper to evaluate the feasibility of robots as a solution to the demographic problems Japan is facing. Rather it is to show why and how the Japanese see them as so. So far, we have seen what conditions have pushed Japan to consider using robots. Unable to increase fertility and reluctant to take immigrants, Japan has a trump card up in its sleeve. Japan is named the “robot kingdom” not by chance as it is the biggest producer of robotics and the 3<sup>rd</sup> most densely robotized and automated country which is fascinating considering its population. Japan houses robotics giants such as Sony, Honda, Yaskawa Electric, FANUC, Mitsubishi Electric, Seiko Epson, Kawasaki, Yamaha, and DENSO. The robotics industry in Japan accommodates companies that are vastly specialized in a wide variety of robotics fields and created an industry bringing revenue worth billions of yen every year to Japan, 52.97 billion yen in 2019<sup>9</sup> to be exact, almost doubling every year coming to this point. Japan defines what a robot is as “an intelligent mechanical system that incorporates three technological elements: sensing, intelligence and control, and drive” (Ministry of Economy, Trade and Industry/METI). The country produces robots and robotics software for a variety of fields, major groups being manufacturing robots, social robots,

---

<sup>8</sup> Pew Research Center, Perceptions of immigrants, immigration and emigration

<https://www.pewresearch.org/global/2018/11/12/perceptions-of-immigrants-immigration-and-emigration/>

<sup>9</sup> Statista, Total sales value of the robotic process automation (RPA) market in Japan from fiscal year 2016 to 2023 <https://www.statista.com/statistics/1050719/japan-robotic-process-automation-market-sales/>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

unmanned systems, service robots and entertainment robots. With former PM Abe's introduction of the "New Robot Strategy" in 2015, Japan has forwarded its attention and has never been more focused on the topic of robotics and its existing and potential roles in the Japanese society and economy.

The idea of substituting robots for workers is not a new idea in Japan, unlike many believe so, in fact, it is one of the kickstarting factors that lead to the creation of the Japanese robotics industry. The idea first appeared in Japan quite ironically in times of population growth, not decline, but when expected growth rates demanded greater numbers of workers and labor where the already increasing numbers could not keep up. There was a symposium in Japan regarding robotics in 1967 whose title can be translated as "What can a robot do for a society in need of labor?" (Lynn, 1983). At this time robots, mostly understood back then as factory automation, were perceived as a way to reach the necessary number of the workforce needed to achieve the desired annual growth. Design, production and use of robots as automation in Japan's newly flourishing automotive industries and the highly successful results have made Japan aware of what robots can do. Perhaps, the first impression regarding robots use in economics being positive has helped Japan to develop a very positive attitude towards robotics, which is studied in detail in subsequent chapters. One thing for sure, the idea of robots coming to the rescue for Japan's problems is not a new idea and has a place in this nation's history.

When talking about robots, one should not only imagine mechanical arms operating in factory lines. From humanoid robots (androids and gynoids) to animal-like ones, robots of all types are now wanted to be employed to deal with the labor shortage. Japan was already a highly automated country, as it is voiced before with a lot of robots placed in manufacturing. The robots primary place however is no longer perceived as the factory as with the governments help, private enterprises design and produce robots for all aspects of life, especially for fields suffering from an acute labor shortage, such as elder care, agriculture, construction, logistics and service sector with collective effort. Specially designed service robots are expected to overtake industrial robots in Japan in the next five years<sup>10</sup>. Some examples are Pepper, a social robot providing companionship and interacting with customers on many occasions, RIBA (or Robear), a human lifting robot, Paro, a robot seal for therapy, HRP series undertaking construction tasks and HAL, an exoskeleton assisting people with walking disabilities.

---

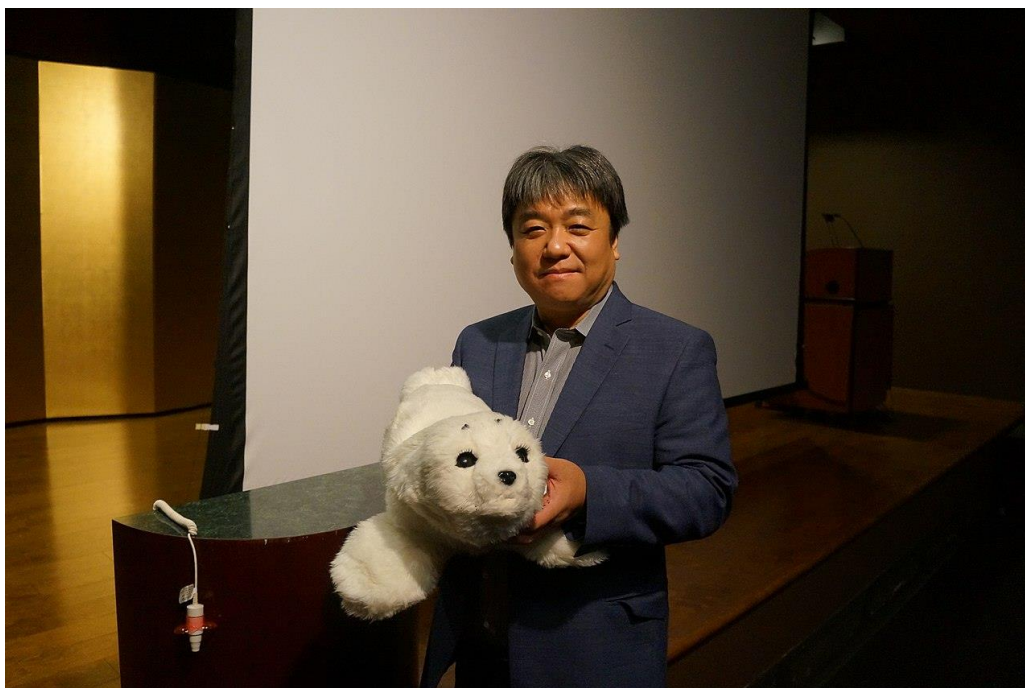
<sup>10</sup> Japan | robot market overview Market Intelligence, Market Intelligence, Orange Labs Tokyo

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Most of these examples are not in a condition of doing tasks by themselves without human support. However, the line between prototypes and actual usage gets thinner every day. We must also note here that the goal is not to develop robots that are designed to fully replace humans, for the short term at least, but to assist them in the workplace, getting rid of the need for extra employment and workers, which Japan is now desperately in need of. Therefore, for example, two eldercare workers can treat more elderly people with the help of robots compared to a situation with no robots as they decrease the employees' workload. The common understanding which entails robots being introduced to the workspace at a greater pace lowering wages and increasing unemployment is also found not evident in the case of Japan. Adachi and Kawaguchi's (2021) report on robots' effects on jobs has pointed out that robots increased wages and employment in Japan in addition to the expected output which is quite surprising as it is not the case in other developed countries. Therefore, Japan also has little reason to fear backlash from its labor force, not tolerating the introduction of robots in many fields.

The special attention robots receive from the government and the public is also due to it being seen as an alternative to immigrants. The previous chapter has discussed how Japan has a quite controversial history with the topic of immigrants and their integration. Certainly, robots seem a better option for many Japanese compared to immigrants even though they are not as close as capable. In 2010, the mayor of the city of Nanto granted the robot Paro (figure 7) family registry (戸籍/*Koseki*), presenting it to the robot's inventor, therefore acknowledging the robot as a Japanese citizen. This is a luxury not even given to 4<sup>th</sup> generation Korean and Chinese 在日/*Zainichi* (living in Japan, a foreigner living in Japan), who only have permanent residency lacking many rights citizens have. Additionally, Japan has many unsettled historical feuds between where most of the foreign labor is coming from, East and Southeast Asia, a legacy of Japanese imperialism in WW2. This shows us how the Japanese see robots compared to non-Japanese.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT



*Figure 7. Therapeutic robot Paro and its creator Dr. Takanori Shibata*

Source: By Geraldshields11 - Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=69799329>

Certainly, there are some concerns regarding robots' increased penetration into social and economic life. Individual and societal isolationism that is causing many concerns in contemporary Japan is expected to surge (Koudela, 2019) with certain portions of human-to-human relations and interaction being substituted by human-to-robot interactions. Furthermore, the expected jobs to be overtaken by robots in the near future are dominantly service jobs, where the employed group had traditionally been married women. This can cause many women to lose their economic independence as those who work in non-regular service jobs are primarily women who left their regular jobs after marriage or childbirth. A grey field is also about the ethics of using robotic eldercare measures. With certain criticisms pointing out the planned dehumanization underway in eldercare, it should be stressed that the human interaction that the elderly are desperately in need of will be under question with robots becoming more common in eldercare centers. However, when we look at Coco's (2018) study comparing attitudes towards care robots between Finland and Japan, we see that the Japanese hold a much positive sentiment towards the use of robots than the European country. Some factors can make the Japanese see robots with a special affinity compared to other societies of the world which might

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

explain Japan's willingness to accept robots in a wide variety of social and economic life and brush off the concerns.

### 5. Japan's Affinity for Robots

There are certain factors that make the Japanese feel more attracted to and adaptable towards a life with robots compared to the rest of the world. Japan has a history with mechanized objects. Mechanical Japanese dolls, 絡繰り人形/*Karakuri Ningyō*, were produced and used in entertainment and as souvenirs, becoming popular starting from 17<sup>th</sup> century. These dolls had certain mechanisms inside them which made them undertake certain gestures and movements, often pouring tea or shooting arrows with a combination of specific motions. These dolls certainly held a place in the Japanese mindset after centuries of interaction. Further, the prohibition of the development of technology and weaponization of technology under the Tokugawa rule in the Edo period, fearing it would be a danger to their rule and stability, had only left room for technology to develop in toy and entertainment areas (Wagner, 2009). Therefore, unlike the West who saw the devastating effects of technology in warfare with the use of machine and Gatling guns in wars and engagements killing people at an unimagined rate, Japan continued to see technology as a non-dangerous concept, through *karakuri ningyō* for a significant amount of time until its reopening. *Gakutensoku*, what is regarded as the first robot of Japan, a giant humanoid animatronic, certainly has a lot of inspiration from the *karakuri ningyō*, as did its perception by the Japanese.

Another factor that makes Japan more accepting and less skeptical towards living with robots is religious values that have a great place in the Japanese mindset even in irreligious people. Teachings of Shintoism and Japanese schools of Buddhism, two major religions in Japan, house the idea of beings and objects other than humans also having spirits, such as animals, plants and even inanimate objects. The role of animism in the Japanese psyche, therefore, is evident. Placing such features on to objects, also applicable to robots, paving the way for Japan to conform with a life that is under constant robot interaction, where most of the globe stays more skeptical. While the West separates humans from nature, the idea of humans being part of a lively nature, where robots also derive from matter (Sone, 2016), Japan sees no barrier between human and robot connection. The perspective towards robots in Japan is welcoming, where the robot can be seen much more than cables and circuits. Even the first translation of the word "robot" in Japan, which was introduced in 1923 when Čapek's R.U.R

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

play was performed, was translated as 人造人間/*Jinzō Ningen*, meaning artificial human, signaling intimacy and acceptance of robots as human-like.

The representation of robots in the popular culture and media in Japan is also certainly another factor creating extra affinity for robots. Japanese popular culture includes a lot of robot characters with a big majority of them friendly, affectionate, and helpful. Some of these series are the legendary Astro Boy, Doraemon and the Gundam universe. These creations through manga (comic book) and anime (Japanese animation) culture, have obtained a considerable amount of presence in Japanese life, for over generations. It is no secret that these series affect the roboticists and robotic engineers of Japan to long for creations that they grew up with, trying to make fantasy real. Roboticists and engineers are not the only ones as the general public also developed warmth and goodwill towards robots being exposed to positive representation of robots over decades. Unlike most of the rest of the developed world where robots are majorly represented as enemies of humankind in pop culture, of course with many exceptions, Japanese pop culture delivered robots as a non-dangerous and auspicious concept. The particularity and uniqueness of the “special” bond Japan has with robots are under debate. It is argued in this paper, however, that these factors cannot be left out of the equation when one tries to understand Japan’s ongoing endeavors regarding robots and their perception.

### 6. Robots Beyond Just Labor

The aim of this thesis is to find why robots are perceived as primary candidates in dealing with the demographic decline in Japan. So far, we have seen the reasons as them constituting a substitute for the declining workforce and a desirable alternative to other options, mainly immigrants. However, as it will be argued in this paper, these are not the primary reasons, as there are undisclosed motives behind the collective effort to put robots into the center of the population crisis. To uncover these, critical discourse analysis is conducted on three things, the fictional story called “One Day of the Inobe Family” published in the scope of Innovation 25 long term initiative at 2007, “Robot Town Sagami 2028”, an animated short put out in 2016 and a speech given by former PM Abe in 2017 at CeBIT Welcome Night.

One Day of the Inobe Family<sup>11</sup> is a story created by the Japanese PM’s office, METI and Ministry of Innovation in the scope of Innovation 25 that is defined as “a long-term strategy initiative for the creation of innovation contributing to the growth with an eye on the

---

<sup>11</sup> Cabinet Office, 伊野辺家の1日(One Day of the Inobe Family)  
<https://www.cao.go.jp/innovation/action/conference/minutes/inobeke.html>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

year 2025”<sup>12</sup> by the cabinet office itself. The story depicts the daily life of a Japanese family living in 2025. The family consists of 6 members, grandfather Ichiro, grandmother Masako, father Naoyuki, mother Yumiko and the children Daiki(m) and Misaki(f). The story tells the audience what this family’s day consists of, starting from 06:30 to 23:00. Few visuals are included in this story, with another set of them created for the Innovation 25 dream. Now we look at what kind of a future is imagined and constructed by the Japanese government.

The story imagines a future where daily life is highly technologically advanced. Instant health check-ups when waking up, smart commuting via interconnected smart vehicles are features depicted in this story but in the center for us is Inobe-kun. Inobe-kun is a child-sized humanoid robot doing many household tasks, communicates with the family and is interconnected with a lot of other appliances, updating the family on other robotized features of their house. The name Inobe/イノベ derives from イノベーション, meaning innovation. In this story, Inobe-kun does many of the household tasks that are traditionally seen as the responsibilities of the women. The robot cleans the house, keeps contact with the family members and prepares a bath for Yumiko. Inobe refers to its owners as father and mother. Later, Yumiko thinks “I’ve been able to fully build my career while raising two children, thanks to the promotion of family support policies that have been in full swing since Daiki was born.”. What does Yumiko mean by these policies? Perhaps what she means is the effort and help of the government in developing such technologies.

The discourse presented to the audience through this story depicts robots more than a substitute for labor. Here, robots represent a way to actually solve the population decline rather than being a coping measure. In this short slice of life of the Inobe family, robots are shown as liberators from work where people can allocate more time to their personal needs, which also provides time and resources for childrearing. The presupposition behind the story is known to everyone, Japan is aging and losing its population. The entailment provided in this discourse is that robots and technology through innovation can disintegrate the causes for these problems. If we look back at the major causes for demographic decline listed, we see that they include women’s struggle with keeping a work-private life balance and the change in the family institution. Here, robots are portrayed as a solution to these problems. The indexicality is in 2025 (time), Japan (space), after years of low fertility and aging (epistemic right) will find resolution in becoming a highly robotized society (deontic right) and end these issues. Therefore,

---

<sup>12</sup> What is “Innovation 25”? [https://japan.kantei.go.jp/innovation/okotae2\\_e.html](https://japan.kantei.go.jp/innovation/okotae2_e.html)



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

the official discourse constructed by the Japanese government, as this was a combined effort of many governmental bodies, is that Japan can go back to a traditional family life where three generations live together and can eradicate factors for low fertility with the help of robots, as they provide a work-life balance for couples.

The next piece of media where the constructed discourse is analyzed is the animated video called “Robot Town Sagami 2028”<sup>13</sup>. This video has been released by the Kanagawa Prefectural Government on YouTube and on the designated website<sup>14</sup> to promote the “Sagami Robot Industrial Special Zone” and what it tries to achieve. The zone contains 12 municipalities in the Kanagawa prefecture and houses a lot of industrial centers, laboratories and research hubs all specialized in robotics. These centers are researching and developing robots for a variety of fields. The video gives a story that takes place mainly in 2028, in the Sagami Special Area of what life looks like.

Takao, at his office work in 2016, gets a call from his wife, Yumi and learns that she is pregnant and that they are going to have a child. Takao rushes to his home in happiness, buying an Astro Boy doll on the way. However, a car that goes out of control and crashes into him on the sidewalk. At the hospital in a bad condition, Takao’s spirit looks at himself on the hospital bed and his wife on his side, deeply saddened, while suddenly, Astro Boy in a spirit-like form joins him and takes him to the future, to the year 2028. Takao is baffled as he sees where he lives, Sagami, is so different from before, robots roaming the streets with a technologically advanced commodity present in every corner. He thinks he is dead as he cannot interact with anything materially. The rest of the story consists of Takao observing what the daily life of his wife and now-grown daughter, Hina, looks like. The story ends with a revelation of Takao seeing his future self, wearing a robotic exoskeleton, which presumably saved his life and helps him in his everyday life. Overjoyed, Takao teleports back to the hospital bed, knowing that he will survive and that he has a lovely future in front of him.

Similar to the Inobe family story, life here is presented as a highly robotized reality. Sagami area of 2028 includes self-driving cars, humanoid robots on the street helping people with directions, robotics exoskeletons or wearable robotics, drones carrying packages and disaster prevention robots. One particular image is Robita (figure 8), a small humanoid social

---

<sup>13</sup> Robot Town Sagami 2028(English)

[https://www.youtube.com/watch?v=IxWuJrXNGiI&ab\\_channel=%E3%81%8B%E3%81%AA%E3%83%81%E3%83%A3%E3%83%B3TV%E3%88%E7%A5%9E%E5%A5%88%E5%B7%9D%E7%9C%8C%E5%85%AC%E5%BC%8F%E3%83%89](https://www.youtube.com/watch?v=IxWuJrXNGiI&ab_channel=%E3%81%8B%E3%81%AA%E3%83%81%E3%83%A3%E3%83%B3TV%E3%88%E7%A5%9E%E5%A5%88%E5%B7%9D%E7%9C%8C%E5%85%AC%E5%BC%8F%E3%83%89)

<sup>14</sup> Robot Town Sagami <https://sagamirobot.pref.kanagawa.jp/>





Source: ROBOT TOWN SAGAMI 2028(English), かなチャン TV (神奈川県公式)

When we put some indexicality to this video, the overall position is that in 2028 (time), Sagami (space) which is/was a place where Japan's demographic issues were one of the most seriously felt (epistemic right) has solved these issues thanks to the use of robotics (deontic right). The presupposition and entailment in this discourse are similar to the Inobe 25 example. The discourse presents the reality of aging and demographic decline as a presupposition and constructs a future ideal where robots, as entailment, are saviors on the basis of how they make individuals freer and healthier. Overall, these representations materialize the future.

Before moving on to the third component of the discourse analysis, some scholarly opinion regarding human-robot relations has to be introduced at this point. Producers influence what their robots entail and embody. Šabanović (2010) asserts that aware or unconsciously, producers of robotics make their robots in line with their own socio-political and cultural values and wish for their integration into the market and society be according to that image. Therefore, robots in Japan are imagined and are pushed to be integrated as they were “Japanese” people. We must note that conservative LDP is and has been the chief promoter, endorser, and advocate of robotics in Japan. The essence of Nihonjinron (Japaneseness) is what is expected from robots to incorporate in Japan (Kovacic, 2018). Indeed, as Robertson (2018) argues, many robots in Japan are gendered and constructed according to Japanese stances towards what a woman or a

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

man should do, as they do tasks that traditionally have been the responsibility of the respective gender. She also looks at the Inobe 25 story and draws parallels to WW2 era propaganda, where the output of Japan, in the past through colonialism, now to be techno-colonialism have spread civilization to the area under effect. Robertson additionally, establishes connections with WW2 era family propaganda where the government also depicts an ideal family structure from their perspective.

So, what does this mean in the scope of usage of robots in the struggle against the population crisis? It means that the Japanese government, not only intends to solve the population crisis with robots, but also aims to protect and preserve Japanese traditions, norms, and values by doing so. Robots look like a solution that does not impose a challenge compared to other proposed solutions to the demographic issues of Japan as they all are measures that some way or another reorganizes society to the current realities and needs. When we look back at the One Day of the Inobe Family feature and Robot Town Sagami Video, we see that robots eradicated certain problems which are the major causes for low fertility, such as high workload and distressing home-work balance. Yet what the Japanese government envisions still shows traditional family roles. Fathers are not shown as partakers of childrearing and women still continue to cook and be responsible for the housework, this time checking on household robots to see whether everything is on track.

To further delve into the reasons why the Japanese government sees robots as a desirable remedy, one last discourse analysis is conducted on the speech given by former PM Abe at CeBIT Welcome Night in 2017<sup>15</sup>, exactly 10 years after his Inobe 25 plan was announced. CeBIT is a technology expo and trade fair, held each year in Hanover, Germany. It was held from 1970 to 2018, where it was organized for the last time. Shinzō Abe has represented Japan at CeBIT 2017 as a partner country for that year. Furthermore, the Hanover declaration was signed between the ministries of Germany and Japan to establish cooperation in IT security, Internet of Things (IoT) and data standardization. Now we shall look at what kind of a discourse former PM constructs in his speech.

The speech is highly concentrated on the use of technology, innovation and how these concepts will change the society of the near future. It gives many clues on why Abe and his former government were so much focused on technology and robotics regarding the future

---

<sup>15</sup> Prime Minister of Japan and His Cabinet, Address by Prime Minister Shinzo Abe at CeBIT Welcome Night  
[https://japan.kantei.go.jp/97\\_abe/statement/201703/1221682\\_11573.html](https://japan.kantei.go.jp/97_abe/statement/201703/1221682_11573.html)

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

of Japan. Firstly, he hints at how he perceives the future of technology. Abe says, “Machines equipped with AI, or machines that are essentially robots no longer perform only narrow, singular functions... The machines of tomorrow will be tasked with the mission of solving that multitude of challenges.” He hints that technological commodities will not only be used to enhance what they are designed to do but will also be used to solve an issue that is previously thought to be unrelated to technology, perhaps indicating domestic problems of Japan like the demographic crisis. He continues by stating that innovation is the most important thing for the developed world. He reasserts Japan’s faith in innovation and technology as a resolve for its problems, saying “It will be innovation too that will unquestionably resolve the issues we face in the future... For that reason, Japan has no fear of AI. “Machines will snatch away jobs” -- such worries are not known to Japan. Japan aims to be the very first to prove that growth is possible through innovation even when a population declines.” He demonstrates his belief that a wide variety of problems, regardless of origin, are solvable by innovation/technology.

Towards the end of his speech, former PM Abe draws attention to another concept. Summarizing mankind’s steps towards development and the industrial revolutions that made us venture this far, he voices that now the world is coming to the fifth chapter, to the “Society 5.0” ideal. He defines this phase as “This age in which all things are connected, and all technologies fuse is the advent of “Society 5.0”. Society 5.0 is a concept which entails a super-digital society where every technology, system and data is interconnected, creating a super-smart society where individuals benefit from highly advanced technology to the personal level. Abe concludes his speech by referencing this concept, by saying “The fifth chapter of humankind will surely be a world with a bright and rosy future ahead. Let us walk on, forward”. Overall, the former PM constructs a world in his discourse where every problem has a technological fix. Through this idea, with innovation and the use of AI and robots, mankind will advance to another form of society, Society 5.0. The presupposition is that the developed world has problems, but the entailment is that the solutions to those problems derive from innovation and technology.

From this discourse evident in many other actions and programs of the Japanese government, we can point out another reason for robots being the most desired remedy for the population crisis. It is believed that if robots are actively used in combating population decline, Japan can better translate and organize itself to the new societal system, “Society 5.0”, with an early start of integrating robotics and AI into daily life and harmonizing the new lifestyle that the new industrial phase anticipates. Furthermore, until the transition happens wherein the

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

Society 5.0 problems such as low fertility will no longer naturally be a problem, Japan can protect its social fabric via the use of robots and do not apply to other measures which can pose a challenge to “Japaneseness” that is wanted to be preserved. At least it is argued that this is what the advocates of robots against population decline aim to achieve.

Overall, there are several factors identified through this study as the reasons behind the push for robotics as a remedy for the demographic crisis in Japan. Robots are not only thought of as an alternative to foreign substitutive labor but also as an element that will eliminate the causes of the problem. Robots are perceived as a solution to the population crisis where they protect and reinforce traditional Japanese values and norms. Lastly, using robots to combat the demographic problems, Japan prepares itself to proceed to the next industrial-societal phase, the Society 5.0 and preserves Japaneseness in the process compared to alternative solutions which will make Japan proceed to the next phase with undesired societal features. These are believed to be the major motives of proponents who support the effort for using robots to deal with demographic problems.

It is argued in this paper that the structural functionalist perspective provides a good conceptual explanation to the findings of this study. Structural functionalism is a theory/framework concerning sociology and anthropology which acknowledges a society as a sum of structures each having and serving a certain function that keeps the society stable, balanced and proper (Harper, 2011). It provides a macro-level look at society and how it works. Man-made structures of the society, institutions and norms, for example, meet the needs of the society in order to make it progress and not be subject to radical change in small timespans.

When we look at the topic of robots from a structural functionalist perspective, we should focus on what the functions of technology and robots as a structure, are in the Japanese society in the scope of demography. Now, structural functionalism identifies two types of functions, manifest functions and latent functions. Manifest functions are the intended purpose of an institution and latent functions are positive or negative unintended consequences of an institution. What is identified in this paper as the arguments behind the push for robots against demographic decline are manifest functions of robots and technology as a structure. Latent functions, however, will be evident after robots become mainstream as it may be too early to identify them but is a very attractive research topic for the future, about what the unintended results robots gave birth to in their proliferation and use against combating the population crisis. Structural functionalism argues that in the event of a disruptor coming to the society, constituent elements of the society will attain new functions in order to negate a radical change in the

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

society which is thought to be a negative development. In this case, low fertility and super-aging are seen as a disruptor to the Japanese society where robots function as an alleviator, getting rid of the disruptor factors and negating the social change that the Japanese government is not in favor of. As a result, robots provide stability and contribute to society, making it operate smoothly.

### Conclusion

Throughout, this study has been successful in what it has aimed to achieve, which was to find out why robots are perceived and enforced as a way to deal with Japan's population crisis. Firstly, the main causes of the population crisis in Japan were outlined. Overworking is deemed as a factor that kept individuals away from spending time on relationships and family making, as did social reclusion and isolation. The high cost of childcare's negative effects on childbearing is pointed out. It is discussed how changing gender roles are not caught up with by the business cycle and creates an obstacle for women who want both a career and a family. Additionally, the change in the perspective towards what a family is and what it brings is considered to be a major factor as the family institution is not seen as a necessary concept in life by an increasing number of Japanese.

The major negative effects of the demographic decline have been studied. Some notable ones examined are such as labor shortage and its effects on the Japanese economy, lack of sufficient eldercare, strains on the pension system and decline of the countryside. Now knowing the main causes and the outcomes of the crisis, the focus was directed towards the governmental policies that were designed to deal with it. They are divided into two groups in this paper as pro-natalist policies and counteracting policies where the first group tries to increase fertility and get rid of the major causes of the problem while the latter struggles to mitigate its outcomes. The achievements and failures of these policies are illuminated.

The issue of robots has been evaluated separately from these policies. They are not acknowledged only as a labor substitute in this study, which is the general understanding regarding robots in the scope of the Japanese demographic crisis. Nevertheless, an analysis is done regarding how Japan is using robots in fields that are facing a serious labor shortage. Features that are thought to be making Japanese especially feel affectionate towards robots, such as intimacy with mechanical dolls, socio-religious beliefs and positive popular culture representation, are also voiced. This has led to the point of research on other reasons for the push for robots other than filling empty work positions.

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

After conducting critical discourse analysis on 3 main pieces of media, a short story and an animated short published by an intra-ministerial program and municipal government project respectively and lastly a speech given by former prime minister Shinzō Abe, which are selected on the basis of robots being shown or being presented as saviors, three main deductions have been made. These findings all are stated as reasons why robots are perceived and pushed as an element in the effort against demographic problems Japan is facing. The first finding shortly is that robots are not only being viewed as a countermeasure to the fallout of demographic decline but also as a factor that can solve the causes of the population crisis. Meanwhile, they would keep the features of the Japanese society that is not desired to be lost by the conservative government which would be the case if other methods and policies against the demographic decline are implemented. Lastly, by adopting robots to combat its demographic problems, Japan prepares itself to proceed to the Society 5.0, a new industrial phase and preserves Japaneseness in the process which would otherwise be lost if the struggle against population decline was to be managed via other ways. These are identified as the reasons why the proponents of using robots against population decline aim in their cause and their perception towards robots as a method in the process.

The demographic decline in Japan will continue, reaching worse levels regarding the overall population and ratio of the elderly towards the mid-21<sup>st</sup> century. We cannot say that they are going to be a major card against the problem in the future, yet it is highly possible. One of the major supporters of robots and their use in demographic matters, Prime Minister Shinzō Abe, who created most of the discussed schemes and policies in this paper, has resigned in 2020. With him leaving the office, the rate of robotization and the roles robots have been given in the effort against demographic decline may face a change of pace. Although he occasionally pointed out robots and robotization's crucial importance for Japan, it is too early to judge the new Prime Minister's, Mr. Yoshihide Suga's opinions regarding the use of robots in combatting demographic decline. Yet it seems hardly likely that robots as an option will be dropped. One thing for sure is that they will be tried. Whether they can be successful or not is the topic of another study.



## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

### List of References

1. Adachi, D., Kawaguchi, D. & Saito, Y. U. (2021), “Robots and Employment: Evidence from Japan, 1978-2017”, *RIETI Discussion Papers*, 20-E-051  
<https://www.rieti.go.jp/en/publications/summary/20050012.html>
2. Apriliyanti, I. D. (2018) Aging Labor and Japanese Industry Performance: Lessons for Indonesia Policies, *Jurnal Ilmu Sosial dan Ilmu Politik*, Volume 22(1), pp.34-48  
<https://doi.org/10.22146/jsp.31754>
3. Bloom, D. E., Boersch-Supan, A., McGee, P. & Seike, A. (2011) *Population Aging: Facts, Challenges, and Responses*, Program on the Global Demography of Aging, Working Paper No. 71
4. Clark, R.L., Ogawa, N., Kondo, M. & Matsukura, R. (2010) Population Decline, Labor Force Stability, and the Future of the Japanese Economy, *European Journal of Population*, Volume 26(2) pp. 207-227 <https://www.jstor.org/stable/40784186>
5. Coco, K., Kangasniemi, M. & Rantanen, T. (2018) Care Personnel’s Attitudes and Fears Toward Care Robots in Elderly Care: A Comparison of Data from the Care Personnel in Finland and Japan, *Journal of Nursing Scholarship*, Volume 50(6), pp. 634-644 <https://doi.org/10.1111/jnu.12435>
6. Coleman, D. & Rowthorn, R. (2015) Who's Afraid of Population Decline? A Critical Examination of Its Consequences, *Population and Development Review*, Vol. 37, pp. 217-248 <https://www.jstor.org/stable/41762406>
7. Dahl, N. (2018) Governing Through Kodokushi. Japan’s Lonely Deaths and Their Impact on Community Self-Government, *Contemporary Japan*, Volume 32(1), pp. 83-102 <https://doi.org/10.1080/18692729.2019.1680512>
8. Fukai, T. (2017) Childcare Availability and Fertility: Evidence from Municipalities in Japan, *Journal of the Japanese and International Economies*, Volume 43, pp. 1-18. <https://doi.org/10.1016/j.jjie.2016.11.003>
9. Fukuda, S. & Okumura, K. (2020) Regional Convergence Under Declining Population: The Case of Japan, *Japan and the World Economy*, Volume 55,  
<https://doi.org/10.1016/j.japwor.2020.101023>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

10. IPSS - Population Projections for Japan (2016-2065): Summary [http://www.ipss.go.jp/pp-zenkoku/e/zenkoku\\_e2017/pp\\_zenkoku2017e\\_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1](http://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2017/pp_zenkoku2017e_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1)).
11. IPSS - Summary of Projection Results [http://www.ipss.go.jp/pp-zenkoku/e/zenkoku\\_e2017/pp\\_zenkoku2017e\\_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1](http://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2017/pp_zenkoku2017e_gaiyou.html#:~:text=Based%20on%20the%20results%20of,and%20Figure%201%2D1)).
12. Harper, D. W. (2011) *Structural-Functionalism: Grand Theory or Methodology?*  
University of Leicester Press
13. Hollifield, J.F. & Sharpe, M.O. (2017) Japan as an ‘Emerging Migration State’,  
*International Relations of the Asia-Pacific*, Volume 17(3), pp. 371-400  
<https://doi.org/10.1093/irap/lcx013>
14. Hori, K., Saito, O. & Hashimoto, S. (2021) Projecting Population Distribution Under  
Depopulation Conditions in Japan: Scenario Analysis for Future Socio-Ecological  
Systems, *Sustainability Science*, Volume 16, pp. 295-311  
<https://doi.org/10.1007/s11625-020-00835-5>
15. Hsu, M. & Yamada, T. (2017) Population Aging, Health Care, and Fiscal Policy Reform:  
The Challenges for Japan, *The Scandinavian Journal of Economics*, Volume  
121(2), pp. 547-577 <https://doi.org/10.1111/sjoe.12280>
16. Kato, T. (2018) Associations of Gender Role Attitudes with Fertility Intentions: A  
Japanese Population-Based Study on Single Men And Women of Reproductive  
Ages, *Sexual & Reproductive Healthcare*, Volume 16, pp. 15-22  
<https://doi.org/10.1016/j.srhc.2018.01.002>
17. Kim E. H. (2018) Low Fertility and Gender Inequity in Developed Asian Countries, *Asian  
Population Studies*, pp. 113-115 <https://doi.org/10.1080/17441730.2018.1463667>
18. Komine, T. & Kabe, S. (2009) Long-term Forecast of the Demographic Transition in  
Japan and Asia, *Asian Economic Policy Review*, Volume 4(1), pp-19-38  
<https://doi.org/10.1111/j.1748-3131.2009.01103.x>
19. Koudela, P. (2019) Robots Instead of Immigrants: The Positive Feedback of Japanese  
Migration Policy on Social Isolation and Communication Problems, *Asia-Pacific*

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

*Social Science Review*, Volume 19(1), pp. 90-104

<https://www.researchgate.net/publication/331635222>

20. Kovacic, M. (2018) The Making of National Robot History in Japan: Monozukuri, Enculturation and Cultural Lineage of Robots, *Critical Asian Studies*, Volume 50(4) pp. 572-590. <https://doi.org/10.1080/14672715.2018.1512003>
21. Lam, P. E (2009) Declining Fertility Rates in Japan: An Ageing Crisis Ahead, *East Asia*, Volume 26, pp.177-190 <https://doi.org/10.1007/s12140-009-9087-y>
22. Lee, H-H. & Shin, K. (2019), Nonlinear Effects of Population Aging on Economic Growth, *Japan & The World Economy*, Volume 51(C) <https://doi.org/10.1016/j.japwor.2019.100963>
23. Lynn, L. (1983) Japanese Robotics: Challenge and – Limited – Exemplar, *The Annals of the American Academy of Political and Social Science*, Volume 470, pp. 16-27 <https://www.jstor.org/stable/1044797>
24. Ma, L. (2009) *Social Policy and Childbearing Behavior in Japan since the 1960s – An Individual Level Perspective*, European Population Conference 2010
25. Mason, A. (2001) *Population Change and Economic Development in East Asia: Challenges Met, Opportunities Seized*, Stanford University Press.
26. Macnaughtan, H. (2015) Womenomics for Japan: is the Abe policy for gendered employment viable in an era of precarity? 日本にとってのウーマノミクス安部政権、雇用政策のジェンダー化はプレカリアートの時代に実現可能か, *The Asia-Pacific Journal – Japan Focus*, Volume 13(13), Article ID 4302
27. Matanle, P (2014) Ageing and Depopulation in Japan: Understanding the Consequences for East and Southeast Asia in the 21st Century, In H. Dobson (ed) *East Asia in 2013: A Region in Transition*, pp. 30-35, Sheffield, White Rose East Asia Centre and Foreign and Commonwealth Office Briefing Papers.
28. McDonald, P. (2000) Gender Equity, Social Institutions and the Future of Fertility, *Journal of Population Research*, Volume 17(1), pp. 1-17. <https://doi.org/10.1007/BF03029445>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

29. Myrdal, A. (1941) *Nation and Family: The Swedish Experiment in Democratic Family and Population Policy*, The MIT Press
30. Oishi, A. S., Yanfei Z. & Ueda, A. (2002) Childcare System in Japan, *Journal of Population and Social Security*, Supplementary Volume 1, pp. 411-425  
<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.563.267&rep=rep1&type=pdf>
31. Poston, D.L. & Bouvier, L.F. (2010) *Population and Society: An Introduction to Demography*, Cambridge University Press.  
<https://doi.org/10.1017/CBO9780511781001>
32. Roberts, G. S. (2018) An Immigration Policy by Any Other Name: Semantics of Immigration to Japan, *Social Science Japan Journal*, Volume 12(1), pp. 89-102  
<https://doi.org/10.1093/ssjj/jyx033>
33. Robertson, J. (2017) *Robo Sapiens Japonicus: Robots, Gender, Family, and the Japanese Nation*, University of California Press
34. Šabanović, S. (2010) Robots in Society, Society in Robots: Mutual Shaping of Society and Technology as a Framework for Social Robot Design, *International Journal of Social Robotics*, Volume 2, pp. 439-450 <https://doi.org/10.1007/s12369-010-0066-7>
35. Sato, R. & Beppu, M. (2016), The Low Fertility Spiral in Japan: Can Public Policies Raise Fertility? *National Institute of Population and Social Security Research*, 2017 International Population Conference Report.
36. Schad-Seifert, A. (2019) Womenomics: A Model for a New Family Policy in Japan? In U. Meier-Gärwe, A. Schad-Seifert, M. Motozawa (ed) *Family Life in Japan and Germany: Challenges for a Gender-Sensitive Family Policy*, pp. 157-176. Springer VS [https://doi.org/10.1007/978-3-658-26638-7\\_8](https://doi.org/10.1007/978-3-658-26638-7_8)
37. Simon, J. L. (1985) The Ultimate Resource, *American Journal of Physics*. Volume 53(3), pp. 282-285 <https://doi.org/10.1119/1.14144>
38. Statista Research Department - Number of elderly one-person households in Japan 1980-2015. <https://www.statista.com/statistics/642764/japan-senior-one-person-household-number/>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

39. Statista, Society, Historical Data, Population of Japan from 1800 to 2020,  
<https://www.statista.com/statistics/1066956/population-japan-historical/#:~:text=As%20living%20standards%20rose%2C%20the,oldest%20populations%20in%20the%20world.>
40. Statista, Society, Historical Data, Total fertility rate in Japan from 1800 to 2020,  
<https://www.statista.com/statistics/1033777/fertility-rate-japan-1800-2020/>
41. Statistical Handbook of Japan 2020, Chapter 12, Labour  
<http://www.stat.go.jp/english/data/handbook/c0117.html#c12> ,  
<http://www.stat.go.jp/english/data/handbook/pdf/2020all.pdf#page=139>
42. Statistics Bureau of Japan. (2020). Labour: Table 12.1: Population by labour force status. Statistical handbook of Japan 2020. Ministry of Internal Affairs and Communications. <http://www.stat.go.jp/english/data/handbook/index.html>
43. Sone, Y. (2016) *Japanese Robot Culture: Performance, Imagination, and Modernity*, Palgrave Macmillan US
44. Suzuki, T. (2006) Fertility Decline and Policy Development in Japan, *The Japanese Journal of Population*, Volume 4(1)  
[https://www.researchgate.net/publication/260403378\\_Fertility\\_Decline\\_and\\_Policy\\_Development\\_in\\_Japan](https://www.researchgate.net/publication/260403378_Fertility_Decline_and_Policy_Development_in_Japan)
45. Tanaka, K. & Iwasawa, M. (2010) Aging in Rural Japan—Limitations in the Current Social Care Policy, *Journal of Aging & Social Policy*, Volume 22(4), pp. 394-406  
<https://doi.org/10.1080/08959420.2010.507651>
46. Tsuya, O. N. (2010) *The Impacts of Population Decline in Japan: Demographic Prospects and Policy Implications*, Suntory Foundation Forum 005 Special Report  
[https://www.suntory.com/sfnd/jgc/forum/005/pdf/005\\_tsuya.pdf](https://www.suntory.com/sfnd/jgc/forum/005/pdf/005_tsuya.pdf)
47. Tsuya, O. N. (2017) Low Fertility in Japan - No End In Sight, *AsiaPacific Issues*, No 131.  
<https://www.eastwestcenter.org/publications/low-fertility-in-japan%E2%80%94no-end-in-sight>
48. Ventura, S. J. (2009) *Changing Patterns of Nonmarital Childbearing in the United States*, NCHS Data Brief, No. 18 <https://www.cdc.gov/nchs/data/databriefs/db18.pdf>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

49. Wagner, C. (2009) *The Japanese Way of Robotics': Interacting 'Naturally' With Robots as A National Character?* The 18th IEEE International Symposium on Robot and Human Interactive Communication Toyama, Japan, pp. 510-515  
<https://doi.org/10.1109/ROMAN.2009.5326221>
50. The World Bank - Population, Total – Japan  
<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JP>
51. The World Bank - Fertility Rate - Japan  
<https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=JP>
52. The World Bank - Japan Death Rate 1950-2021  
<https://www.macrotrends.net/countries/JPN/japan/death-rate>
53. Yamashige, S. (2014) Population Crisis and Family Policies in Japan, *University of Tokyo Journal of Law and Politics*, Volume 11, pp. 108-128 <https://www.ipp.hit-u.ac.jp/activityreport/yamashige201412.pdf>
54. Yamauchi, T. (2017) Overwork-Related Disorders in Japan: Recent Trends and Development of a National Policy to Promote Preventive Measures, *Industrial Health*, Volume 55(3), pp. 293-302 <https://doi.org/10.2486/indhealth.2016-0198>
55. Yamauchi, T. (2018) Incidence of Overwork-Related Mental Disorders and Suicide in Japan, *Occupational Medicine*, Volume 68 (6), pp. 370-377.  
<https://doi.org/10.1093/occmed/kqy080>

## THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT

### Resümee

Jaapani demograafilised probleemid (madal iive ja vananev ühiskond) on kõige olulisemad probleemid Jaapani ühiskonnas. Kuidas nende väljakutsetega tegeletakse määrab nii Jaapani majanduse, sotsiaalsüsteemi, vanurite hoolekande ja mitmete teiste valdkondade jätkusuutlikuse. Üha enam räägitakse robotitest kui võimalikust lahendusest. Ka Jaapani valitsus suunab üha enam raha ja toetusi just sellesse valdkonda. Tavaliselt mõeldakse robotitest kui alternatiivist välismigrantidele. Käesoleva teadustöö eesmärk on aga aru saada, miks tegelikult robotitest demograafilise kriisi valguses räägitakse. Robotid ei ole vaid osa lahendusest, neid nähakse ka kui probleemi kõrvaldajaid. Roboteid nähakse Jaapani traditsiooniliste väärtuste ja normide kaitsjatena. Usutakse, et robotid võimaldavad saavutada Jaapani ühiskonna järgmise arengutaseme (*Society 5.0*) ilma halbade kõrvalmõjudeta, samas kui kõik teised lahendused eeldaksid teatud soovimatuid kõrvalmõjusid. Kirjeldatud järeldused ühtivad struktuur-funktsionalistliku lähenemisviisiga (*structural functionalist perspective*), kus teooriat rakendatakse selleks, et tagada mõistelist arusaama (*conceptual understanding*).

**THE JAPANESE POPULATION CRISIS AND ROBOTS AS A WAY OUT**

Non-exclusive licence to reproduce thesis and make thesis public

*Ozan Bal*

herewith grant the University of Tartu a free permit (non-exclusive licence) to

reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

*The Japanese Population Crisis and Robots as A Way Out: The Reasons Why Robots Are Perceived as A Desirable Remedy*

supervised by

*Urmas Hõbepappel*

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

*Ozan Bal*

**21/05/2021**