

GALESS Yearbook 2025

Research Reports Conferences Vienna and Singapore 2025

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POVERTY**



GALESS Yearbook 2025 - Empty Pocket

The 4th GALESS Yearbook covers a year of research-efforts from our international student-community in the research domain “Empty Pocket, Poverty, United Nations SDG 1”.

Both conferences, in Vienna (Wiedner Gymnasium) and in Singapore (School of Science and Technology Singapore), showed us the diversity and complexity of this dilemma in the different national settings and international perspectives.

Again, and it can’t be said enough, our young generation students showed great inspiration and efforts in their research-reports and discussions afterwards. An enthusiastic and motivated student generation is a sparkling asset in the creation of a sustainable living world where we fight against poverty !

GALESS will continue with the conference initiatives in 2026. The research domains will be different each year, the basic question to our young generation stays the same : Inspire us with your ideas and solutions for complex issues in our society of today to create a sustainable future for all of us.

We’ll promote this yearbook in our GALESS Community and bring it to the attention of authorities being involved in this particular research domain “Empty Pocket”.

Thank you all, students, guiding staff, jury members, organizers, speakers, volunteers and third parties for all these experiences and memories this year, carved in our minds and never to be forgotten anymore.

The GALESS Team

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Diverse Perspectives on Homelessness in Austria

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Abstract

Homelessness has a devastating impact on the lives of those affected by it; often these people are not able to assimilate back into society after being homeless. Unclear and fluctuating definitions make it increasingly difficult to have a complete understanding of poverty and homelessness. While relative and absolute poverty have existing definitions, they do not take into account more complex and hidden factors that could lead to eventual loss of housing. In Austria, a comparably wealthy and well developed country, there is still a significant amount of individuals living in precarious situations. These can be caused by unexpected expenses, inflation, or medical issues among many others. In order to examine the causes and potential solutions for homelessness, we did interviews with professors in this field and organizations helping the homeless, as well as with homeless people themselves. Our interview partners offered us not only diverse professional opinions on poverty and homelessness but also insights into the first-hand experience of being homeless. The experts we talked to educated us on underlying causes such as migration, large families, and debt. The organizations confirmed this, adding on disparities in education and not enough help and consultation opportunities. The homeless people we spoke to told us about shelters not admitting them because of their lack of Austrian documents and difficulties finding a job as a homeless person. Using this acquired information, we suggest increasing funding in projects like “Housing First” and expanding preventative initiatives that seek out people in danger of homelessness and help them regain financial stability and confidence before they end up homeless in the first place. Additionally, increasing education and drug prevention in affected areas would get to the root of the problem.

Keywords

Homelessness, Poverty, Housing, Prevention, Poverty-alleviation

1.0 Research Question

In this paper, we aim to examine the root causes of acute poverty in Austria, with a particular focus on homelessness and the challenges it entails. Our study will not only identify the factors contributing to homelessness but also propose solutions to alleviate the hardships faced by homeless individuals. Additionally, we will try to suggest strategies to prevent people from falling into such circumstances in the first place.

To gain a deeper understanding of the issue, we will combine firsthand accounts and expert insights. This includes speaking directly to homeless individuals, engaging with homeless shelters to learn about the support they provide, and consulting with professors who can offer scientific data and contextual analysis. By blending personal experiences with expert knowledge, we aim to provide a balanced evaluation of the problem and propose actionable, effective solutions.

2.0 Theoretical Introduction

Poverty can be measured in many different ways, which often leads to conflicting and inaccurate data. The two most common ways to classify poverty are relative and absolute poverty. Someone living in relative poverty, often also known as at-risk-of-poverty, earns less than 60% of the median income per capita. The at-risk-of-poverty threshold in Austria was at 1 572 per month for a one person household in 2023 and is adjusted based on how many people live in a household. Relative poverty however does not measure how a household can cope with their income, rather merely how much they earn. The absolute poverty index, on the other hand, looks at if someone can afford their basic needs. These basic needs are 13 factors determined by the EU, of which a household needs to be able to fulfill at least seven to not be in severe material or social deprivation. [2]

17.7% of the population was living in relative poverty in Austria in 2023. This number has been consistently rising and is not a significant deviation from the 17.5% in 2022. Absolute poverty, however, was at an all time high in 2023, with 3.7% in severe material or social deprivation, a 1.4% increase from 2022. This can be explained by the 8.6% and 7.8% in 2022 and 2023 respectively, as absolute poverty focuses on affordability. [1, 3]

In Austria, certain minority groups such as immigrants, single-parents, or unemployed people face a higher risk of poverty. There are also large disparities between women and men, women consistently having a higher chance of being both at risk of poverty and in severe material deprivation by 1-6%, varying based on age group. Additionally, households with female earners face a 12% higher risk of poverty than ones with male earners, as women are almost four times more likely to be engaged in part time jobs than men, mainly due to extreme imbalances in childcare. Another disproportionately affected group are children and youth under 18. They make up 25% of all people living in relative as well as absolute poverty, with immigrant children being, on top of that, almost four times as likely to be affected than Austrian children. [1, 4, 5, 9]

In 2024, 28% of Austria's population had a migrational background, most coming from Germany followed by Romania and Turkey. People coming from Germany or any other EU country have a relatively low rate of poverty when looking at people with countries of origin outside of the EU in contrast. When compared with citizens of countries outside the EU, EU citizens have less than half a chance to be at-risk-of-poverty. This is often caused by language barriers, slow integration into the labor market, or not recognized education, leading to immigrants working under their qualifications. [1, 6]

2.1 Homelessness

Homelessness, too, is notoriously difficult to measure and define. Homeless people live either on the streets, in public spaces, with friends or family, or in temporary shelters,

making it near impossible to get an accurate idea of how many homeless people there really are. Additionally, there is no single system used by all countries to measure homelessness. That said, the OECD (Organization for Economic Co-operation and Development), an international organization aiming to improve economies and societies, uses ETHOS typology to understand different degrees of homelessness. ETHOS divides homelessness into 13 categories ranging from overcrowded households to living on the street (living rough) while ETHOS Light, the shorter version of ETHOS, gathers data on extreme and acute homelessness. [10, 12]

According to data from 2022, about 19 000 people were registered as homeless in Austria. As such, homelessness went slightly down in the past few years, though it has been fluctuating between 19 000 and 24 000 since 2013. Over half of homeless people in 2022 were registered in Vienna and 68% were men. ETHOS Light only includes the three most severe categories in its calculations in Austria, where 50% of estimated homeless people live rough. However, all of these numbers are only of registered homeless, and a very large number of unrecorded data is assumed. Most of this uncaptured data would be made up of women and youth, who are more likely to live in “hidden homelessness”, meaning they couch-surf or stay with friends and family more likely than men, because of extremely unsafe conditions living rough. [10, 11, 12]

2.2 Aid Organisations in Austria

There are many different organizations in Austria fighting poverty and homelessness, such as the “Caritas”, “Neunerhaus” and many more. These organizations offer different kinds of support systems for people in need, whether they are homeless shelters, donations or counseling.

“Caritas” is a large charitable organization helping people in need around the world, including in Austria. In Austria, “Caritas” has 71 counseling centers and homeless shelters

with over 2.500 beds. Homeless individuals receive warm meals, a sleeping place, clean clothing, and the possibility to shower. They also receive ongoing support, so they can eventually get back on their own feet. However, Many people have to face administrative difficulties, causing a delay in receiving help.[7]

“Housing First” is a state funded initiative that provides homeless individuals with a home. It has been very successful internationally since 2012 and “Neunerhaus” introduced this concept to Vienna in 2021. Since then, around 650 people in Vienna have found permanent housing through this initiative, with 93% of those who received housing through Housing First maintaining their apartments long-term. It is a model where homeless individuals are directly provided with a permanent home. This approach is unconventional, as typically people are gradually reintegrated and receive housing only after some time. Those participating in “Housing First” pay their own rent but receive support from counselors and caseworkers who assist them in rebuilding their lives and achieving stability. [14]

3.0 Methods

Since finding diverse opinions and data on homelessness and poverty was quite difficult by pure literary research, we decided to gather information from three different sources by holding interviews. We conducted interviews with professors specializing in poverty research as well as with representatives of aid organizations and affected homeless themselves. In total, we interviewed three professors, representatives from four organisations in the homelessness sector, and two homeless people. Five of these interviews were done through online correspondence, the remaining three over the telephone or in-person. As such, some of our questions received more extensive responses than others.

Our first questions were formulated to be sent to aid organizations, and while we stuck to the same topics, the rest of the interviewees received slightly different questions

based on their area of expertise or personal experiences. The questions listed below are the ones we based our further queries on.

3.1 Interview Questions

What would the people you help wish for?

Do they receive financial support from the government and if so, which?

What are the most common reasons for homelessness amongst the people you help?

What do you think could be improved in the system and how?

Which government subsidies would be helpful in preventing housing loss?

What is/was the educational or working status of your residents?

What do the people you help do to regain independence?

Where did they grow up?

From what kind of circumstances do your residents come from?

What would you, as an employee, wish for in order to help yourselves and those seeking help?

4.0 Interviews

As discussed earlier, we spoke with multiple interviewees. Four of them were representatives of aid organizations focused on helping homeless individuals. We received feedback from the “Red Cross”, which supports homeless people with warm rooms, emergency shelters, medical care, and social counseling; “Caritas”, which provides

emergency shelters, social counseling, food distribution, and supervised housing for homeless people; “Neunerhaus”, which offers affordable housing, free medical care, and social counseling to homeless and at-risk individuals; and “BAWO”, the Federal Association for Homeless Assistance, which works to combat homelessness, coordinates aid services, develops social concepts, and engages in advocacy for affected individuals.

Additionally, we spoke with experts in this field. Among them were Sina Ansari, a sociologist specializing in statistics and both qualitative and quantitative methods; Christoph Reinprecht, a sociologist and leader of various projects and studies such as “Housing for Refugees in Vienna,” “Ending the Shame: Destigmatizing Homelessness,” and “Inclusive Housing Policies: Housing is the Beginning”; and Alban Knecht, whose area of expertise is inclusion research.

4.1 Analysis

The interviewees often shared similar views and were able to answer almost all of our questions. The only question they struggled with was whether homeless individuals accept government assistance. For this question, we only received an answer from the “Red Cross”, which stated that most of them receive state minimum benefits or support from basic social services.

There was strong agreement among the interviewees on the following topics:

- The wishes of homeless individuals: According to the interviewees, they primarily wish for affordable housing, more support services, and better cleanliness in shelters and emergency accommodations.
- Reasons for homelessness: The responses were largely similar and included factors such as the cost-of-living crisis, large families, minimum pensioners, unequal educational opportunities, high rents or exclusion from social housing, rent

arrears, unemployment, family issues, debt, and migration.

- Government subsidies that help prevent housing loss: The interviewees mentioned that programs like “Housing First” and free counseling services for individuals with rent arrears have been successful in combating homelessness and should be further expanded. They also emphasized the need to strengthen eviction prevention efforts.

Furthermore, most interviewees indicated that the education level among affected individuals is generally low, many are or have been unemployed, and the proportion of non-Austrian citizens among the homeless population is disproportionately high. Regarding their backgrounds, they often came from unstable and impoverished circumstances.

There was disagreement among the interviewees regarding what systemic improvements should be made. Their answers varied significantly on approaches to combating poverty. Suggestions included improving counseling centers, expanding overnight accommodation options, reducing educational inequalities, implementing an unconditional basic income, and strengthening housing policies. Some even criticized the system itself, arguing that no real system exists. Interestingly, employment was not mentioned as an area for improvement, despite unemployment being cited as a major cause of homelessness by all interviewees.

There were also differing views on what homeless individuals do to improve their situation. Some interviewees stated that affected individuals accept help from social workers, address their health issues, or look for work. Others, however, provided a different perspective, saying that the first step for many is to “try to regain their personal strength,” though it was unclear what exactly this means. Some interviewees had no response to this question at all.

Finally, we asked what personal wishes the interviewees had for improving support for homeless individuals. Responses included: more solidarity and equal opportunities, expansion of affordable housing, more job opportunities, unconditional aid services, and strengthening the “Housing First” approach.

4.1 Interview with an Expert

Our final interview partner was Alban Knecht, a sociologist specialising in social psychology and political sociology. Unlike with the rest of our interviewees, we were able to have a live conversation with Knecht, meaning that not all questions were the same as for the rest, as the conversation flowed more naturally from topic to topic. One of Knechts main points on why there is still homelessness even though it could be eradicated was that society, and especially the upper class, needs homeless and unemployed people to keep employment costs low. Unemployed people often settle for very badly paying jobs, often as low as 1 Euro per hour, since no other jobs will hire people without a permanent address. He argues that the wealthier society does not want to do anything about homelessness and unemployment, because then the job market would change, possibly forcing them to pay higher wages, which would remove them from their position so far above the rest.

Continuing on the point of societal structures, Knecht illustrated how politics plays a large role in the very slow progress. He claimed that right-wing parties often construct the narrative that people who receive welfare benefits or unemployment pay often abuse the system, portraying these people as greedy and lazy. Though this has been refuted in multiple studies that show that less than one percent of welfare benefits are misused, it creates negative biases and stigmas around poverty and homelessness which makes people uncompassionate and disinterested in helping those in need. Additionally, there are many people that could receive welfare benefits but choose not to because they are ashamed and afraid of the social consequences.

Knecht agreed with the answers of our previous partners on the topic of education, stating that a lower education very often coincides with poverty. However, he added that education opportunities alone cannot fight poverty, as those coming from poverty stricken families have a harder time focusing on school because of more pressing issues at home. This creates an endless cycle in which someone cannot achieve a higher education because of growing up in poverty, forcing them into a lower paying job, making their children grow up under the same circumstances over again. This, Knecht argued, can only be fought with financial help.

On the topic of homeless shelters, Alban Knecht was adamant they need to be improved and offer daytime shelter as well. He suggested implementing more support and consultation in order to help the homeless people staying there find a more permanent solution. He also described the issues that many homeless have with shelters, such as the prohibition of dogs, making people rather sleep outside with their dog guarding them than have to give up their pet.

Overall, Knecht gave an interesting insight into the structural and political issues surrounding poverty and homelessness, though many of his opinions were very politically connotated. He is not the only example of this, as political parties often do not want to work together to find long-term solutions because of disagreements in policy.

4.2 Interviews with Homeless People

The first homeless person we interviewed was Valeri, a middle aged man from Bulgaria. Valeri had had a home and money in Bulgaria, but he earned only a very little amount of money. Having been told that he could find a well-paying job in Vienna, he came here without having Austrian documentation. Subsequently, he was not able to find a job, and was also not permitted to stay at Caritas emergency shelters. When we met him, he was currently living on the street, saving up money to pay for a bus back to Bulgaria.

The fact that he would have only been able to stay in a shelter with Austrian documents struck us as very problematic, because it significantly reduces access to resources and safety for homeless immigrants, making their integration and transition into working society even more difficult than it already is. Though it is understandable that organizations such as “Caritas” do not want to house illegal immigrants for free because of legal and financial issues, it only increases the number of people living rough and in unsafe conditions.

The second homeless person with whom we spoke wanted to stay anonymous. He was born in Slovakia but has been living in Austria for the past ten years and speaks basic German. He had a well paid job and was able to send money back home until he lost his job when his employer was arrested, and was put onto a black-list, which prevented him from finding an apartment or taking part in some aid programs. Since he is legally in Austria and has all necessary documents, he is able to stay in “Caritas” emergency shelters and receives support from them. Due to this, he is able to search for a job and says he has found one that will likely employ him. Regardless of that he is unemployed and living on the streets, he does not receive any benefits from the government because of bureaucratic misunderstandings at his previous job.

In this interview, we uncovered that illegal employment is another widespread issue that can easily lead to persisting poverty and homelessness. When people are illegally employed, their jobs are significantly more vulnerable and they might not receive government benefits when they lose them. Additionally, they do not receive a recommendation and are not officially registered as employees, thus it is more difficult for them to reenter the legal job market.

5.0 Solutions

With our newly gained knowledge about homelessness, we compiled a list of solutions that could be effective in eradicating, or at least improving the current situation

regarding homelessness. We have included preventative measures as well as those for reintegrating homeless individuals back into society.

5.1 Preventative Solutions

One thing that Knecht mentioned was that a homeless person usually falls into this situation because they already had certain problems to begin with. These mostly include physical and mental health issues. It is of great importance to act upon these issues to prevent further housing loss. Especially mental health issues are a big problem, as homeless people are often affected by depression, anxiety and more, making it much more difficult for them to seek and receive help. There is already a significant demand for therapy spots among the general public, especially when it comes to fully funded spots and people living in poverty have even more difficulty trying to find a therapy spot. We think that it would be of great interest for the Austrian government to increase accessible and fully funded therapy spots.

Addiction disproportionately affects homeless people and is not easily fought. It is often the most significant factor holding people from getting back to a normal life. Therefore we suggest making therapy more accessible, as well as offering addiction treatments and addiction recovery programs.

Another proposal would be to enhance the education system and especially the support system for children with poorer backgrounds. While every child in Austria has the privilege to attend school, children from less well off families often face unfair disadvantages. Therefore, they often do not have the ability to completely focus on school, possibly leading them to fall into a vicious cycle. Supporting these children financially would be a major step in reducing the amount of people falling into poverty in the first place. Additionally, offering more advisory/help centers for young people, especially at schools and neighborhoods where young people have a higher likelihood of falling into poverty,

could be essential in the preventative reduction of poverty. Lastly, educating young people about poverty at an early age might also carry many benefits.

Since preventing housing loss is far more effective than reintegrating homeless individuals, we propose a system where organizations intervene in cases of rent payment delays. Specifically, landlords would be able to report overdue rent and request a social worker to visit the tenant, assess their situation and provide support to resolve any issues. This process would be free of charge and significantly reduce the risk of eviction. Moreover, landlords would benefit from this system as it would eliminate the hassle of finding new tenants and ensure the continuity of the rental agreement.

As mentioned above, families from abroad often struggle to integrate, manage their finances and find employment. To simplify this process for immigrants, we propose a free inclusion assistant. This assistant would help individuals adapt to a new environment and overcome language barriers. They could also monitor finances and offer guidance. Visits could take place up to once a week with one mandatory visit per month.

5.2 Acute Solutions

As previously discussed, the “Housing First” program supports homeless people, by helping them find an apartment as a first step to regain independence. While “Housing First” has already sustainably helped hundreds of people, it could be a lot more effective with more money and resources. This expansion was also mentioned as a driving factor to eradicate homelessness by almost all of the experts and organisations we talked to.

Having a steady income stream is the most important factor for not becoming impoverished. Hearing about our interview partner’s difficulties reentering the job market, we propose a simpler and more accessible way to start working after unemployment or immigration. Austria’s system is heavily

slowed down by unnecessary and complex bureaucracy that often deters people from even trying to find a job. We suggest a special service, without charge, for people who need help integrating into and understanding the labor market. The long-term goal would be to significantly reduce the paperwork needed, but as this cannot be implemented quickly, a simplified system for people in need would markedly increase the amount of people working legally and therefore in steady and safe employment, providing a barrier against poverty and housing loss.

Of course, many of these proposed solutions would need funding from the government to come to fruition. Instead of simply increasing or introducing new taxes, we suggest a system where each individual can see the details of where their money is invested. If they are not in accordance with the expenditures made with their money, they can file a complaint and the money will be spent somewhere else. Although this system would not completely eradicate corruption and fraud, it puts pressure on the government to not spend tax money on things that do not benefit the population.

6.0 Conclusion

Although Austria is a comparably less poverty stricken country, there is still room for improvement. There are still almost 20 000 people living without a permanent home and millions more at risk of falling into such a situation. Through our interviews with both experts and individuals experiencing homelessness firsthand, we learned that while there are many organisations that help homeless people out of their predicaments, preventative solutions would be much more effective in reducing the amount of people living in acute poverty in the first place. Furthermore we conclude that a more justifiable distribution of tax money, such as in education, consultation services and social workers, and in “Housing First” would minimise poverty.

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Appendix

Interview with Homeless Person 1 (Valeri). 12.02.2025

https://docs.google.com/document/d/1izAMCd_7jMLoveUPWCcb0x4D6nzYl-GYfXal-Vu8J2w/edit?usp=share_link

Interview with Homeless Person 2 (Anonymous). 12.03.2025

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Interview with Expert (Alban Knecht). 31.01.2025

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Poverty in Austria

-Perception and perspectives

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Abstract

This paper examines Austria's poverty status by national and international standards. Further on we explore sustainable solutions for economic disparity. Most of our research is based on a survey we conducted for the 2025 GALESS conference with the purpose of researching the public perception of poverty, taxation, and wealth distribution.

Findings indicate that while Austria has achieved the Sustainable Development Goal (SDG) of "no poverty", this does not depict reality accurately, with 14.9% of the population still being on or below the poverty line. Additionally, the survey shows that Austrian citizens are only partly content with the country's taxing system. Although most Austrian citizens recognize income inequality, they are hesitant toward higher taxation for redistribution.

The paper also investigates Austria's global responsibility in the context of the "spillover effect", explaining the impact of Austria's reliance on imports, particularly in the energy, textile and agricultural sectors. We analyze how Austria contributes to pollution globally and economic disparity in less developed countries. Potential solutions to improve both national and global economic equity include a tax reform, increased social welfare measures, and policies that promote domestic production to reduce Austria's "spillover effect".

These solutions do not include typical STEM-Solutions because we believe complicated socioeconomic issues are rooted in the way societies are set up. We believe precisely identifying where our economy and legal system is lacking is crucial for solving these issues. This is why a survey was the preferred method to evaluate Austrians opinion on poverty, taxes and wealth distribution.

Keywords:

Poverty, taxes, wealth distribution, "spillover effect"

Introduction

In the 2024 SDG-report, Austria has officially achieved “no poverty”. The SDGs (sustainable development goals) specifically target global issues, with annual reports being released every year to assess each country’s progress on these goals. “No poverty”, according to the SDGs, is defined by two indicators. Firstly, the poverty headcount ratio being above 3.65\$ and secondly, the poverty rate after taxes and transfers [1]. According to the sustainable development report, after achieving this goal poverty is ended in all forms everywhere [1], consequently there should be absolutely no poverty in Austria, however this is not true. Poverty remains one of the most pressing social and economic challenges. This Paper explores measures that could be taken to effectively reduce poverty, by analyzing survey data and extensive research.

1. Survey

For the 2025 GALESS conference participants are asked to investigate their country’s poverty status in the perspective of international standards, discuss sustainable measures, and introduce STEM solutions. We believe that poverty cannot be eradicated by STEM-solutions, as these issues are deeply rooted in society. Additionally, the first step during the problem-solving-process is to fully understand the problem, which includes evaluating and understanding the populations opinion. To achieve this, we created a survey consisting of 17 questions, out of which 7 had the purpose to evaluate the participant’s life situation, to later be able to draw connections between their lifestyle and their answers. An open comment section was also added. We used Google Forms to conduct the survey online and anonymously. Depending on a person’s financial situation we also created different paths: A person that is financially independent was asked different questions than a person that is not.

The largest percentage of participants were 35-54 years old, followed by those aged 25-34. This is relevant because these age groups are usually the ones paying the most taxes.

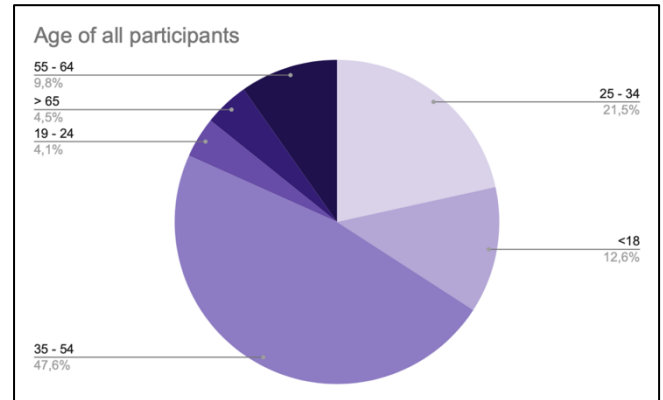


Figure 1: Age of participants

As many of our participants were under 18, they were likely to still receive financial aid and therefore have a different point of view on social welfares, the distribution of wealth, and taxes, as they maybe never even had to pay taxes. Out 257 participant 19,5% were financially dependent and 80,5% were financially independent. To dieferentiate more precisely we asked participants about their current professional situation. Most of which were in full time employment at the time of the survey.

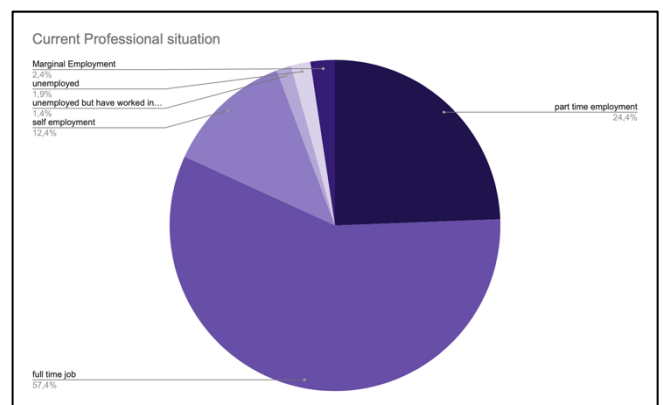


Figure 2: Current professional situation of participants

2. Poverty

There are many ways to define poverty. Austria is not included in the Multidimensional Poverty Index (MPI) developed by the OPHI, which was the recommended way to assess our country’s level of poverty, as is stated on the GALESS website. We decided to use the method which is most used to assess the amount of poverty in Austria, which is relative poverty [1]. This definition states that people who

annually earn 60% or less of the median income, also called the “net household income”, are on or across the poverty line [1]. This doesn’t necessarily mean a person who falls into that category suffers from poverty in the way society would perceive it, which is why it is referred to as relative poverty. Additionally, absolute poverty, which is defined by being unable to cover basic needs, was considered [2]. If a person is unable to fulfil 7 out of 13 different basic European living standards, they suffer from absolute poverty [2], making it measurable. These standards include a person being able to sustain a healthy diet, pay rent or cover sudden expenses. These two kinds of poverty are essential when understanding poverty overall, since a person suffering from relative poverty is also more likely to suffer from absolute poverty [2].

2.1 Poverty in Austria

The Federal Ministry for Social Affairs, Health, Care and Consumer Protection in Austria calculated the percentage of people on or below the relative poverty line in the year 2023 to be 14.9% which is a 1.2% increase from the evaluation before the pandemic and the energy-cost-increase in 2019 [1]. This study also showed that about 336.000 people suffer from absolute poverty, with 88.000 being children [2]. Compared to 2022, 130.000 more people and roughly double the number of children are affected by absolute poverty in Austria [2]. Even though the poverty in Austria did increase, Austria still performs better than most of Europe, with an average of 17.7% relative poverty, which has also increased by 1.2% since 2019 [1]. Something to take into consideration is the fact that in this study only people who are official citizens of Austria and are below the age of 65 or receive a state pension are considered, meaning parts of old-age poverty and migration poverty are not considered [1].

The findings of our survey indicate that more than 14,9% of Austrians are on or below the poverty line, as the study of the federal ministry suggests. Over 23% of the participants of our survey stated that they have financial troubles of some kind. Interestingly, most participants stated that they are “rather wealthy”, however only 3,3% of participants stated that they are very wealthy. It is important to note, that these

numbers are not objective and are based on the participants subjective perception of their own wealth.

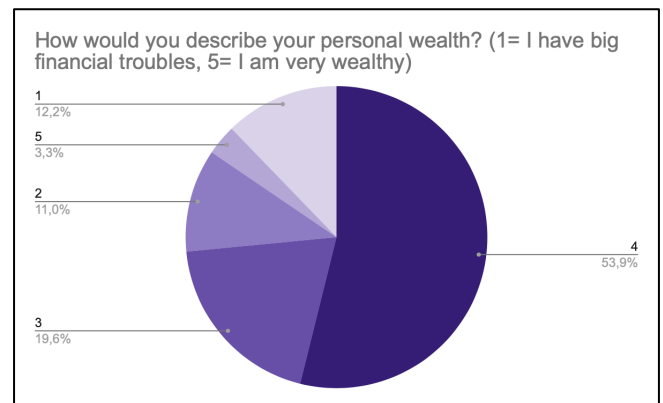


Figure 3: Perception of personal wealth

2.2 Kinds of poverty in Austria

The likelihood to suffer from poverty is not the same for every person in Austria. Especially people that were long term unemployed suffer the most from absolute poverty, making up 28% of those affected [2]. Households in need of professional care and households with three or more children make up about 8% respectively [2]. Single-parent-households are also heavily affected, with 15% suffering from poverty [2]. People with little education and people without an Austrian citizenship are also some of the most affected groups [2]. Effects of absolute poverty range from not being able to afford housing, clothes, food or an education to being excluded from general cultural and social events and conventions [2], further isolating poor people from society. This makes poverty a main cause of physical and mental health issues [2].

2.3 Measures against poverty

One of the most important state funded organisations is the AMS, which is Austria’s leading provider of labour-market related services. Among other things they are responsible for the unemployment benefits which are supposed to help

people that are currently without a job or in between jobs, to cover their monthly expenses. However, there are certain criteria a person must meet to receive these benefits. Those include taking part in further training courses to get a new job more easily and having to work for the AMS for at least 20 hours per week. Although there are some exceptions, for example being a single parent to a child under the age of 10. Another thing to consider is people can only receive unemployment benefits for up to 20 weeks, except in special cases like partaking in longer training courses or health related issues. Finally, unemployed people may only receive about 50% percent of their last annual net income, which can be difficult if they were earning the Austrian minimum wage of 12,13 Euros net per hour or 2.025 Euro net per month. That would leave them with an unemployment benefit of approximately 1.013 Euros, which puts them way below the poverty line and would make covering rent, food, gas or electricity impossible without additional help [3]. Still, this poses as a reliable safety net for those in between jobs or those unable to work.

Another measure taken is free health care within Austria if the person is employed or receiving money from the AMS [4]. Regular medical check-ups and necessary surgeries as well as dental care is usually free, with the exception of certain therapies, medication or higher quality dental care to name a few. This means that most people suffering from poverty, provided they are able to apply for unemployment benefits, are able to remain in relatively good health. Austria also tries to prevent old-age-poverty by providing reliable pensions [3]. Without those 67% of people in retirement would suffer from poverty. However, to cover these expensive pensions, Austria needs to spend the largest percentage of its annual budget on them [5].

3. Austrias taxing system

As mentioned above, poverty in Austria prevails especially in the eyes of the Austrian population, as seen in the survey. To further understand the complex topic of poverty in Austria and how it is related to the distribution of wealth, it

is important to first analyze Austrias taxing system. It is important to note that this chapter will only scratch the surface of the complex Austrian taxing system and is heavily simplified. Naturally, it would be nearly impossible to list and correctly portray all the different taxing laws, which is why this chapter will be focusing on the interrelationship of these specific concepts: income tax, as it is the governments most efficient way to regulate wealth within the state and where the state generates the second to most part of the state's annual budget [5]. Therefore, we will specifically focus on the participants' contentment with these concepts.

First and foremost, it is vital to establish who is liable for the income tax. In Austria there are two different kinds of income tax: The "Lohnsteuer", which applies to employees in all fields and retired people that receive a monthly pension, and the "Einkommensteuer", which is for self-employed people [6]. The tax rate is generally the same [6], though there are different tax rates for different income ranges [6]. The "tax free existential minimum" is an income that is below 12816 euros, meaning that a person earning less than this specific amount annually would not be obliged to pay income tax [6]. Since a person can be liable to pay taxes in two different states, there are so-called "double-taxing agreements" to ensure that one is not taxed twice for the same income [6]. The next tax rate of 20% applies to anyone who earns between the range of 12816 to 20818 euros [6]. Overall, there is a trend of around 10% increase in taxes per range, though the ranges are not directly proportional to each other [6]. This leads to a huge gap in how well wealth is distributed between high earning people or businesses in Austria since the same income tax rate of 50% applies for those who earn 99266 euros and those who earn up to a

million and everyone earning above one million annually pays the same tax rate of 55% [6].

Income Brackets in Euros	Marginal Tax Rate 2024
12,816 and below	0%
Over 12,816 to 20,818	20%
Over 20,818 to 34,513	30%
Over 34,513 to 66,612	40% ²
Over 66,612 to 99,266	48%
Over 99,266 to 1,000,000	50%
Over 1,000,000 ¹	55%

Figure 4: Tax brackets

Whether this is "fair" or not has been an ongoing discourse in politics, especially because there is no inheritance or wealth tax in Austria.

3.1 Contentment with the taxing system

Participants of our survey seem to have split opinions on the question whether the taxing system in Austria is fair or not. Of the participants 56.7% stated that the amount of taxes they are paying is justified, which suggests contentment in most parts and 1.7% of people disclosed that they do not pay taxes. However, 37.7% claimed that they are paying too many and only 3.9% would be willing to pay more taxes.

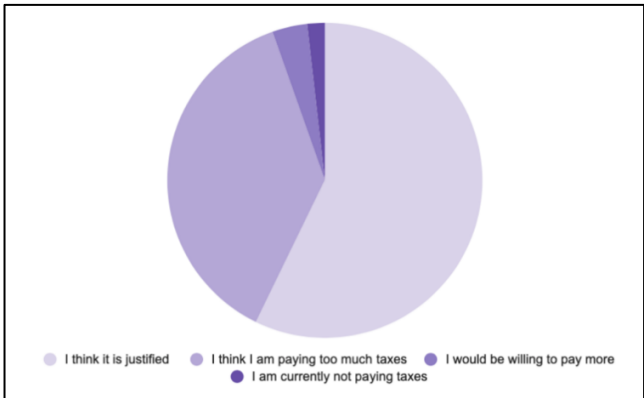


Figure 5: Contentment with taxing system

At first glance, these numbers suggest that Austrians are not willing to give up bigger percentages of their income for those in need (in terms of social benefits). The results of another question, however, suggest a general need for more social benefits, since 59.5% claimed that they are content

with Austria's social benefits but would wish for more. 18.9% said that they are satisfied with them the way they are. A little over 5% claimed that they are not content with the social benefits and would wish for less.

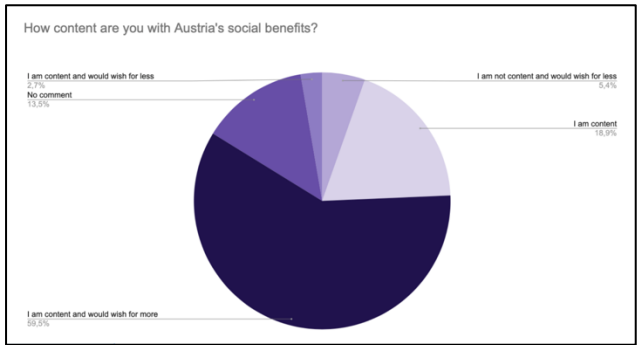


Figure 6: Contentment with Austria's social benefits

These results may lead one to assume that Austrian citizens are willing to pay more taxes to in return achieve more social benefits funded by the state.

In contrast to that, when asked if they would be willing to raise the tax rates to offer financial support for those in need, 34.6% answered with a clear "no", 19% with a clear "yes" and 46.3% claimed that they would only be willing to do so under the right circumstances. To further understand what this means, a thorough look at the additional comments to our survey offer a closer, more personal view into the perspective of Austrian citizens.

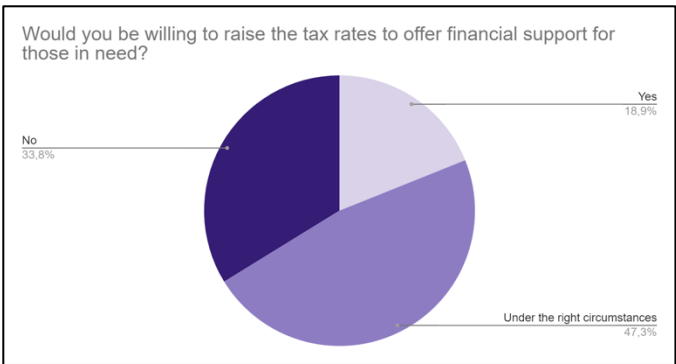


Figure 7: Willingness to raise taxes

Just like in the survey, the additional comments portray a variety of different opinions. Common themes were better management of taxes, raising of tax rates, especially for wealthier people, an implementation of an inheritance tax, and responsible usage of social benefits. Generally, a lack of even distribution of wealth and irresponsible or

untrustworthy management of tax money are the main critique on Austria's taxing system. While more social benefits are generally demanded, Austrian citizens are hesitant toward a tax reform or the raising of tax rates for these reasons.

4. Distribution of wealth

The distribution of wealth is a highly complex and nuanced topic, that is influenced by many factors. Austria is generally considered a highly developed country with high standards of living, yet the wealth is distributed very unevenly across the population. The most used measurement for income inequality is the Gini coefficient. The Gini coefficient is calculated by drawing to axes, one representing the percentage of the population and on representing the percentage of total income. As seen in figure 8, if everyone received the same amount of income the graph would align with the "Line of perfect equality", if they don't, the Lorenz curve emerges [7].

The Gini coefficient describes the percentage of Area A of the Area A+B.

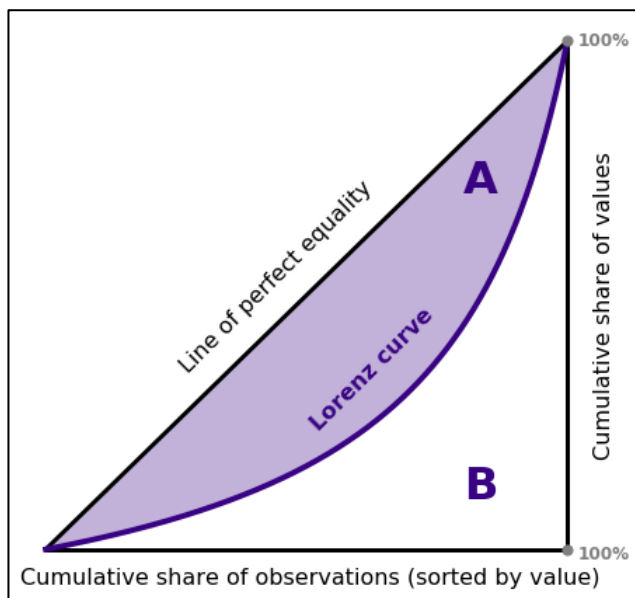


Figure 8: Calculation of the Gini coefficient

Austria has a Gini coefficient of 27, which is good in the global comparison and has remained relatively stable over the past few years [8]. Some may believe that this number indicates a low level of wealth inequality. However, it is important to note, that the Gini coefficient measures only income equality and not total assets, which include stocks,

properties, and savings, and is therefore not capable of capturing all aspects of wealth inequality.

The wealthiest 10% of Austria's population own approximately two thirds of the total assets in Austria [9]. This inevitably leads to 90% of Austria only owning about a third of the total net assets. As visualized in figure 9, the poorest half of Austria's population only owns 2,5% of the total net assets [9]. These numbers already illustrate that despite Austria's Gini coefficient being 27, the wealth in Austria is far from being equally distributed.

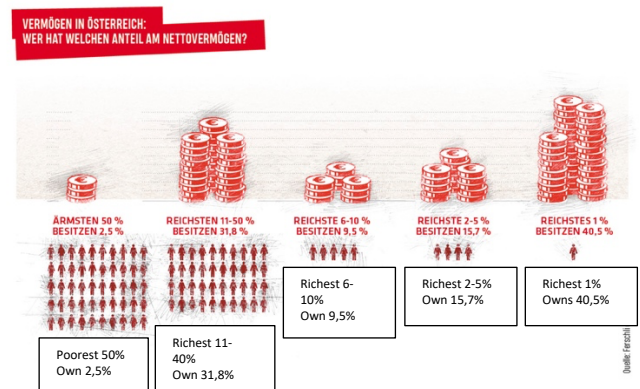


Figure 9: Distribution of wealth in Austria

This data can also be seen in our survey. Whilst Austria is a social democracy and a strong welfare state, wealth inequality persists.

When talking about highly complex socio-economic issues, such as this one, it is essential to consider not only the populations perception of the problem, and their point of view, but also in what way they are willing to contribute to solving it. Our survey's goal was exactly that. To get a profound, accurate, and current Idea of the perception of Austria's population of the distribution of wealth. This is not only supposed to lead to a better understanding of how these inequalities affect Austrians but also contribute to the problem-solving-process. To achieve this, we asked Austrians how equally they believe the wealth is distributed in Austria on a scale from one to five. One meaning that the wealth is not equally distributed at all, and five meaning that the wealth is distributed equally.

When one looks at the answers of all participants it becomes clear that the most part of

Austria's population agrees that the wealth is unevenly distributed across the population. Over 70% of perceive the distribution of wealth as "unequal" or "rather unequal". About one in five participants gave the equality a three on a scale from one to five which is equivalent to stating that you view the distribution as neither equal nor unequal. Only 1,2% think the wealth is distributed equally and just under 7% believe the wealth is distributed rather equally.

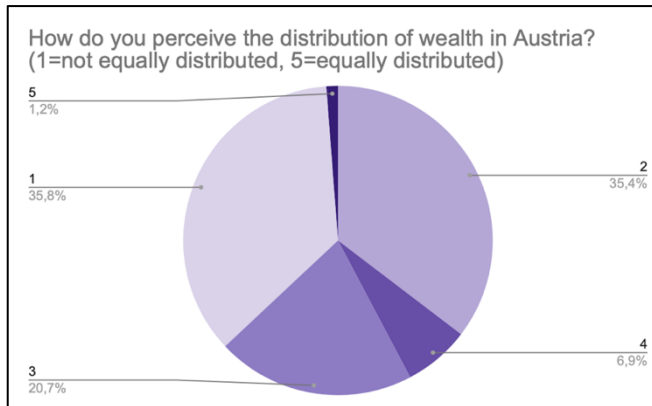


Figure 10: Perception of the distribution of wealth

To evaluate the participant current life situation, we also asked them to evaluate their personal wealth (figure 3) and distinguished between financially dependent and financially independent participants. It becomes evident why this distinction is essential, when one looks at how participants view their personal wealth in connection with their perception of the distribution of wealth. When one analyzes this connection of financially independent participants it is notable that not even one of those who perceived the distribution of wealth as "unequal" perceives themselves as "wealthy" or "rather wealthy". Out of all 257 participants only 3 stated that they perceive the distribution of wealth in Austria as equal. Out of these three, two think of themselves as rather wealthy.

It is most likely that this is the case because poorer Austrians experience more inequalities and therefore perceive the wealth as more unequally distributed. However, this finding is not nearly as explicit when one investigates the answers of financially dependent participants. This can probably be led back to the fact, that with financial aid one's personal wealth does not necessarily have to be related to one's work experience, as family finances can still have an enormous impact on opportunities and past or current experiences.

5. Spillover Effects and Austria's Global Impact

The spillover effect can be defined in many ways and is used in multiple contexts, but the basic concept is always the same. From now on, when we talk about the spillover effect, we will refer to the following definition, which is also used by the United Nations and goes as following:

"In economics, spillover effects are economic events in one context that occur because of something else in a seemingly unrelated context. For example, externalities of economic activity are non-monetary effects upon non-participants "[10].

These events can of course have a negative or positive impact on other countries, although the term is mostly associated with negative impacts.

5.1 Measuring the spillover effect

When assessing a countries spillover effect economic, socioeconomic, and environmental changes caused in other countries are considered. Obviously, an effect as widely spread and complex as the spillover effect is extremely hard to measure. The SDG Report attempts to do so with the so called "Spillover Index", which looks at the spillover effects of countries in the context of the sustainable development goals. They define it as follows:

"Each country's actions can have positive or negative effects on other countries' abilities to achieve the SDGs. The Spillover Index assesses such spillovers along three dimensions: environmental and social impacts embodied into trade, economy & finance, and security. A higher score means that a country causes more positive and fewer negative spillover effects. "[11].

This score ranges from 0, being the worst possible score, up to 100, the best possible score [11].

5.2 Austria's spillover Effect

Austria is a first world and highly developed country and has the sixth best SDG rank [11]. However, Austria got a 60.04 as its Spillover Index, a score that does not look exceptionally bad at the first glance, becomes significantly less impressive when one realizes that Austria is placed 151st out of 166 countries [11]. High-income countries have a bigger global impact on the environment. This is mainly due to trade-related interactions such as unsustainable and irresponsible consumption, which contributes to air pollution and produces waste [11]. As Austria is relatively small country and is unable to produce all the goods needed at a cheap price due to lacking infrastructure and raw materials [12], it is less expensive to import goods from countries that can produce products at a more favorable price. Austria spends approximately 174 billion euros on imports every year [13]. Countries that perform the worst when it comes to the Spillover Index are simultaneously the countries that are ranked higher when it comes to achieving the SDGs. As mentioned before Austria holds the sixth place in said ranking, however this is only possible at the expense of other countries.

6. Inheritance Tax

In general, the inheritance tax refers to a tax that is applied to the assets that an heir may receive. This would, in theory, help regulate wealth that is passed down through generations, including properties for example, as very wealthy people would be required to pay a percentage of their assets back to the state.

In Austria, a political socialist party with the third most voters in the recent parliamentary elections called the SPÖ is specifically advocating for the inheritance tax [14]. They developed a model that has the purpose of redistributing wealth in Austria, specifically targeting multi-millionaires [14]:

Every person that owns one property which they live on and that is not worth more than 1.5 million euros is not viable for

the inheritance tax. After that, depending on the worth of the assets, the person must pay different tax rates:

1-5 million euros 25%
5-10 million euros 30%
10-50 million euros 35%
50 million euros up 50%

This way, only rich people would be taxed, protecting vulnerable groups and making sure housing will not be affected. The money generated could be reinvested into the state, specifically into social benefits. While the inheritance tax finds support within Austrian politics, the opposition of this concept is even stronger, with three political parties (ÖVP, FPÖ, NEOS) criticizing the inheritance tax [15,16,17], which is why it has yet to be implemented. For now, Austria's taxing system seems to remain the same for at least a few years more. However, it is important to note that Austrian citizens seem to notice the disparities in wealth within Austria and try to find solutions for them.

7. Conclusio

Ultimately, it becomes evident that poverty is a highly complex issue that cannot be solved through one solution; however, there are multiple measures that the Austrian government could implement to reduce poverty. Based on the findings of our survey and extensive research, it becomes clear that the most realistic and efficient measure to reduce poverty is the introduction of an inheritance tax. This tax revenue would contribute to a more equal distribution of wealth and an increase in equal opportunities.

However, changing the tax system is not the only measure that should be implemented. Education is another crucial aspect when addressing poverty reduction. Raising awareness among all citizens and students, especially those who are not directly affected by poverty, is essential. Financial literacy and an understanding of economic inequalities promote responsible consumption and more informed financial behavior, such as supporting fair trade products and ethical businesses.

By combining financial reforms, such as adjustments to the tax system, with educational initiatives that raise awareness, Austria would take meaningful steps toward reducing poverty. This multi-layered approach is necessary because solutions should address both immediate challenges and underlying systemic issues.

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8.1 Appendix

Figure 1: created by the authors

Figure 2: created by the authors

Figure 3: created by the authors

Figure 4: Bundesministerium Finanzen (01.08.2024).

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Figure 5: created by the authors

Figure 6: created by the authors

Figure 7: created by the authors

Figure 8: Joe Hassel (2023). Measuring inequality: what is the Gini coefficient. Joe Hassel. Retrieved from:

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Figure 10: created by the authors

The Hidden Cost of “Success”: Tuition Culture and Socioeconomic Inequality in Singapore.

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Word Count: 3398

Keywords

Tuition culture, Parentocracy, social equity, socio-economic status

1.0 Summary

Parentocracy is a system in which a child's education is shaped more by parental wealth and aspirations than by the child's abilities and efforts. This model is prevalent in many Asian countries, where academic success is often equated with high test scores and prestigious qualifications. This has led to a booming tuition industry, with parents dedicating a significant portion of their income to tuition programs. Wealthier families can afford to send their children for extensive tuition programs, giving them an advantage in terms of having access to education opportunities. Meanwhile, students from lower-income families may struggle to keep up due to limited access to such resources. This paper examines how achievement gaps between children from higher socio-economic statuses and lower socio-economic statuses are widening, creating a cycle where success is increasingly determined by financial privilege rather than merit, leading to intergenerational disadvantages and a reduction of intergenerational mobility in Singapore. [9]

1.1 Introduction

The need for supplementary education classes where children are signed up for additional tuition on top of their regular schooling has become ubiquitous in several Asian countries such as Singapore and China. These supplementary classes have become known as tuition, a word that was recorded as early as the 1580s and has been defined as the action or business of teaching pupils individually or in small groups. In Singapore, tuition culture has become an essential part of a child's education as parents are insisting on sending their children to classes to aid in their academics, usually in fear of them losing out on opportunities to their peers. Parents' mindsets remain deeply entrenched in the idea that academic excellence translates to success in their child's future. In an alarming pattern, the Singapore Department of Statistics from 2024, noted that the amount spent on private tuition has more than doubled from \$820 million in 2008 to \$1.8 billion in 2023. [1] This paper analyses data collected from a survey conducted within our local context along with data cited from existing literature, including government statistics, supporting how Singapore's tuition culture and prevailing parenting styles contribute to growing educational inequality, widening the gap between students from different socioeconomic backgrounds.

1.2 Methodology

As part of our research, we conducted two online surveys. Random sampling was used to select individuals for our survey. Data was collected from 58 parents and 109 students. Qualitative and quantitative data was collected using a range of open-ended and closed-ended questions. [4] The survey designed for students was targeted for school going children aged 7 to 18 to gain insights on the cost of their monthly tuition classes as well as their reasons for attending. In addition, information was gathered on how students perceive the effectiveness of their classes and whether they enjoy attending these classes. The survey designed for parents was targeted at parents who have signed their children up for tuition classes. The purpose of the survey was to determine the amount that was being spent on tuition classes per month and the reasons parents had for signing their children up for these tuition classes. In addition, information was acquired on parents' beliefs and mindsets towards what determines success.

2.0 Education in Singapore

Singapore's education system involves 6 years of primary education, 4 years of secondary education and 2-3 years of post-secondary education (Junior College, Polytechnic or the Institute of Technical Education), followed by university. Singapore has multiple national exams which determine which school students might go to, and the curriculum students will study. As early as 12 years old, national examinations begin as students take the Primary School Leaving Examination (PSLE). At the end of secondary school, students take the General Certificate of Education Ordinary Level (GCE O Level) or the General Certificate of Education Normal Academic Level (GCE N(A) Level) examination, which determines their eligibility for post-secondary education. Students who wish to pursue higher education mainly take the GCE Advanced Level (GCE A Level) examination or more rarely, the International Baccalaureate (IB). There is an emphasis on rote learning, memorisation and academic performance to get into desired schools which can offer different curriculums, such as one focused on Chinese culture in a Special Assistance Plan (SAP) school or an exemption from the GCE O levels in the Integrated programme (IP). [2] Competition for top-performing secondary schools is intense, resulting in many parents investing substantial time and resources to help their children excel in the PSLE. [3]

2.1 Definition of success in Singapore

In recent years, the Ministry of Education (MOE) has made decisive and significant moves to broaden the definitions of merit with initiatives that embrace learning beyond grades and with greater emphasis being placed on students' holistic development. [5] Despite these efforts by MOE, societal perception in Singapore still equates success largely with academic achievement. The aforementioned high-stakes national examinations such as the Primary School Leaving Examinations (PSLE) and the GCE O Levels are used as benchmarks in measuring success since they influence school placements and thus future opportunities. Education in Singapore is seen as a key to success and upward mobility given the emphasis on hard work and achievement. [2] This means that in meritocratic Singapore, there still exists a profound emphasis on educational achievement as a pathway to future success in terms of wealth and higher social status. This is also a mindset that is held by a large percentage of parents as determined by a survey conducted by Channel News Asia (CNA) when changes were made to the PSLE scoring system in 2021. According to CNA's survey, 64% of parents said "a good score was a stepping stone to a good future or career". [6] Furthermore, while vocational courses prepare students using hands-on training and real-world application of knowledge, rather than traditional academic subjects, the salary earned is generally lower as compared to students who have attained a university degree. In a study done by the National University of Singapore (NUS) social work department from 2020 to 2021, they determined that Singaporeans who have a university degree or post-graduate degree earn a median salary of \$4,200 a month – more than double the \$2,000 that those with secondary and lower education and those with Institute of Technical Education (ITE) qualifications earn. [7] Hence, in hopes of achieving success in life, the emphasis on academic excellence is deeply rooted into our society.

2.2 The driving forces behind tuition culture in Singapore:

2.2.1 Parenting styles and their correlation to Asian culture

Parentocracy is a system in which a child's education is shaped more by parental wealth and aspirations than by the child's abilities and efforts. Traditional Asian parenting practices often involve high levels of control and obedience from children, with a focus on academic achievement and respect for authority, [10] resulting in parents playing a significant role in shaping their children's educational trajectories and future success. The inherent cultural norms in an Asian society propels parents to invest heavily in their children's educational pursuits, often fostering a competitive

environment between parents, in which parents feel compelled to keep up with other parents who provide tuition for their children. Colloquially, Singaporeans use the term "kiasu parenting" which is a common practice where "parents have the idea that they need to give their children an edge and may feel guilty if they do not provide this support." One of the main reasons why spending on tuition has been increasing steadily over the years in Singapore is due to the fact that "there is a prevalent idea in Singapore that it is not enough to simply pay attention in class, do your homework diligently, revise regularly, and monitor your own learning in collaboration with your school teachers...there's still this perceived need for an external figure, whether paid or not, to provide...coaching." [1] With this mindset, many parents might face influence from their peers and send their children to tuition, in hopes it would give them a road to a better future. From our survey of parents, an alarming majority of 96.5% had placed their children in tuition classes from kindergarten or primary school. In line with this idea of "kiasu parenting", this suggests that parents who have a financial advantage take the opportunity to push their children into tuition classes at young ages leading to these children obtaining a crucial early advantage over their peers from lower SES families.

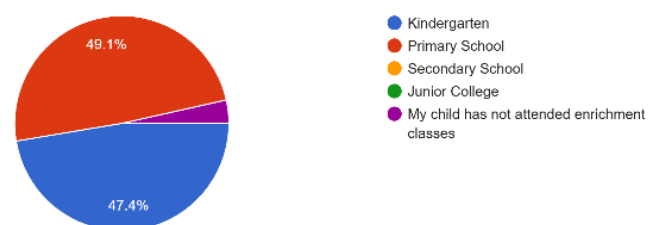


Figure 1: Ages at which children are enrolled into tuition classes by parents

2.2.2 Fearmongering marketing tactics by tuition centres

As the tuition industry expanded over the years, a number of tuition centres have engaged in unethical advertising practices. These centres use a fear-based advertising strategy where they invoke excessive anxiety among parents, causing them to doubt their child's abilities and ultimately influence their decision in sending their child for tuition classes. [11] These tuition centres often construct large advertisements placed in areas with high foot traffic, overwhelming parents with the idea that they need to take action regarding their child's studies. Deemed as the "black sheep" of the tuition industry, [11] harsh phrases such as "Wake up! Your child needs us!" [12] plays on "kiasu parenting" culture attracting parents to spend exorbitant amounts of money for these classes. In addition, referral schemes are another common technique, where centres offer heavy discounts or even vouchers and monetary rewards to both parents and children when they refer the tuition centre to their friends. [13] There are a number of tuition centres that conduct entrance tests for

prospective students, only accepting better-performing students. [14] These practices fuel the misleading idea that tuition can greatly impact one's grades and encourage more parents to send their children to tuition.



Figure 2: Instagram post showing fearmongering tactics



Figure 3: Instagram post showing referral schemes

2.3 The rise of tuition culture and its impact

Together with “kiasu parenting” and a competitive education system, the demand for additional academic support outside of school grew. Tuition centres started emerging in Singapore in the late 1970s and early 1980s. This led to the establishment of the first tuition centres, which offered supplementary classes and coaching to help students excel in their studies. Over the years, the tuition industry in Singapore has continued to expand and evolve, with a wide range of centres catering to various subjects and academic levels. [8] The culture of attending tuition classes regularly grew more and more apparent within Singapore’s student body, with many students bearing the mindset that tuition plays a crucial role for them in order not to fall behind their peers. This is supported by the survey we conducted, where we asked students their reasons for attending tuition classes. As seen in Figure 4, a large percentage of students (48.6%) requested for their parents to enroll them into tuition classes,

suggesting that students themselves feel the pressure to achieve academic success.

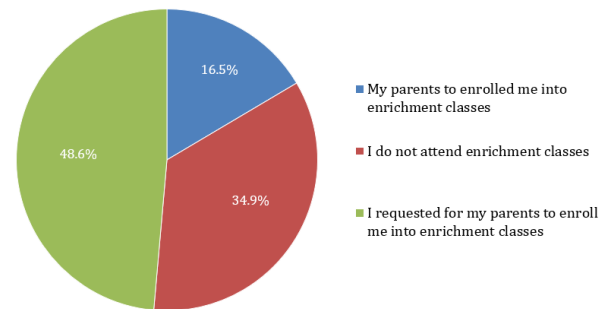


Figure 4: Students reasons for attending tuition classes

This is compounded by the fact that there are limited spots available at top schools and universities resulting in students and parents believing that paying more for tuition will give them an advantage in obtaining desired placements in these educational institutions. In Singapore, tuition might become an addiction as it is fueled by the belief that extra classes and constant studying are the only pathways to success. Students and parents fear that without it, they will lose their competitive edge, leading to a loss of educational opportunities [8] As students and parents now see tuition as an essential need to achieve their academic goals, as well as future success in the workforce, many of them wish to enroll into such classes and are willing to spend large sums of money for them if it means that they would gain a better edge against other students. From Figure 5, the results of our survey indicated that the majority of parents (61.4%) are spending up to SGD\$1000 per month, with up to 22.1% of parents spending between SGD\$1000 to SGD\$2000 and above per month on tuition.

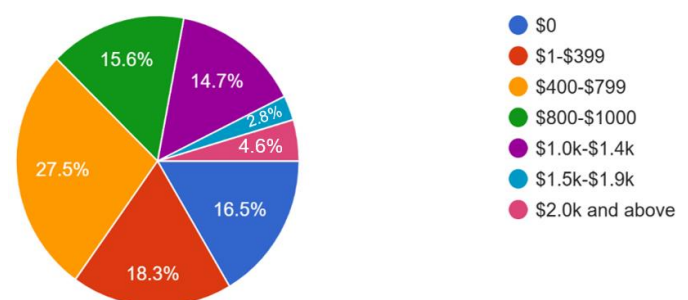


Figure 5: Monthly spending for tuition classes

2.4 Socioeconomic status (SES) exacerbating the addiction of tuition culture

In general, children from affluent families often have access to better resources, such as private tuition, tuition programmes, and elite school networks, giving them an advantage over their peers from lower-income backgrounds. The Singapore Longitudinal Early Development Study (SG LEADS) conducted between 2018 and 2019 indicated that

families of a higher SES have “relatively high capacity to provide their children with an organised physical home environment, quality childcare, schooling, and cognitively stimulating materials such as books and educational toys” [9] and “are likely to employ tutors to coach their children for entry examinations (to higher ranking schools) and to ensure that their children learn musical instruments and gain other cultural or extra-curricular experiences to signal to prospective schools their worthiness as students.” On the other hand, families from lower SES may not have the financial means to invest in their children’s education on a similar level as parents from higher SES. [3] Due to this, students who come from families with higher SES are able to seek the most support academically, while less privileged students are not able to experience such luxury. While academic support is provided in school in the form of additional lessons after school, these extra lessons are usually only open to the weakest handful of students in the class who are chosen by the teachers based on their academic performance and attitude. Hence, students of lower SES are unable to seek as much educational support as those of higher SES, which results in a widening gap where students with the financial means to go for more classes are able to gain more knowledge and opportunities outside of school while those of lower SES are disadvantaged.

3.0 Resolving our dependence on tuition culture: a comparison to China

The culture and mindsets of parents in China is largely similar to that of Singapore’s “kiasu parenting” ideology with the term “jiwa parenting” being used in China which is a term to describe aggressive helicopter parenting. [15] Likewise, Chinese parents are notorious for sending their children to tuition classes. Before the 2021 tuition ban, parents were spending a whopping SGD\$133 billion on tuition classes for their children. In response to the issue, the Chinese government imposed a ban on tuition in a widely known “double reduction” campaign driving the tuition industry underground. [16] The ban has exacerbated the issue further as the underground tuition industry has increase the cost of tuition lessons, such that some parents are now no longer able to afford sending their children for these additional classes. Though this policy was implemented to ease pressure on students in China’s notoriously stressful education system, affluent parents have the means to support their children’s educational journey, despite the increase in tuition fees while ordinary families are the most affected by this policy. [16] The ban in China, while well-intentioned has widened the gap between students from different socioeconomic backgrounds which is the very thing the ban aimed to bridge.

4.0 Possible solutions in mitigating tuition culture addiction and its corresponding impact on the widening gap between socioeconomic inequality

4.1 Changing societal mindsets by redefining the idea of success

One key takeaway from the experiences of China is that a shutdown of the tuition industry would not be effective in Singapore as it would similarly lead to the domino effect of the growth of an underground tuition industry which intensifies the widening gap between families from higher and lower SES. Hence, the first issue that needs to be addressed is to redefine the idea of success in our society. The intense competition in schools has fuelled the growth of the tuition industry with many parents and students believing that attending the most elite schools gives them the best chance to succeed in later life. This mindset ignores the notion that all citizens have the ability to contribute positively towards society. By reframing our understanding of education, we can work towards placing more emphasis on lifelong learning with more weight attached to the holistic development of a student, rather than simply academics. In line with this, placements into educational institutions can be based on other factors rather than simply academic achievement, which is MOE’s current direction. For instance, schools are in the process of inculcating 21st century competencies as seen in Figure 6 with the intention of focusing on acquiring skills rather than simply academic grades so as to better equip students with the necessary skills to survive in the fast-changing world. MOE’s direction aims at working with various stakeholders such as parents and partners to change their mindset to understand that all employment has a value. This would decrease the reliance on tuition and limited tuition classes to students who need it the most, with the understanding that tuition centres should be bridging the gap between academically weaker and academically stronger students and not providing an unfair advantage towards students whose parents can afford to pay for these classes.

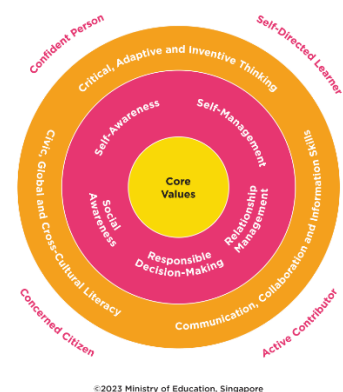


Figure 6: Framework for 21st Century Competencies and Student Outcomes [17]

4.2 Regulating advertising in the Tuition Industry

This leads to the second issue where there needs to be regulatory measures placed on tuition advertisements so as to prevent tuition centres from leveraging on the already present anxieties of parents towards their children's academic progress. Tuition centres need to work towards offering a variety of price plans that caters to all income levels and should be willing to accept all students, instead of selecting better performing students to boost the reputation of their centres.

4.3 The evolution of Artificial Intelligence (AI)-driven education solutions

Finally, as technology continues to advance, we can integrate AI-powered teaching tools in schools to mitigate the reliance on tuition culture. AI-driven platforms can offer real-time feedback, adaptive lessons tailored to individual learning needs, and interactive resources that make learning more engaging and accessible. For instance, adaptive learning platforms can adjust lesson difficulty based on student performance, ensuring that each learner progresses at their own pace. Furthermore, AI tutors provide real-time explanations and personalised guidance, reducing the need for external tuition. By implementing such technology, students from diverse socio-economic backgrounds can receive high-quality academic support without the financial burden of tuition fees. AI-driven analytics can also offer parents real-time insights into their child's progress, helping to alleviate anxiety and decrease reliance on supplementary tuition by fostering a more transparent and supportive learning environment. This helps bridge the education equality gap, ensuring that all students, regardless of their financial status, have access to the resources needed to succeed academically.

providing necessary academic support to struggling students and have instead become a tool for parents to quell their anxieties. This urge from affluent parents to provide an endless amount of tuition classes for their children, widens the gap between the socioeconomic classes, reinforcing a cycle where children of more affluent families are afforded better opportunities leading to better employment opportunities. As society continues to evolve, the focus must shift to redefining the purpose of education itself with learning not being seen as a competition but instead as a way to influence students' resilience towards challenges they will face later in life. Ultimately, if parents continue to view education as a competition to win rather than a tool for learning and self-improvement, tuition will continue to value results over genuine learning. Thus, a shift in mindset is essential to creating a more equitable system where education is viewed as a process that equips students with the skills and adaptability needed for the future. Without such a shift, this inequality will persist, perpetuating a cycle that disadvantages students from lower socioeconomic backgrounds.

5.0 Conclusion

Tuition culture is deeply entrenched in traditional Asian societies such as Singapore and China which reflects the broader problem that education is viewed as a means to an end rather than a tool for growth. This mindset is primarily shaped by parents, who are driven by fear and societal expectations resulting on a heavy emphasis on their child's academic results rather than fostering the joy of learning in their child. As such tuition culture has worsened inequality. Wealthy families can afford premium tutors and material investments in their children's education. In many cases, the push for tuition classes does not stem from an actual need for academic support but fear of their child falling behind their peers in the competitive school environment. As a result, tuition and tuition classes have shifted away from

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Brazil's Agricultural Success and the paradox of inequality and hunger

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Brazil stands as one of the world's largest exporters of essential agricultural products, including soybeans, raw sugar, molasses, beef, poultry, corn, and coffee. Its extensive food production chain positions the country as a key player in global agricultural markets and highlights its dominance in exporting vital commodities. Despite its agrarian strengths, Brazil faces stark inequalities; it is the most unequal country in Latin America. According to Human Development Index (HDI) data, Brazil's HDI has hovered around 0.7 in recent years, reaching 0.76 in 2024. The 2024 Global Hunger Index reflects a generally low level of hunger in Brazil, scoring 6.6. Moreover, the United Nations Report on the State of Food Insecurity and Nutrition in the World highlights that severe food insecurity in Brazil decreased by 33% between 2021 and 2023. The number of people experiencing severe food insecurity plummeted from 21 million (9.9%) during the 2020-2022 period to 14 million (6.6%) in 2024, however, the numbers did not reach desirable levels. Additionally, moderate food insecurity also showed a significant decline. Given these insights, this report aims to investigate and compare the quality and accessibility of meals for Brazilian citizens across various states and the per capita household average earnings over the past five years. It will also explore potential strategies to address specific deficiencies, analyze the social programs implemented by the government over the years that have succeeded in minimizing undesirable impacts of inequality, and suggest measures to reduce them.

1. Introduction

Brazilian agribusiness exports totaled USD 164.4 billion in 2024. The sector accounted for 49 percent of the country's total exports, demonstrating its resilience despite declining international prices for some major commodities. The drop in soybean complex and cereal exports—driven by a smaller harvest and lower global prices—was offset by growth in other key segments. Meat exports increased by 11.4 percent, the sugar-alcohol complex grew 13.3 percent, forestry products rose 21.2 percent, and coffee exports surged by a 52.6 percent increase. Other segments, such as textile fibers, juices, cocoa products, and horticultural goods, also recorded significant growth. In 2024, Several sectors reached record export levels, reinforcing Brazil's role as a major global supplier. Among the products with the highest growth were sugar, coffee, cotton, pork, beef, poultry, pulp, orange juice, and orange essential oil. Non-traditional exports also expanded, with notable increases in lemons and limes, chocolate, pet food, ginger, cocoa paste, and onions [1].

China remained the leading destination for Brazilian agribusiness exports. The European Union ranked second, followed by the United States. Emerging markets also gained importance, with Africa and the Middle East driven by renewed diplomatic engagement and trade promotion efforts. These results align with the government's strategy to diversify both exported products and market destinations. In 2024, Brazil recorded unprecedented export growth in various sectors where it has been increasing its global market share. This success was fueled by a record number of new and expanded trade agreements, along with intensified promotional efforts abroad—particularly for

emerging value chains with high commercial potential. Rising agricultural production has allowed Brazil to meet domestic demand while generating export surpluses, boosting foreign exchange revenues and job creation, particularly in rural areas [1].

Despite agribusiness's success, the year 2024 was marked by extremes. A year that challenged Brazilian agribusiness, forcing it to deal with both the severe drought [2] in the central region of the country and the floods that flooded the crops in Rio Grande do Sul. Some record harvests and other production losses were observed. This year, important international negotiations were concluded, major events were held, and key markets were reached. In the political sphere, a record Harvest Plan was launched, in addition to legislative approvals that create a fertile environment for the consolidation of sustainable agriculture and a leading role in the energy transition in the coming years [3].

Brazil faced its worst drought since records began in 1950, according to the National Center for Monitoring Natural Disasters [2]. The lack of rainfall in major parts of Brazil, combined with above-average temperatures, caused rivers to dry up and caused significant damage to agriculture. According to CEMADEN, since June 2023, the drought has affected 5 million km² – around 59% of Brazil's territory. The North region was the most affected by the phenomenon, but 137 cities across Brazil faced at least nine consecutive months of drought. Coffee farming was one of the crops most affected by the lack of rainfall, especially in Minas Gerais and São Paulo states. At the beginning of the season, the National Supply Company had predicted growth in Brazilian coffee production; however, adverse weather conditions caused estimates to fall below the last harvest.

Sugarcane was another crop that was severely affected by the water deficit, especially in producing areas in the Southeast. In the case of grains, the drought delayed the start of sowing for the 2024/25 harvest [3].

In 2024, in some regions of the south of Brazil Rio Grande do Sul state, heavy rain that lasted for more than 10 days overwhelmed the important river basins. Due to the excess water, the rivers overflowed and flooded municipalities, causing one of the greatest natural disasters in the history of Brazil. According to official data more than 2.4 million people were affected, and around 616 thousand were left homeless. The floods submerged crops, decimated livestock and compromised grain stocks. Agricultural production suffered major losses, with losses in the transportation, storage and marketing of products with significant impacts on crops such as soybeans, rice and corn [3].

In 2024, Brazil recorded significant progress in opening new markets for agricultural products. In total, 221 markets were conquered for items such as meat, grains, eggs and even more specific products, such as embryos, sesame, fresh grapes, yerba mate, sorghum, and açaí powder, among others. For comparison purposes, the pace of expansion was much higher than in previous years: in 2019, there were 35 new markets; in 2020, 74; in 2021, 77; in 2022, 53; and in 2023, 78 [3]. However, Brazilian agriculture and livestock markets have been challenging and efforts are made to accomplish environmental requirements. For instance, the implementation of the Anti-Deforestation Law, which prohibits the import of soy, beef, cocoa, coffee, palm oil, timber, rubber, and other products linked to deforestation, even if legal in the country of origin. Important international agendas were defended, and 2024 was also marked by approvals in the Brazilian legislature that should create a fertile environment for the consolidation of sustainable agriculture, traceability of products, and a leading role in the energy transition in the coming years.

Comparing the Brazilian agribusiness data to Global Hunger Index (GHI) and food security is observed a contradictory fact. Currently, Brazilian GHI reflects a generally low level of hunger in Brazil, scoring 6.6. The country has been lowering food insecurity along the years, however, it is still in the hungry map. Despite Brazil's strength in livestock and agricultural markets, in 2023, 8.4 million Brazilians faced hunger, according to a UN study released on July 24, 2024 [4]. Moderate food insecurity affected 5.3% of households (4.2 million people), and severe food insecurity affected 4.1% (3.2 million people). The severe food insecurity scenario was more significant in rural areas usually associated to crop production [5]. For that reason, this report aimed to investigate the main causes of the lack of food availability and food insecurity in Brazil.

2. Methodology

This report is produced consulting public literature available and reflected on the matter. Two questions were addressed:

- 1) Why does a country classified as a big food producer still have food and nutritional limitations?
- 2) What could be done to change the current scenario?

To answer this question, government data and agrobusiness for agriculture and livestock production were accessed, critically analyzed, and compared to the human developing index. As the main agrobusiness products could supply the internal Brazilian market and provide a healthy diet, it is hard to understand why the population faces hunger or food insecurity.

The following steps of bibliographic research were conducted

- a. Identify the topic
- b. Search for and select sources
- c. Critically analyze the materials found
- d. Organize and record the references
- e. Solutions for the topic were addressed

3. Results and discussion

Brazil is the world's largest exporter of beef, with almost 160 destinations. Brazil has also consolidated its position as a global leader in the production and export of poultry meat, currently accessing more than 150 markets in 2024. Brazil has reached new milestones from January 2023 to November 2024. The country also registered records in chicken egg production and milk [6]. Even in a challenging scenario of severe drought (Appendix 1) [3], and prices of the international market, the country is still a leader in food production. The year 2024 stood out as an atypical and alarming period for fires in Brazil, with a significant increase in the area burned in almost all biomes, especially forest areas, which are not normally so affected. The impacts of this devastation expose the urgency of coordinated actions and engagement at all levels to contain an environmental crisis exacerbated by extreme weather conditions but triggered by human action. This increase in burned areas in Brazil is associated with the accumulated effects of a long dry period that affected the country, associated with the "El Niño" phenomenon between 2023 and 2024, classified as moderate to strong. With low humidity, vegetation becomes more susceptible to fire [7]. Despite exportation records, fires directly and/or indirectly affected the agribusiness; therefore, climate issues explain a 7.2% decline compared to the 2023 harvest of production of cereals, legumes, and oilseeds [8]. Comparing the drought maps (Appendix 1) and Table 1, it is noticed that two of the

big Brazilian productive areas, Midwest and Southeast, were affected by severe drought, besides flood affect the Brazilian South. Fortunately, showing resilience, the country had a positive productive production balance. It is worth mentioning that if this scenario occurs again, it will compromise not only Brazil but also the world's food supply in the future; therefore, specific measures and strategies must be taken to avoid uncontrolled and harmful environmental challenges.

Table 1 shows the agriculture power of Brazil in cropped land area and total production of cereals, legumes and oilseeds per Brazilian Federal Unit and Region. Rice, beans, coffee, bread, vegetables and beef are the basis of the Brazilian diet, being the six most consumed items, and provides the base of protein, carbohydrate. Soybean and sunflower oils are often the choice for cooking contributing for lipids supply [9]. The data presents in Tables 1 and 2 showed the in-home Brazilian production and land availability in all states can supply internal market. Contradictory, in the 2024 Global Hunger Index, Brazil ranks 33rd out of the 127 countries with sufficient data to calculate 2024 GHI scores. Therefore, it is a weird situation for a country which produces the typical food present on Brazilians "table". With a score of 6.6 in the 2024, Brazil has a level of hunger that is considered low. The Global Hunger Index (GHI) is a tool for comprehensively measuring and tracking hunger at global, regional, and national levels. GHI scores are based on the values of four component indicators: I) Undernourishment the share of the population with insufficient caloric intake, II) Child Stunting: the share of children under age five who have low height for their age, reflecting chronic undernutrition; III) Child Wasting: the share of children under age five who have low weight for their height, reflecting acute undernutrition; IV) Child mortality: the share of children who die before their fifth birthday, partly reflecting the fatal mix of inadequate nutrition and unhealthy environments. Based on the values of the four indicators, a GHI score is calculated on a 100-point scale reflecting the severity of hunger, where 0 is the best possible score (no hunger) and 100 is the worst. Each country's GHI score is classified by severity, from low to extremely alarming, ≤ 9.9 low; 10.0–19.9 moderate, 20.0–34.9 serious; 35.0–49.9 alarming, ≥ 50.0 extremely alarming [11]. Despite the index consider low index of hunger, it still means millions of people food insecure according to Food and Agriculture Organization of United Nations (FAO) research The State of Food Security and Nutrition in the World (SOFI, 2024) [12].

Table 2 [14] shows a large variate of crops and their planted area and productivity in Brazil and actually they correspond to the main components of food in Brazilians menus all over the country. Therefore, there are availability of ingredients to guarantee desirable quantitative and quality for population nutrition. Despite Brazil has low GHI, analyses of data of food insecurity (Figure 1 - yellow and grey bars),

shows that low and very low food secure in all regions are present. The classification of food security is considered as: a) High Food Security when there are no problems or limitations related to food access or availability; b) Marginal Food Security when concern that food will run out before being able to afford more. **Low Food Security** considered reduced quality, variety, or desirability of food intake. A household at this level is also classified as "**food insecure.**" **Very Low Food Security** is a disrupted eating patterns resulting in reduced food intake. A household at this level is also classified as "**food insecure.**" [12]

Regardless of power of Brazil food productivity, the biggest producer region is the third worst in food security (Figure 1), displaying that 7.9% of household are food insecure. North and Northeast regions displays 16% and 18.8% of food insecure, respectively. These percentages seem to be small, but actually in absolute numbers means million people undergo severe food insecure, it shows that a person is in fact stay without access to food and goes an entire day or more without eating. It represents hunger that, if sustained regularly, leads to serious harm to physical and mental health, especially in early childhood, impacting in body and cognitive development. Brazil population is about 212.583.750 citizens [13], and considering the sum of citizens in state of food insecure of each region the number surpass 2.5 million people in food insecure situation. Government data shows food insecurity is decreasing, despite it remains high in households in the North and Northeast regions. Food insecurity was also higher in households where the head of household is a woman (59.4%). And most households classified as food insecure had children in the age groups of 0 to 4 years and 5 to 17 years (37.4% and 36.6%, respectively) compared to households with people over 65 years old (20.9%). Black and mixed-race people accounted for 69.7% of the population with some degree of food insecurity in Brazil. The North Region had around four times more households living with severe restrictions on access to food, that is, with severe FI (food insecurity), when compared with the South Region (7.7% versus 2.0%). This information reveals regional inequalities in access to food, and huge productive areas do not proper supply their population [15].

Investigating the cause of regional inequalities, data of human developing index (HDI) was studied (Table 4) [16]. Indeed, regions North, Northeast and Midwest exhibited the lowest HDI in all parameters (income, education and life expectance). Exception was noticed in Distrito Federal. The Federal District, besides being the political center of Brazil, is also an important economical center, having the eighth largest gross domestic product – GDP among the federation units and the greatest per capita GDP in Brazil. The average monthly income per capita is 2,460 reais, the greatest among all of the federal units. However, there is great social inequality in the Federal District, characterized by the variation of income distribution among the Administrative Regions. The economy of the Federal District is quite diverse, but due to its administrative function, the services sector is of great importance, holding the largest

participation in the GDP and occupying the great majority of the economically active population [17].

Table 1: Estimative of Planted Area and total productions of cereals, legumes and oilseeds in Brazil regions and federal units in 2024

Federal Unit per region.	Area (ha)	Productivity (t)
Brazil	79 049 440	292 705 861
North	5 180 431	18 187 566
Rondônia	1 036 389	4 116 358
Acre	63 988	186 688
Amazonas	18 664	50 777
Roraima	148 551	629 013
Pará	1 749 789	5 652 087
Amapá	10 592	23 353
Tocantis	2 152 458	7 529 290
Northeast	9 064 709	25 792 907
Maranhão	1 957 595	6 635 556
Piauí	1 794 958	5 780 393
Ceará	930 965	518 070
Rio Grande do Norte	80 193	36 134
Paraíba	177 250	73 170
Pernambuco	309 028	183 890
Alagoas	66 934	134 975
Sergipe	195 835	1 049 624
Bahia	3 551 951	11 381 095
Sudeste	6 911 390	25 816 536
Minas Gerais	4 202 157	16 570 199
Espírito Santo	25 814	68 346
Rio de Janeiro	4 183	16 196
São Paulo	2 679 236	9 161 795
Sul	21 974 041	78 342 460
Paraná	10 554 800	37 531 600
Santa Catarina	1 466 662	6 217 195
Rio Grande do Sul	9 952 579	34 593 665
Midwest	35 918 869	144 566 392
Mato Grosso do Sul	6 437 270	19 653 486
Mato Grosso	21 420 903	91 806 563
Goiás	7 876 596	32 322 144
Distrito Federal	184 100	784 199

[9] Source: IBGE, Diretoria de Pesquisas, Coordenação Agropecuária, Levantamento Sistemático da Produção Agrícola (adapted)
Considered products: cotton seed, peanut, rice, oats, rye, barley, beans, sunflower, castor oil, corn, soybeans, sorghum, wheat and triticale.

Brazil is known for its high-income concentration, with the richest 1% of the population holding 28.3% of total income, making it one of the most unequal countries in the world. The country has also experienced significant changes in

recent decades regarding inequality. Recent researches concerning social inequality and the redistributive function of the State has gained prominence in recent decades. The tax system plays a fundamental role, since the way taxes are collected and distributed can significantly influence the equity of society. Research shows that direct taxes have a limited progressive effect, while indirect taxes have a regressive impact, resulting in a higher tax burden for the poorest compared to the richest.

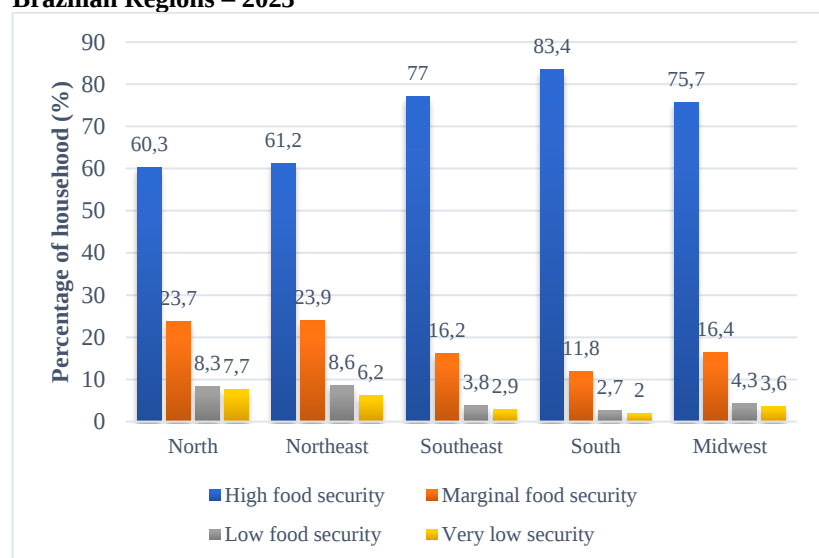
While direct taxes are levied directly on the income and property of the final taxpayer, as is the case with Income Tax and vehicle property tax (IPVA), indirect taxes are charged on products and services, being passed equal for the consumers in the sales chain. Brazil's tax system reinforces social inequalities by taxing labor more than capital and by heavily taxing consumption. This makes the country less able to reduce inequality, which is already among the worst in the world.

Table 2: Planted Area and e Production of main Brazilian Crops in 2024

Crops products	Area (ha)	Production (t)
Seed of cotton	2 027 769	8 866 378
Peanut	277 556	793 832
Rice	1 573 503	10 591 604
Oats	513 979	1 059 343
Banana	461 153	6 995 034
Potato	138 230	4 507 809
Cocoa almonds	632 466	287 784
Coffee	1 955 136	3 425 399
Sugar cane	9 219 524	706 720 425
Cashew nut	450 054	161 014
Barley	117 353	416 239
Beans	2 732 659	3 099 161
Tabacco	329 677	626 649
Orange	524 086	12 216 934
Castor bean	52 565	31 717
Cassava	1 231 516	19 059 194
Maize	21 351 224	114 703 192
Soybeans	46 036 036	144 946 662
Sorghum	1 330 201	3 985 503
Tomato	61 686	4 666 924
Wheat	2 956 080	7 530 249
Triticale	17 507	43 729
Grape	82 451	1 763 397

[14] Source: IBGE: Levantamento Sistemático da Produção Agrícola. (adapted)

Figure 1: Distribution of permanent private households, by food security situation in the household, according to the Brazilian Regions – 2023



Source: [14] IBGE. Pesquisa Nacional por Amostra de Domicílios Contínua Segurança alimentar 2023

Table 3: Human development index (HDI) per Brazil Federal Unit 2021

Federal Unit and Region	Rank HDI	HDI	Rank HDI Income	HDI income	Rank HDI education	HDI Education	Rank Longevity	HDI Longevity
Distrito Federal								
Midwest	1	0,814	1	0,821	2	0,817	6	0,803
São Paulo								
Southeast	2	0,806	2	0,771	1	0,839	5	0,81
Santa Catarina								
South	3	0,792	4	0,759	3	0,79	3	0,827
Minas Gerais								
Southeast	4	0,774	9	0,718	7	0,762	2	0,846
Rio Grande do Sul								
South	5	0,771	3	0,767	10	0,75	7	0,797
Espírito Santo								
South	5	0,771	10	0,715	11	0,742	1	0,864
Paraná								
South	7	0,769	6	0,744	4	0,78	10	0,785
Rio de Janeiro								
Southeast	8	0,762	4	0,759	8	0,758	16	0,769
Mato Grosso do Sul								
Midwest	9	0,742	7	0,733	12	0,741	18	0,751
Goiás								
Midwest	10	0,737	11	0,714	5	0,778	26	0,721
Mato Grosso								
Midwest	11	0,736	8	0,72	8	0,758	24	0,73
Ceará								
Northeast	12	0,734	17	0,658	6	0,766	11	0,784
Tocantins								
North	13	0,731	13	0,684	13	0,732	12	0,779
Rio Grande do Norte								
Northeast	14	0,728	12	0,692	22	0,68	4	0,819
Pernambuco								
Northeast	15	0,719	23	0,647	14	0,721	7	0,797
Acre								
North	16	0,71	18	0,655	19	0,692	9	0,788
Sergipe								
Northeast	17	0,702	16	0,662	21	0,684	17	0,764
Rondônia								
Northeast	18	0,7	15	0,677	18	0,694	23	0,731
Amazonas								
North	18	0,7	25	0,641	15	0,72	21	0,744
Roraima								
North	20	0,699	14	0,68	24	0,673	20	0,745
Paraíba								
Northeast	21	0,698	19	0,653	25	0,669	12	0,779
Bahia								
Northeast	22	0,691	21	0,648	26	0,659	15	0,772
Pará								
North	23	0,69	24	0,645	20	0,686	21	0,744
Piauí								
Northeast	23	0,69	20	0,649	17	0,698	25	0,726
Amapá								
Northeast	25	0,688	21	0,648	27	0,647	14	0,778
Alagoas								
Northeast	26	0,684	26	0,63	23	0,679	19	0,748
Maranhão								
Northeast	27	0,676	27	0,603	16	0,716	27	0,715

Source: Atlas do Desenvolvimento Humano no Brasil [15]

4. Final considerations and conclusions

Brazil needs to improve several actions to reduce social inequality as tax more taxpayers with higher income and assets, invest in education to increase HDI, that means prepare young people to be productive adults, invest in health to improve quality of life, combat discrimination promoting diversity and representation in different areas, combat land concentration, as showing in this report Midwest has the biggest productive area however low HDI, strengthen social programs, reform the structure of the economy reducing costs and minimizing regional disparities.

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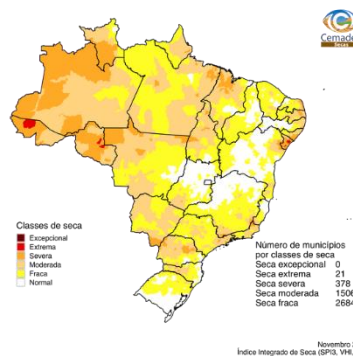
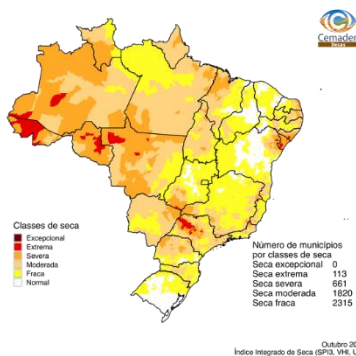
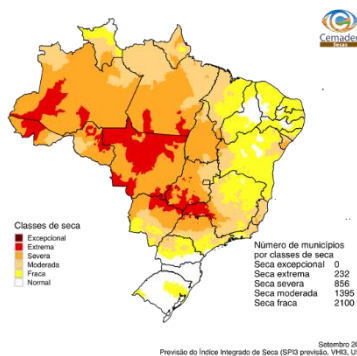
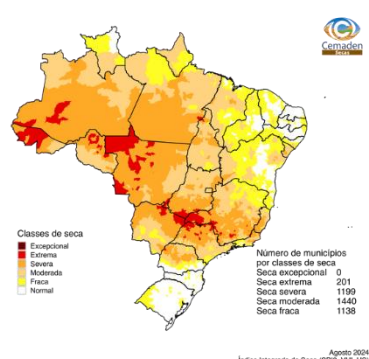
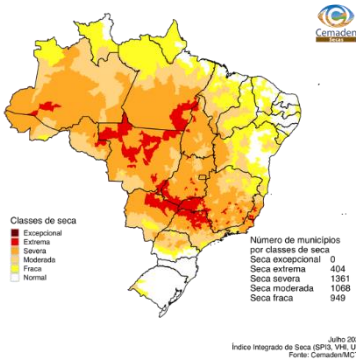
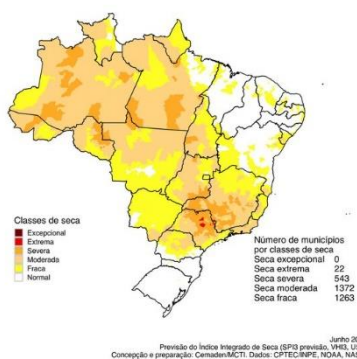
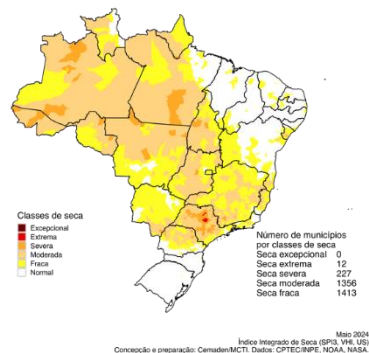
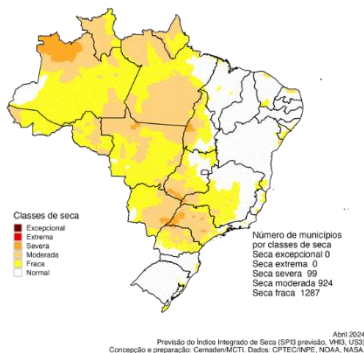
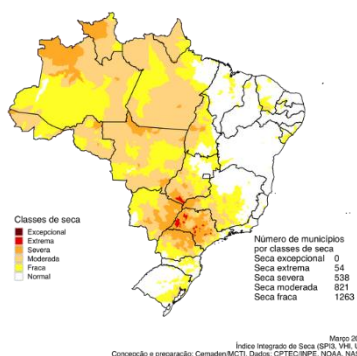
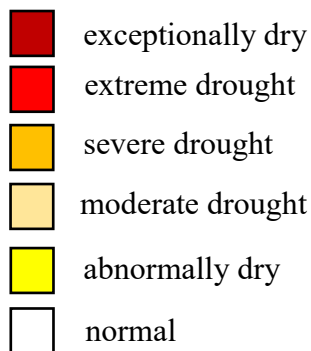
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Appendix 1

Brazil drought maps show the most severe drought months, March to November 2024. At the bottom right of the map, there are the number of cities affected by drought.

Drought classification (legend)



Corruption, Poor Leadership, and Limited Resources: The roots of Economic Inequality in Uganda

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09/04/2025

Summary

In Uganda, there is a big gap between rich and poor people. Many citizens have "empty pockets" while a small group control most of the country's wealth. Our research looks at why this happens, focusing on corruption, poor leadership, and lack of access to opportunities. Corruption takes about 9.1 trillion shillings from public funds every year, money that could help people in need. Bad leadership and unfair policies make things worse through poor tax collection and unfair land distribution. Many Ugandans also struggle to get good education, jobs, and financial services, which keeps them poor. We suggest solutions like stronger anti-corruption efforts, better government, fairer economic policies, and more investment in education, healthcare, and jobs. By comparing Uganda with Kenya, which has similar challenges but some better policies, we can learn valuable lessons to reduce inequality in our country.

1. Introduction

Uganda, often called the "Pearl of Africa," has plenty of natural resources, good land, and about 47 million people. Despite having what it needs to be successful, our country faces big economic problems. Inequality – the gap between rich and poor – is one of the biggest issues. Our research project looks at why so many Ugandans have "Empty Pockets" while a few people enjoy great wealth.

The Gini coefficient (a number that measures inequality where 0 means perfect equality and 1 means complete inequality) is 0.42 for Uganda as of 2023. This shows serious economic differences among our people. The

richest 10% of Ugandans control about 35.7% of the country's wealth, while the poorest 40% share just 11.2% of national income. This inequality shows up in many ways: poor access to good schools and healthcare, bad housing, food shortages, and few job opportunities for most citizens.

As students from Jinja, an industrial town in Uganda, we see these differences in our own community every day. We notice the contrast between fancy houses and poor settlements, between private schools and overcrowded public schools, between well-equipped hospitals and understaffed clinics. These observations made us want to study why this inequality exists and find good solutions to create a fairer society.

This research matters not just for Uganda but also contributes to the global effort to reduce inequality, which is goal number 10 of the United Nations Sustainable Development Goals. By studying Uganda's specific problems and comparing them with Kenya (another East African country), we hope to provide useful ideas that could help create better policies to reduce economic inequality.

2. What We Studied

2.1 The Problem in Uganda

Our study focuses on economic inequality in Uganda, especially the big differences in income, wealth, and access to resources and opportunities. Through our research, we found that this inequality isn't just because of market forces or individual choices but is deeply rooted in system-wide problems that need thorough understanding and targeted solutions.

The problem shows up in many ways in Ugandan society:

1. **Income Differences:** The average monthly income for the poorest 20% of Ugandans is about 50,000 UGX (about \$13 USD), compared to over 3,000,000 UGX (about \$800 USD) for the richest 10%.
2. **Regional Differences:** Northern and eastern regions have poverty rates almost twice as high as central regions, with the Karamoja region having poverty rates above 60%.

3. **Urban–Rural Divide:** Urban areas, especially Kampala, have much lower poverty rates (about 19%) compared to rural areas (about 31%).
4. **Gender Inequality:** Women earn about 30–40% less than men in similar jobs and have less access to resources, loans, and economic opportunities.

Our research tries to answer these key questions:

1. What are the main causes of economic inequality in Uganda?
2. How do governance issues, especially corruption and policy implementation, contribute to economic differences?
3. What role does access to education, healthcare, and financial services play in continuing or reducing inequality?
4. What workable solutions could effectively address these inequalities while promoting economic growth for everyone?

3. What We Found

3.1 Main Causes of Economic Inequality in Uganda

3.1.1 Corruption and Misuse of Resources

Our investigation showed that corruption is one of the biggest contributors to economic inequality in Uganda. According to the Inspectorate of Government, corruption costs Uganda about 9.1 trillion shillings (equivalent to \$2.5 billion USD) every year—about 9% of the country's GDP. This huge drain on public resources greatly reduces the government's ability to invest in essential services and infrastructure that could benefit more people.

Key findings about corruption include:

- **Public Money Being Stolen:** Many big corruption scandals have involved stealing money meant for education, healthcare, and infrastructure development.
- **Inflated Contract Costs:** Government contracts often cost much more than they should, with estimates suggesting that 30–50% of procurement budgets are lost to corruption.

- **Bribery Culture:** Our interviews revealed that citizens regularly pay bribes to access basic services, with the poorest households spending about 12.6% of their yearly income on such payments.
- **Unfair Law Enforcement:** Laws and regulations are often applied inconsistently, favoring those with political connections or money, which reinforces existing power structures and inequalities.

One small business owner in Jinja we interviewed said: "When you want to get anything done—register a business, get a permit, or even access public services—you must 'speak the language of money.' Those who cannot afford these extra payments are left behind."

3.1.2 Poor Leadership and Bad Policies

Our research identified poor governance and ineffective economic policies as important factors that keep inequality going:

- **Poor Tax Collection:** Uganda's tax-to-GDP ratio is about 13%, well below the sub-Saharan Africa average of 16.5%. This limited revenue collection restricts public service delivery. Also, the tax structure puts too much burden on lower and middle-income earners through consumption taxes, while giving many exemptions and incentives that often benefit wealthier individuals and corporations.
- **Privatization Benefits Only a Few:** The privatization of state enterprises, while increasing efficiency in some sectors, has frequently benefited only a small elite group without adequately addressing wealth distribution or creating broad-based employment opportunities.
- **Political Favouritism:** Resources and opportunities are often distributed based on political loyalty rather than need or merit, reinforcing existing power structures and inequality.

An economist we consulted stated: "Uganda's economic policies have prioritized overall growth without sufficient attention to distribution. The result is 'growth without development'—impressive GDP figures that mask deepening inequality."

3.1.3 Limited Access to Resources and Opportunities

Our investigation found that a large portion of Uganda's population faces substantial barriers to accessing resources and opportunities necessary for economic advancement:

- **Education Gaps:** Despite the Universal Primary Education (UPE) policy, the quality of education varies dramatically between public and private institutions and between rural and urban areas. Secondary school enrollment stands at just 27%, with significant disparities based on income level. Among the poorest 20%, only 16% complete lower secondary education, compared to 70% among the wealthiest 20%.
- **Healthcare Inequalities:** Public healthcare facilities often lack adequate staffing, equipment, and medicines, forcing even poor families to seek private healthcare or go without treatment. Out-of-pocket health expenses push an estimated 4% of households into poverty every year.
- **Financial Exclusion:** About 66% of adult Ugandans remain unbanked or underbanked, limiting their ability to save, invest, or access credit. Interest rates for small businesses and individuals typically range from 20–25%, making loans inaccessible to many.
- **Digital Divide:** Internet access stands at about 26%, with big urban–rural disparities. This limits access to information, digital financial services, and online economic opportunities.
- **Employment Challenges:** The formal sector employs only about 20% of the workforce, with the majority engaged in vulnerable informal employment without social protection or stable incomes.

Through our interviews with community members, we found that these barriers often combine and make each other worse. As one unemployed youth explained: "Without proper education, I cannot get a formal job. Without a formal job or collateral, I cannot get a loan to start a business. It feels like a trap with no way out."

3.2 Impact of Economic Inequality on Ugandan Society

Our research identified several significant consequences of economic inequality:

- **Continuing Poverty:** Despite overall economic growth, poverty reduction has slowed, with about 21.4% of the population living below the national poverty line.
- **Health Problems:** Life expectancy, maternal mortality, and child malnutrition show strong relationships with income levels, with the poorest 20% experiencing much worse outcomes.
- **Social Division:** Growing inequality contributes to social tensions, crime, and political instability, as shown by increasing youth protests and civil unrest.
- **Poor infrastructure:** Communities continue to struggle with poor roads, no electricity, and poor water supply which directly affects trade and hence the economic inequality.
- **Environmental Damage:** Economic desperation often leads to unsustainable resource extraction and environmental practices, particularly among the poorest communities.

One civil society leader we consulted emphasized: "Economic inequality in Uganda is not just about money—it affects dignity, health, security, and even democracy. When people feel the system is rigged against them, they lose faith in institutions and the social contract weakens."

4. Our Proposed Solutions

Based on our analysis of the causes and impacts of economic inequality in Uganda, we propose these solutions:

4.1 Strengthening Anti-Corruption Measures

To address corruption, which significantly drains resources that could benefit more people, we recommend:

- **Independent Institutions:** Strengthen the independence and resources of anti-corruption institutions such as the Inspectorate of

Government and the Anti-Corruption Court, enabling them to investigate and prosecute cases without political interference.

- **Transparent Procurement:** Implement fully digitized and transparent procurement processes with civil society oversight to reduce opportunities for corruption.
- **Whistle-blower Protection:** Strengthen legal protections for people who report corruption and establish secure channels for reporting.
- **Asset Declaration and Recovery:** Enforce strict asset declaration requirements for public officials and implement effective ways to recover illicitly acquired wealth.
- **Public Education:** Launch comprehensive campaigns to change the cultural acceptance of bribery and corruption.

These measures could potentially recover billions in lost resources every year, which could be redirected to public services and inequality reduction programs.

4.2 Improving Governance and Economic Policies

To address poor leadership and ineffective policies, we propose:

- **Fairer Taxation:** Reform the tax system to increase fairness by reducing reliance on consumption taxes, expanding the income tax base, eliminating unjustified exemptions, and implementing effective taxation of wealth and property.
- **Participatory Budgeting:** Implement participatory budgeting processes at local levels to ensure public resources address community priorities and needs.
- **Regional Development:** Develop targeted policies to address regional inequalities through infrastructure investment, service delivery, and economic incentives in underserved areas.

4.3 Expanding Access to Resources and Opportunities

To address limited access to resources and opportunities, we recommend:

- **Education Investment:** Increase education funding with particular focus on improving quality in public schools and expanding secondary and vocational education access for disadvantaged groups.
- **Better Healthcare:** Strengthen the public healthcare system through increased funding, better management, and implementation of universal health coverage to reduce out-of-pocket expenses.
- **Financial Inclusion:** Promote financial inclusion through regulatory frameworks that encourage innovative banking solutions for underserved populations, credit guarantee schemes for small enterprises, and financial literacy programs.
- **Digital Access:** Expand affordable internet access, particularly in rural areas, and develop digital literacy programs to enable broader participation in the digital economy.
- **Youth Employment:** Implement comprehensive youth employment strategies combining skills development, entrepreneurship support, and job creation incentives.

4.4 Community-Level Implementation

While national policies are essential, change must also happen at the community level. We propose:

- **Community Savings Groups:** Expand village savings and loan associations (VSLAs) to improve access to credit and savings opportunities at the grassroots level.
- **Cooperative Development:** Support the formation and strengthening of producer and marketing cooperatives to enhance bargaining power and value addition for small-scale farmers and producers.
- **Skills Centers:** Establish community skills development centers that provide practical training aligned with market demands and local economic opportunities.

- **Community Monitoring:** Implement community-based monitoring of public services and development projects to improve accountability and effectiveness.

These community-level interventions can create immediate benefits while building momentum for broader systemic changes.

5. Comparing Uganda and Kenya

To gain perspective on Uganda's economic inequality challenges and potential solutions, we compared Uganda with Kenya, another East African nation with similar historical background but different economic paths.

5.1 Similarities

Both Uganda and Kenya face significant economic inequality challenges:

- Both have Gini coefficients above 0.4, indicating substantial income inequality
- Both countries struggle with corruption and governance issues
- Regional disparities are pronounced in both nations
- Rural poverty rates exceed urban poverty rates in both countries

5.2 Key Differences

Despite these similarities, several important differences emerged:

- **More Diverse Economy:** Kenya has achieved greater economic diversification, with a more developed manufacturing sector, stronger service industry, and more robust technology ecosystem. M-Pesa, Kenya's mobile money platform, has revolutionized financial inclusion, with 96% of households having access to mobile money services compared to 78% in Uganda.
- **Better Tax Collection:** Kenya's tax-to-GDP ratio stands at approximately 16.8%, significantly higher than Uganda's 13%. This has enabled greater domestic resource mobilization for public services.

- **Decentralization:** Kenya's 2010 Constitution implemented a devolved governance system that has, despite challenges, improved resource allocation to previously marginalized regions and enhanced local participation in governance.
- **Anti-Corruption Efforts:** While both countries struggle with corruption, Kenya has shown more robust prosecution of high-profile corruption cases, demonstrating greater institutional independence in anti-corruption efforts.

5.3 Lessons for Uganda

Kenya's experience offers several valuable lessons for Uganda:

- **Financial Innovation for Inclusion:** The M-Pesa model shows how technological innovation, supported by appropriate regulatory frameworks, can dramatically improve financial inclusion and economic participation.
- **Benefits of Decentralization:** While maintaining national cohesion, more substantial decentralization of resources and decision-making authority could address regional inequalities in Uganda.
- **Economic Diversification:** Deliberate policies to diversify the economy beyond agriculture and extractives could create more resilient and inclusive growth patterns.
- **Institutional Independence:** Strengthening the independence of anti-corruption and judicial institutions can improve accountability and resource management.

These lessons suggest that while Uganda faces significant challenges, practical examples from a neighbouring country with similar contexts demonstrate that progress is possible with appropriate policies and implementation.

6. Conclusion and Recommendations

Our research shows that economic inequality in Uganda is deeply rooted in systemic issues including corruption, governance failures, and barriers to accessing resources and opportunities. Addressing these challenges

requires a multifaceted approach combining policy reforms, institutional strengthening, and community-level interventions.

We recommend these priority actions:

1. **Fight Corruption Now:** Strengthen anti-corruption institutions and implement transparent procurement systems to recover resources currently lost to corruption.
2. **Reform Tax System:** Reform the tax system to enhance fairness and improve revenue collection, creating fiscal space for essential investments in education, healthcare, and social protection.
3. **Create Youth Opportunities:** Develop comprehensive strategies for youth skills development, employment, and entrepreneurship to harness Uganda's demographic dividend.
4. **Use Technology for Inclusion:** Leverage digital technologies to improve financial inclusion, service delivery, and economic participation, particularly for rural and marginalized populations.
5. **Strengthen Regional Cooperation:** Strengthen East African Community collaboration to address regional dimensions of inequality and learn from successful interventions in neighbouring countries.

Our findings suggest that while economic inequality in Uganda is severe, it is not inevitable. Strategic interventions, political will, and citizen engagement can create a more equitable society where prosperity is shared more broadly. This would not only benefit Uganda but would also contribute to global efforts to address inequality, as outlined in the UN Sustainable Development Goals.

As young Ugandans, we believe that addressing economic inequality is essential for building a society where everyone has the opportunity to thrive regardless of their background or circumstances. The "empty pockets" that characterize the lives of too many of our fellow citizens need not be a permanent condition but can be transformed through deliberate action and sustained commitment to inclusive development.

Building Our New Normal: One Sensory Space at A Time

Maya Hammoud and Lara Hammoud

I. Abstract

Neurodevelopmental disorders (NDDs) affect over 300 million individuals globally, including 40,000 in Michigan alone. Despite the demonstrated benefits of sensory rooms, calming environments that enhance fine motor and cognitive skills, many middle- and low-income communities lack access to these resources due to high costs, often reaching \$30,000. To address this disparity, we interviewed families affected by NDDs, ABA therapists, and Title I special education teachers to assess accessibility barriers. Our findings revealed a critical need for cost-effective sensory interventions. In response, we developed an affordable sensory room model (\$500–\$1,000), incorporating medical and educational expert recommendations. Each sensory room consists of four key areas: (1) an active area (ball pit or trampoline) to promote movement, (2) an enclosed quiet area (tent, weighted blankets, cushions) for self-regulation, (3) a reading and fine-motor skill area (sensory books, tactile toys) to enhance cognitive engagement, and (4) an art area (varied art mediums) for creative expression. These sensory rooms have been successfully implemented in under-resourced community centers, schools, refugee aid organizations, and medical clinics, demonstrating their adaptability and effectiveness in diverse settings. By providing an accessible and scalable solution, this model reduces sensory inequality and ensures that individuals with NDDs have equitable access to vital therapeutic spaces.

II. Introduction

Neurodevelopmental disorders (NDDs) affect over 300 million individuals worldwide. These conditions are typically lifelong and present from birth, often involving both mental and physical challenges. Individuals with NDDs may experience speech, communication, fine motor skills, and sensory processing impairments. Despite the widespread prevalence of these disorders, no definitive cures or comprehensive treatments are currently available (UC Davis). In many parts of the world, individuals with NDDs face significant stigma, which leads not only to social marginalization but also to exclusion within healthcare systems (Carillo). This stigma compounds the daily challenges faced by people with NDDs and limits their access to supportive environments that promote growth and well-being. One promising intervention is the use of sensory rooms. These specially designed spaces are tailored to regulate sensory input, providing therapeutic benefits such as improved focus, reduced stress, enhanced communication, better balance, and increased opportunities for social interaction, and most importantly, a space for those who may feel overwhelmed in typical settings (St. Jude's). Despite their proven effectiveness, sensory rooms remain largely inaccessible. The cost of installing a fully equipped room can exceed \$30,000, making them unattainable for many families and institutions. Even in areas with sufficient funding, these spaces are rarely found in public places, limiting access for those who need them most (Autistica). In response to this sensory room disparity, our project set out to design a cost-effective sensory room that preserves the core benefits of traditional sensory rooms while making them accessible in public spaces to ensure that more NDDs can benefit from supportive, inclusive environments.

III. Methodology

1. Research and Review of Existing Sensory Room Models

We began by comparing existing sensory room designs, consulting reputable commercial websites such as *Fun and Function* to identify commonly used features and equipment. This helped us understand the standard components, including tactile, auditory, visual, for sensory spaces.

2. Review of Scientific and Clinical Literature

We reviewed publications from the National Institutes of Health (NIH), hospitals, and therapeutic organizations to ground our design in scientific evidence. This allowed us to identify which sensory room elements, such as adaptive lighting, interactive tactile walls, soft seating, swings, and noise-reducing materials, have been empirically shown to benefit individuals with neurodevelopmental disorders.

3. Community Interviews

We interviewed special education teachers, Applied Behavior Analysis (ABA) therapists, and families of individuals with NDDs. These conversations provided insight into which sensory tools were most effective in real-world settings and where sensory rooms would be most impactful.

4. Conceptual Design and 3D Modeling

Initial sketches of room layouts and design features were created using *GoodNotes*. These sketches were then translated into digital models to visualize space use and simulate its appearance.

5. Funding and Implementation Planning

To bring our designs to life, we applied for external funding through the Karma for Cara Foundation, which supports youth-led service initiatives. Our proposal focused on building a public sensory room at the Michigan Science Center, an accessible location with high educational value and diverse visitorship.

6. Construction and Evaluation of the Pilot Sensory Room

With grant funding secured, we built and installed our cost-effective sensory room model at the Michigan Science Center. After installation, we gathered feedback from center staff and educators to evaluate the room's functionality, accessibility, and overall impact to assess the effectiveness of our model.

IV. Results

Vital Sensory Elements:

Through multiple sources, including literature reviews, interviews, and commercial product analyses, we identified a core set of sensory tools and spatial features consistently associated with improved outcomes for individuals with NDDs. These included:

- **Weighted blankets and bean bag chairs** for proprioceptive input and stress reduction
- **Controlled lighting** (e.g., dimmable LEDs, light projectors) to accommodate light sensitivity
- **Body socks and trampolines** for active sensory engagement and balance development
- **Sensory rotators and swings** to stimulate vestibular processing and support regulation

These findings were cross-validated through stakeholder interviews, in which most professionals and caregivers surveyed mentioned at least one of these tools as “highly effective” in their experience.

Community Interviews:

Interviews with special education teachers, ABA therapists, and families of children with NDDs revealed the overwhelming demand for accessible public sensory spaces. Over 50% of parents interviewed expressed that they often avoid public places such as museums, doctor’s offices, or schools with their children who have NDDs, due to sensory overload and lack of accommodations.

As one parent shared:

"I feel like we always have to leave early or avoid going altogether. There's nothing in place for my son to take a break or feel safe in those settings."

Professionals emphasized the importance of multi-zonal spaces and highlighted four essential areas that should exist in any effective sensory room model:

1. **Sensory Corner** – soft seating, tents, weighted materials, and calming lighting
2. **Active Zone** – movement-focused tools like trampolines, ball pits, and open floor areas
3. **Creative Area** – art supplies, crafts, and a creative expression wall
4. **Play Area** – manipulatives like magnetic tiles, sensory toys, and fidgets

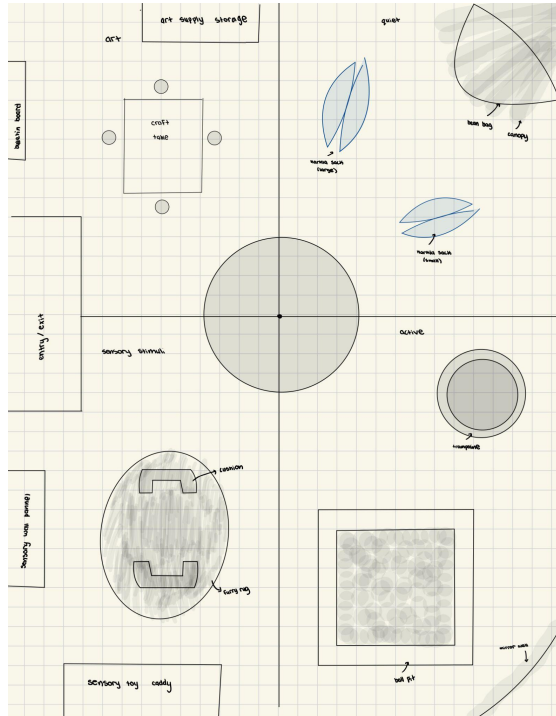


Figure 1: Schematic of the Sensory Room with the Four Zones

Adaptability and Affordability

We tested our sensory room design in varied spatial simulations (ranging from 100–300 square feet) and found the model highly adaptable. Contrary to the widely held belief that sensory rooms require large spaces and expensive equipment, our findings show that a fully functional, inclusive room can be built for under \$1,000, reducing the traditional estimated cost by over 95%, and in a variety of spaces. This cost reduction was achieved by prioritizing multi-use items and identifying alternate sellers and vendors for vital items while maintaining therapeutic efficacy.

Equipment and Supplies			
Expense Description	Cost/each	#	Total
Large Rug (Shag Area Rug - Dark Grey, 9x12) - Link	\$121.99	1	\$121.99
Plush Toys (Sensory Plush Set) - Link - Plush #1 Link - Plush #2	\$12.00	2	\$24.00
Sensory Storage Bin (Organizer with Removable Bins) - Link	\$79.00	1	\$79.00
Sensory Lights (Fairy Curtain Lights) - Link	\$13.99	1	\$13.99
Sensory Ceiling Lights (Thundercloud LED Lights) - Link	\$84.99	2	\$169.98
Sensory Swing (Indoor Hanging Therapy Swing) - Link	\$49.99	2	\$99.98
Bean Bags (Comfortable Sensory Seating) - Link	\$69.99	2	\$139.98
Harkla Sac (Inflatable Sensory Seat) - Link	\$62.99	1	\$62.99
Rocking Chair (TED Kangaroo Sensory Rocker) - Link	\$79.99	1	\$79.99
Sensory Books (Set of Books for Developmental Learning) - Link	\$10.00	5	\$50.00
Velcro Blackout Curtains(Velcro and removable, creates dark enviornment) - Link	\$24.99	1	\$24.99
Sensory Canopy (Hanging Sensory Tent) - Link	\$16.99	1	\$16.99
Sensory Fidgets (Fidget Kit for Autism Support) - Link	\$19.99	1	\$19.99
Sensory Panels (Set 5, Wall-Mounted Sensory Squares) - Link	\$84.99	1	\$84.99
			\$988.86

Figure 2: Price Breakdown of the Sensory Room Items



Figure 3: Lara and Maya Hammoud in the MI Science Center Sensory Room

V. Discussions

We have not only developed a new sensory room model that can be used in a variety of spaces, such as classrooms, clinics, and even unconventional settings like refugee aids, but have also achieved a 95% cost reduction from the traditional \$30,000 model. This dramatic decrease in cost makes sensory rooms far more affordable and accessible to a broader range of communities. Despite the lower cost, the redesigned rooms retain their core therapeutic benefits, including improved focus, reduced stress and anxiety, enhanced communication, and the creation of calm, supportive environments. This innovative alteration to sensory rooms makes them more realistic and sustainable options for sensory support in under-resourced schools and public spaces. Our design will pave the way for sensory rooms to become standard in public settings and help normalize neurodiversity. Ultimately, our work shifts sensory spaces from a privilege to a necessity, ensuring that individuals with neurodevelopmental disorders have access to the environments they need to thrive.

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The issue of income inequality among farmers: Solution model to reduce disparity in Nakhon Ratchasima Region, Thailand.

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Summary

In Thailand, agriculture is one of the most essential occupations, employing approximately one-third of the workforce. However, it accounts for only 6% of the national GDP. Over half of Thailand's workforce is in the informal sector causing vague value to the overall economy. Every year smallholder farmers face significant economic challenges due to unequal resource distribution, limited market access, and the dominance of large-scale agribusinesses. Most of Thailand's agricultural land is in the hands of large agribusinesses and wealthy landowners. Smallholders can only cultivate crops such as rice, cassava, and rubber. Moreover, wealthy landowners might manipulate the smallholders by having them plant crops for them on unfair terms which leads to the deterioration of society. This study aims to design the solution plan by combining different advantages from various models. By integrating private business plans with the Sufficiency economy plan. We can create a model that helps distribute knowledge to farmers while providing them with opportunities to sell their products back to the owner, establishing a business partnership. Additionally, this model ensures quality and pricing while also serving as a guideline for sustainable economic and social development. Therefore, our model can bridge the gap between large-scale agribusinesses and smallholder farmers, promoting equity and economic sustainability in rural Thailand.

Keywords: Income inequality, Agriculture, Sufficiency economy model, Smallholder farmers, Market access

1. Introduction

Farming is one of the most common occupations in Thailand. In fact, Thailand has over 7.7 million agricultural households, even though it accounts for only 6% of the national GDP. Rice is Thailand's most exported agricultural crop, with approximately 127 million acres of land, of which around 52 percent is suitable for agriculture. While crop cultivation in Thailand is highly diverse, rice has always been the breath of Thai agricultural society and has played a major role in the country's traditions. Thailand ranks among the top ten global producers of rice. Apart from rice cultivation, crop production in the country has also extended to rubber, sugarcane, and cassava, as well as other major crops, including shallots, potatoes, garlic, and onions, to meet domestic and world market demand. [1, 2]

Although agriculture plays a vital role in Thailand, smallholder farmers face significant economic challenges each year due to unequal resource distribution, limited market access, and the dominance of large-scale agribusinesses, making it difficult to improve their productivity. Small farmers, in particular, struggle with high costs and fluctuating market prices. On top of that, they must comply with global standards and adopt eco-friendly methods, which further add to their challenges. Addressing these issues is essential for sustaining Thailand's farming industry.

In Thailand, farming communities play an important role in supporting each other. Farmers often work together, share knowledge, and help one another during crises. These communities create a strong bond that helps farmers deal with challenges and improve their skills. However, some farmers are not part of these communities. They may work alone or in small groups, missing out on the support and resources that others receive. This can make it harder for them to succeed and adapt to changes in the farming industry. Encouraging more farmers to join these communities can help improve their lives and boost agricultural success. [3]

Government policies also play a significant role in the nation by shaping the lives of Thai farmers and the overall

agricultural landscape. These policies influence a range of factors, including crop production, land use, subsidies, and access to resources. Through various programs and initiatives, the government has aimed to support farmers by providing financial assistance, promoting sustainable practices, and improving infrastructure in rural areas. However, not all policies have been equally effective. Many farmers face challenges such as insufficient support, poor implementation of programs, and limited access to modern agricultural technologies. As a result, the effectiveness of these policies is often debated. By examining the impact of government policies on Thai farmers, it becomes clear how important these decisions are in determining the success and sustainability of the agricultural sector, as well as the well-being of rural communities.

This study aims to design a solution plan by combining advantages from various models. By integrating private business plans with the Sufficiency Economy plan, we create a model that distributes knowledge to farmers while providing them with opportunities to sell their products back to the providers, establishing a business partnership.

2. Scope of Studies

2.1. Place

Nakhon Ratchasima is the biggest province in Thailand in terms of space. To its greatness, there are 32 districts which are; Mueang Nakhon Ratchasima, Khon Buri, Soeng Sang, Khong, Ban Lueam, Chakkarat, Chok Chai, Dan Khun Thot, Non Thai, Non Sung, Kham Sakaesaeng, Bua Yai, Prathai, Pak Thong Chai, Phimai, Huai Thalaeng, Chum Phuang, Sung Noen, Kham Thale So, Sikhio, Pak Chong, Nong Bun Mak, Kaeng Sanam Nang, Non Daeng, Wang Nam Khiao, Thepharak, Mueang Yang, Phra Thong Kham, Lam Thamenchai, Bua Lai, Sida Nakhon Ratchasima, otherwise known as Khorat, is the largest northeastern province, and the inhabitants of the province are mainly engaged in agricultural activities, growing such diverse crops as rice, sugar cane, sesame, and fruit. There are more than 100 savings and agricultural cooperatives in the province, 35 irrigation projects, and 7,122 industrial factories. Most of the factories are rice mills, tapioca product manufacturers, and industrial factories.

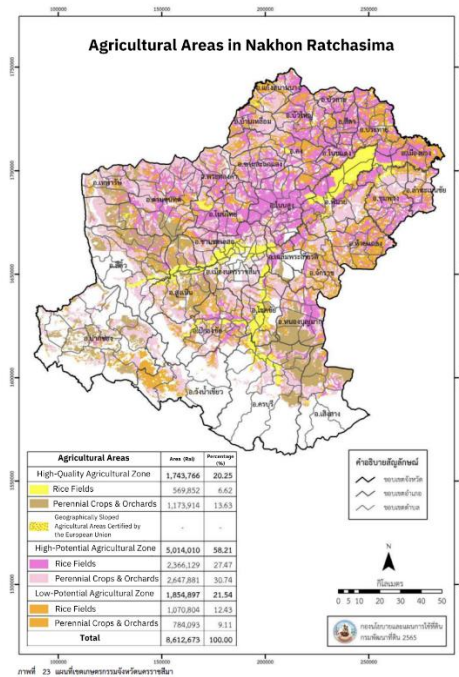
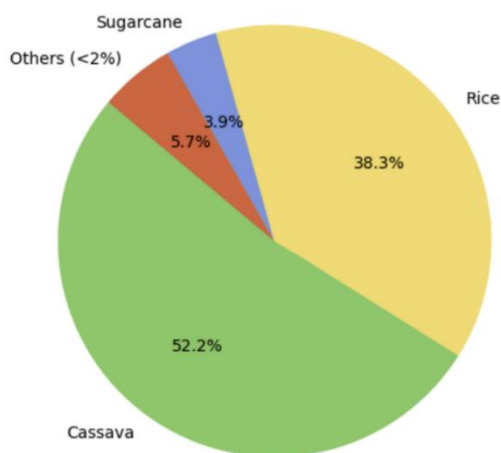


Figure 1: Diversity and Area of Agriculture in Nakhon Ratchasima

Land Use for Agriculture in Nong Bunnak District



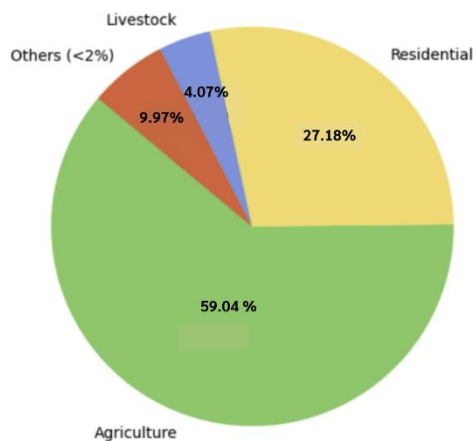
ตารางที่ 2.2 การใช้ประโยชน์ที่ดินด้านการเกษตรของอำเภอหนองบุญมาก จังหวัดนครราชสีมา

การใช้ประโยชน์ที่ดินด้านการเกษตร	พื้นที่ (ไร่)	ร้อยละ
มันสำปะหลัง	88,610.21	52.20
ข้าว	64,955.69	38.26
อ้อยโรงงาน	6,562.92	3.87
ข้าวโพดเลี้ยงสัตว์	5,008.88	2.95
ข้าวโพดเมล็ดพันธุ์	2,549.78	1.50
ยางพารา	710.84	0.42
ไม้ผล	563.78	0.33
พืชผัก	44.75	0.03
พืชอื่นๆ	1,153.05	0.68
รวม	169,760.54	100

ที่มา: ระบุข้อมูลทะเบียนเกษตรกรกลาง กรมส่งเสริมการเกษตร (2566)

Figure 2: Diversity of Crops cultivated in Nakhon Ratchasima

Overall Land Use in Nong Bunnak District



ตารางที่ 2.1 การใช้ประโยชน์ที่ดินของอำเภอหนองบุญมาก จังหวัดนครราชสีมา

การใช้ประโยชน์ที่ดิน	พื้นที่ (ไร่)	ร้อยละ
การเกษตร	217,857	59.04
ที่อยู่อาศัย	100,309	27.18
ปศุสัตว์	15,000	4.07
แหล่งน้ำ	1,849	0.50
อุตสาหกรรม	1,515	0.41
ป่าไม้	5,953	1.61
อื่นๆ	26,517	7.19
รวม	369,000	100

ที่มา: กรมการปกครอง ที่ว่าการอำเภอหนองบุญมาก (2566)

Figure 3: Variety of Economy in Nakhon Ratchasima

2.2. Income inequality

Income inequality is a significant issue in Thailand, particularly when comparing the earnings of farmers to those in other professions.

In 2018, farming households had an average income of 197,373 THB annually, which equals about 16,448 THB per month. This is much lower than the income of individuals in other sectors. The per capita income for farmers in 2018 was even lower, at 74,483 THB per year or 6,207 THB per month. These figures highlight the financial challenges many farming families face.

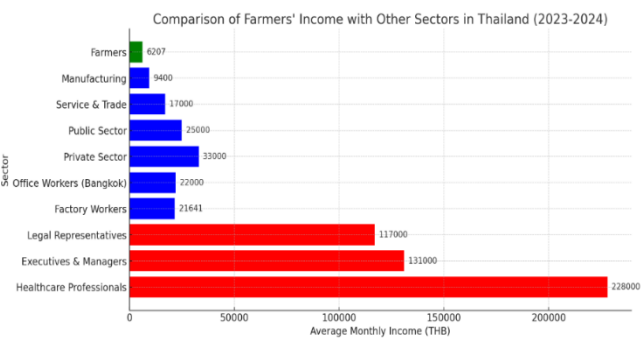


Figure 4: Comparison of Income Across Career Sectors in Thailand (2023-2024)

However, recent data from November 2024 shows a significant increase in farmers' income, with agricultural earnings rising by 21.9% compared to the previous year. Despite this boost, farmers' income still remains below the national average. In 2023, the average monthly income in Thailand was 15,410 THB, or 184,920 THB annually, which is considerably higher than the income of farmers.

The income disparity between farmers and other professions is even more apparent when comparing it to other sectors. For example, in 2023, employees in the manufacturing sector earned an average of 14,000 THB per month. On the other hand, healthcare professionals such as doctors earned about 228,000 THB per month. Executives and managers had an average monthly income of 131,000 THB, while legal professionals, such as lawyers, earned around 117,000 THB per month. Even sales assistants, who are among the lower-paid roles in sales, had an average monthly salary of 49,167 THB.

Career or Profession	Average Monthly Income (THB)	Year
Healthcare Professionals	228,000	2024
Executive and Managerial Roles	131,000	2024
Legal Representatives	117,000	2024
Private Sector Professionals	33,000	2023
Public Sector Workers	25,000	2023
Service and Trade Sector Employees	17,000	2023
Manufacturing Sector Workers	9,400	2023
Factory Workers	21,641	2024
Office Workers in Bangkok	20,000 – 25,000	2023

Figure 5: Average Monthly Income by Occupation in Thailand (2023-2024)

The National Statistical Office of Thailand also reported an increase in wages across the country, with the average wage rising to 15,715.16 THB per month in the third quarter of 2024, compared to 15,328.54 THB per month in the previous quarter. While this increase in wages is a positive sign, the income gap between farmers and other sectors continues to be a significant issue.

The income disparity between farmers and other sectors of society clearly illustrates the ongoing challenges farmers face in terms of financial stability and access to opportunities. Addressing this gap is essential for fostering more equitable growth and providing fairer opportunities for all sectors of Thai society. [4-7]

2.3. Farmers' Challenges

2.3.1. Low Agricultural Productivity

Labor is an essential factor for agricultural productivity. In Thailand, especially in Nakhon Ratchasima Province, migration of labor to the large cities has been taking place. Children in agricultural households who graduated from compulsory education or higher have no interest in taking over their parents' agricultural occupations. Consequently, the farming society is gradually changing into an industrial labor society, a situation which is becoming more severe. Results of this study show that the factors affecting the succession in agricultural occupation are: agricultural work experience, attitude towards agricultural occupation, number of household agricultural laborers, marital status, and having experienced problems with the agricultural resources. [8]

2.3.2. Market Price Fluctuations

Market price fluctuations significantly impact Thailand's agricultural sector, influencing both farmer incomes and the broader economy. Several recent developments illustrate these dynamics:

2.3.2.1. Rice Prices

As of February 2025, Thai rice farmers have faced a 30% year-on-year drop in paddy prices, falling to approximately 8,600 baht per ton. This decline has been attributed to increased cultivation costs and external market pressures. [9]

2.3.2.2. Sugar Industry Challenges

In January 2025, China imposed a ban on sugar syrup and premixed powder imports from Thailand due to hygiene concerns, leading to an estimated loss of 1 billion baht (approximately \$29.5 million). This ban has resulted in leftover supplies and financial penalties for Thai suppliers. The export ban threatens to overflow domestic sugar warehouses, potentially leading to reduced domestic prices and financial strain on producers. [10]

2.3.2.3. Rubber Prices

Excessive monsoon rains and typhoon damage in late 2024 have decreased natural rubber output in Thailand and China, leading to a 10%-15% production decline in Thailand. This supply reduction has driven rubber prices to a 13-year high, with increases exceeding 50% within the year. [11]

2.3.2.4. Agricultural Input Costs

Fluctuations in supply and pricing of agricultural inputs have significantly impacted Thailand's agricultural market, affecting distributors and dynamics. Local companies are adapting by enhancing delivery capabilities and innovation services to maintain customer engagement. [12]

2.3.2.5. Trade Policies and Tariffs

Thailand maintains high tariffs on agricultural imports, with an average bound tariff rate of 42% of the product's price.

This policy poses challenges for U.S. agricultural exports affecting market dynamics and price stability. [13]

3. Methodology

This study adopts a multi-model approach to address income inequality among farmers in Nakhon Ratchasima. Firstly, we utilize the Ohkajhu model, which mainly focuses on organic farming and the farm-to-table market approach to increase farmers' income and market access. Secondly, we then study the sufficiency economy model, which is based on the philosophy of self-sufficiency and sustainable resource management, promoting resilience and economic stability. Lastly, we combine the CP model which represents a vertically integrated agribusiness approach, emphasizing contract farming, supply chain management, and corporate support for farmers.

This research employs a mixed-method approach, combining both quantitative and qualitative techniques to evaluate the effectiveness of these models in reducing income disparity.

3.1. Ohkajhu



Figure 6 : Growth of Thailand Organic Food Market (2020-2024)

Ohkajhu Model Organic farming and direct farm-to-table market integration. Addressing Income Inequality Among Farmers in Nakhon Ratchasima through the Ohkajhu Model

Income inequality remains a significant challenge among farmers in Nakhon Ratchasima, where many small-scale agricultural producers struggle to achieve financial stability. This study proposes applying the Ohkajhu organic farming model as a sustainable solution to bridge the income gap and promote economic resilience. The methodology comprises five key strategies: establishing organic farming networks, developing farm-to-table businesses, promoting agro-tourism, expanding digital sales channels, and fostering government and private sector support.

The first step involves establishing an Organic Farming Network by organizing farmers into cooperatives or community enterprises. These groups will adopt organic farming practices based on the Ohkajhu model, which emphasizes sustainable agricultural methods. Training programs will be implemented to educate farmers on organic cultivation techniques, cost reduction strategies, and certification processes such as Good Agricultural Practices (GAP). This approach is expected to empower farmers with better market access, increased bargaining power, and reduced reliance on middlemen.

The second strategy focuses on Developing Farm-to-Table Restaurants and Organic Markets. Establishing farm-to-table restaurants in key areas like Mueang Nakhon Ratchasima, Pak Chong, and Sikhio will allow farmers to supply fresh organic produce directly to these businesses. Additionally, the creation of organic markets will enable farmers to sell their products directly to consumers, eliminating intermediaries and ensuring higher profit margins. This initiative is anticipated to significantly boost farmers' income and create value-added food products.

Another essential component is Promoting Agro-Tourism Initiatives. By encouraging organic farm tourism, farmers can generate additional income through farm stays, organic harvesting experiences, and sustainable farming workshops. Leveraging the province's natural attractions, such as Khao Yai National Park and Wang Nam Khiao, can attract eco-conscious tourists. Partnering with local hotels and resorts to offer organic farm experiences as part of tourism packages will further enhance the revenue streams for farmers.

To further expand market access, the fourth strategy involves Expanding Sales Channels through Digital Platforms and Delivery Services. Utilizing e-commerce platforms such as Shopee, Lazada, and Facebook Marketplace will enable farmers to reach a wider customer base. Additionally, developing a dedicated mobile application or online marketplace to connect consumers directly with local organic farmers will promote direct online sales. Implementing farm-to-home delivery services will ensure fresh organic produce reaches urban consumers, providing farmers with financial stability and broader market opportunities.

Finally, the methodology emphasizes Government and Private Sector Support. Securing government funding and grants from agencies like the Department of Agriculture and the National Innovation Agency will provide essential

financial backing. Partnerships with private enterprises, restaurants, and supermarkets can create long-term contracts for organic produce supply. Corporate Social Responsibility (CSR) initiatives will also play a crucial role in supporting organic farming communities and ensuring sustainable economic growth.

The Ohkajhu model offers a comprehensive and scalable framework to address income inequality among farmers in Nakhon Ratchasima. By combining organic farming networks, farm-to-table businesses, agro-tourism, digital marketplaces, and institutional collaborations, this methodology aims to enhance farmers' economic resilience and promote long-term agricultural sustainability. With continued support from both the public and private sectors, this model has the potential to transform the livelihoods of farmers and foster a more equitable agricultural economy. [14]

3.2. The Philosophy of Sufficiency Economy

Sufficiency economy is a principle introduced by the King of Thailand, focusing on moderation, reasonableness, and resilience. To live a self-sufficient life, one should first focus on being frugal, cutting down expenses, and avoiding unnecessary spending. Second, one should be honest and work with integrity in their profession. Third, people should avoid aggressive competition for personal gain or harmful business practices. Fourth, it is important to always seek ways to overcome difficulties by learning more and increasing income, with self-sufficiency as the main goal. Finally, people should follow a good path, avoid doing wrong, and live according to religious principles. By following these sufficiency principles, the New Theory was created to help farmers become more resilient to natural disasters and external economic problems.

The basic idea of the New Theory is to divide land into four parts, in a 30:30:30:10 ratio. The first 30% should be used to create a reservoir to store rainwater for irrigation, animals, and aquatic plants. The second 30% should be used to grow rice during the rainy season to make sure the family has enough food all year, lowering costs and helping with self-sufficiency. Another 30% should be used to grow fruit trees, perennial plants, vegetables, field crops, and medicinal herbs, with any extra being sold for income. The last 10% should be used for housing, livestock, roads, and other necessary buildings.

The second phase of the New Theory encourages farmers who have successfully applied these principles to work together in groups or cooperatives. This phase focuses on six areas: working together in production, like preparing the soil,

choosing seeds, and providing water; working together in marketing to improve profits, like managing rice drying areas, storage, and milling equipment; ensuring a good standard of living by providing basic needs like food and clothes; creating welfare services like healthcare and loan funds; promoting education by providing scholarships and supporting local schools; and encouraging social and spiritual growth, with religion as a guide. For this to work well, cooperation from government agencies, private organizations, and community members is necessary.

After completing the second phase, farmers or farmer groups should advance to the third phase, which involves coordinating with financial institutions, such as banks or private companies, to secure funding and improve their quality of life. This collaboration benefits both farmers and financial institutions. Farmers can sell their rice at higher prices without being underpriced, while banks or private companies can purchase rice at lower costs by buying directly from farmers and processing it themselves. Additionally, farmers can buy consumer goods at lower prices through bulk purchasing in cooperative stores. Meanwhile, banks or private companies can allocate personnel to oversee various activities, ensuring more effective operations and mutual benefits.

The sufficiency economy philosophy and the New Theory help farmers and rural communities achieve financial stability and self-sufficiency. By promoting frugality, ethical work, and sustainable agriculture, people can reduce expenses and become less vulnerable to economic changes. The structured land division ensures food security by providing a stable food supply and lowering costs. Water storage, diversified farming, and cooperative support improve resilience to natural disasters and financial crises. Community cooperation increases productivity, improves marketing, and creates better financial opportunities. Access to education, healthcare, and social welfare enhances overall well-being. This system strengthens livelihoods and supports long-term economic sustainability. [15]

3.3. CP All

CP Group engages in contract farming, providing farmers with stable income and reduced risks. For example, CP Foods has developed farm models that improve efficiency and minimize risks, leading to financial stability for contract farmers. These models have gained trust from financial institutions, enabling farmers to access loans more easily. The company contributes to community development and reducing social inequality by supporting job creation and income generation. This includes enhancing financial

literacy, skills, and experiences, aiming to diminish poverty and enable sustainable living for communities.

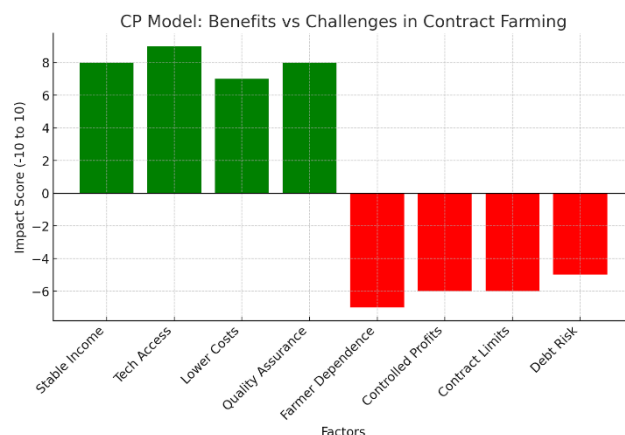


Figure 7: Benefits and Challenges in CP Contract Farming

The process of CP includes 5 major steps. Firstly, farmers sign agreements with CP Group, ensuring a stable market for their produce. Next, CP provides necessary farming inputs such as seeds, fertilizers, and livestock feed. Then, Experts from CP monitor farming activities, offering guidance and training. After that farmers sell their products directly to CP at pre-agreed prices. Lastly, CP assists with financial risks and price fluctuations, ensuring some level of income stability.[16]

4. Result

We built the farming model S.O.F.T. or Sustainable, Organic, Fair-Trade, & Tech-Driven Farming. This combines inspiring strategies and techniques from Ohkajhu model, CP, The Philosophy of Sufficiency Economy.

The idea behind S.O.F.T. is simple: to give farmers everything they need to grow confidently and sustainably. That means hands-on training in things like organic farming, how to care for livestock, how to rotate crops properly, and how to take care of the soil. They also get access to expert support from agronomists, veterinarians, and farming mentors who guide them step by step.

We've also ensured that farmers can use the latest technology, like smart irrigation systems and sensors that track soil moisture or detect issues that may occur in the crop.

Moreover, The S.O.F.T. model aims to connect farmers directly with markets. Through a central website or app, restaurants, retailers, and cooperatives can browse available products from farmers. They can choose the farm or plantation from where they want to buy from. This gives

farmers more control, better prices, and stronger relationships with the people who use their products.

And the whole point of this S.O.F.T. model is community, confidence, and opportunity. It provides a clear path for farmers, from becoming self-sufficient at home, to growing with smart technology, to selling widely in the marketplace.

5. Comparison

	Thailand	Vietnam
Fluctuating Crop Prices	✔ Rice and sugar prices highly volatile due to global market shifts [Reuters, 2025]	✔ Rice and coffee prices fluctuate with global demand [World Bank, 2023]
High Production Costs	✔ Fertilizers, pesticides, and land rentals are expensive [Our research]	✖ Government subsidies and local fertilizer production help keep costs lower
Limited Tech Access	✔ Small-scale farmers lack access to smart farming tools [Our research]	✔ Government promotes agri-tech, but rural gaps remain [Vietnam Gov, 2023]
Land Ownership Issues	✔ Many farmers don't own land; affects investment [Our research]	✖ Land titling more secure; smaller land size, but more ownership [FAO, 2022]
Climate Vulnerability	✖ Less climate impact than Vietnam, though droughts rising [MDPI, 2024]	✔ Mekong Delta faces droughts, saltwater intrusion [UNDP, 2023]

Figure 8: Comparison of Agricultural Problems between Thailand and Vietnam

In comparison, Thailand and Vietnam are both remarkable in agriculture. However, They have different policies to enhance their agricultural sectors. Thailand's policy traditionally supported export-oriented crops like rice, rubber, and sugarcane. Yet, Thailand still struggles with fluctuating prices of agricultural products, high production costs, limited access to technology and infrastructure, land ownership issues, particularly among small-scale farmers.

While Thailand's agriculture suffers from structural inequalities, high costs, and outdated systems, Vietnam's challenges lie in land fragmentation, climate threats, and the need for further modernization. Vietnam has undergone significant transformations since the 1980s, primarily due to the Doi Moi economic reforms that shifted the country from a centrally planned economy to a market-oriented one. These reforms led to instant growth in agricultural production. Despite these achievements, Vietnam still faces challenges, particularly from climate change. The country is highly vulnerable to erratic rainfall, rising temperatures, and extreme weather conditions, which threaten the entire food chain and agricultural practices.

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Assessing the Effectiveness of Digital Recycling Platforms to Promote Sustainability and Eliminate Poverty in Rural Indonesian Communities

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ABSTRACT

The Multidimensional Poverty Index (MPI) shows that the standard of living contributes to poverty in Indonesia. This is reflected in the Informal Waste Sector (IWS), where workers often earn only a fraction of the national minimum wage, with incomes fluctuating based on waste volume and market demand. This study uses primary and secondary data to analyze the effectiveness of current efforts to decrease income disparities within the Indonesian IWS. It proposes the creation of EcoLinkID, a new digital recycling platform that promotes transparent and fair interactions whilst being more user-friendly. Research into the factors affecting the workers' earnings advocates for proper structural interventions like EcoLinkID to ensure fair and equitable wages for waste collectors, contributing to poverty reduction and environmental sustainability.

Keywords: Informal Waste Sector, Sustainability, Digitalization, Recycling Platforms

1. BACKGROUND

Indonesia is the second largest contributor in the world towards marine plastic pollution after China, with the mismanagement of over 4.9 million tons of waste¹. Lack of trash recycling and growing landfills are major detrimental issues for the Indonesian government, generating over 60 million tons of waste annually² with only 10% of it being recycled. The rapid urbanization, population, and economic growth in cities such as Jakarta, Surabaya, and Nusantara now lead to an all-time high waste production, at 8 million tons of waste daily³. The lack of proper recycling or waste collection facilities in these different cities contributes to massive amounts of trash. Waste collection economically burdens Indonesia, being one of the most expensive civic services; leading to the creation of the Informal Waste Sector (IWS), whose workers carry out the work everyone else deems undesirable. The IWS plays a crucial role in local waste management. It refers to an industry of individuals who engage in waste management without formal registration or legal contracts, operating outside of the established governmental system. Informal Waste collectors, known as “Pemulung” in Indonesia, are heavily living in poverty, being exposed to unsanitary conditions and continuous pollution with no proper protections, and earning a third of the government's minimum wage⁴ whilst risking their health constantly.

Jakarta, the capital city, generates over 7600 tons of waste per day⁵ by itself, due to the demands of the citizens. This waste includes hazardous materials such as equipments containing mercury, pesticides and medical waste, that if

exposed daily, could pose risks to citizens' health (The residue mercury in equipments such as broken fluorescent bulbs, thermometers and thermostats are common items encountered by these collectors which can cause lung damage and affect kidneys, livers and muscles when inhaled, earning the name Jakarta's Silent Killer⁶).

Indonesia's government has taken legislative actions, and bans on single-use plastic in mini-markets have been implemented for over 5 years now. National Action Plans on Marine Debris have been set to reduce marine plastic fragments by 70% by 2025⁷. However, as of 2025, there is no available data to support progress toward this goal. Furthermore, there have been collaborations with NGOs in which the Jakarta Provincial Government has partnered with Waste4Change to improve the welfare of informal waste collectors in the period of 2017-2018 to support waste bank initiatives. As over 3.7 million⁸ individuals are collecting unsorted waste, oftentimes unaware that waste management starts and apps.

Despite the progressive policies, such as the Presidential Regulation No.83/2018⁹, the framework implemented by the government aims to reduce plastic waste within the ocean by 70% by 2025. In 2021, the National Plastic Action Partnership (NPAP) reported that 70%¹⁰ of Indonesia's plastic waste has been mismanaged in coordination with rural regions being disproportionately affected due to infrastructural gaps. Handing the responsibilities of waste management onto these rural areas, through the direct dumping and open burning due to the absence of proper disposal options, communities would frequently dump trash onto drains and open areas – totalling up to 346.5 Kilotons a year on average with the range of 201.1 - 552.3 Kilotons a year¹ from rural areas alone.

2. INTRODUCTION

This study aims to use both first-hand primary evidence and secondary evidence to analyze the possibility of decreasing income disparities within the IWS via the increased use of digital recycling platforms and establishing fair and open pricing standards. Furthermore, this study will crucially analyze how these recycling platforms influence the economic status of the rural Indonesian communities by examining 3 key parts: enhanced market accessibility, improvement of traceability within the management system, and increased potential for higher income.

This study holds substantial importance for stakeholders such as policymakers, recycling organizations, rural communities, and scholars by answering the critical gaps within sustainable development and the alleviation of poverty for middle and lower classes. The primary significances include: analytics on recycling platforms for development through effectiveness evaluation; this study will enhance the existing knowledge on technology-driven solutions for sustainable waste management and the circular flow of income within economies; investigations into market accessibility will facilitate improved traceability, transparency, and efficiency by analyzing income trends pre- and post-platform adoption to demonstrate the potential impact of these interventions on poverty alleviation. The results will inform NGOs, PolicyMakers, and developmental agencies to best optimize waste management strategies through the integration of digital tools.

This research aims to answer the following questions:

1. How aware are informal waste collectors of digital recycling platforms?

2. What barriers prevent the adoption of these platforms?
3. What can be improved from the apps that currently attempt to reduce income disparities in the IWS?

3. LITERATURE REVIEW

This review is organized into 4 key themes:

1. Indonesia's Multidimensional Poverty Index
2. Challenges of the Informal Waste Sector and Their Income
3. Past Actions By the Indonesian Government
4. Digital Recycling Platforms for Waste Management

3.1 Indonesia's Multidimensional Poverty Index

The Global Multidimensional Poverty Index (MPI) is an international measure developed by the Oxford Poverty and Human Development Initiative (OPHI). It assesses an area's poverty at an individualistic level, making use of 10 weighted indicators (eg, Child Mortality, Years of School Attendance, Nutrition, Electricity) and their respective thresholds.¹³

According to research conducted in 2017 by the Human Development Report Office, 25.12 million people in Indonesia's current population live below the National Poverty Line¹⁴. Through calculation, they have determined that Indonesia has an MPI score of 0.014, with 3.6% of the population being in multidimensional poverty. Indonesia's Health, Education, and Standard of Living contribute 34.7, 26.8, and 38.5 weightage, respectively, to the MPI score, with Standard of Living being the biggest contributing factor.¹⁸ (See Appendix A for Indonesia MPI Breakdown).

Workers in the IWS suffer from a lack of assets. As noted in a report posted by The Fair Circularity Initiative, most waste collectors own motorbikes; however, they are often purchased on credit, trapping waste collectors in a cycle of debt.¹⁹

3.2 Challenges of the Informal Waste Sector and Their Income

As of 2019, there are 3.7 million Informal Waste Workers within the Informal Waste Sector. These workers live week to week relying on the supply and demand of certain recyclables, working at least 9 hours a day, running around areas to find desirable recyclables.

Challenges include:

1. Health Risks due to exposure to hazardous materials, as areas that the waste collectors must work through are frequently unsanitary environments, e.g., landfills or urban trash dumps, without proper protective gear.

These individuals are often exposed to sharp objects, such as thrown away glass, and toxic chemicals, such as mercury in discarded electronics. Long-term exposure to mercury can lead to physical damage to an individual's lungs, kidney, muscle movement and impairment of speech, hearing and/or walking. This is detrimental as the money raised from collecting trash in these landfills are often used to fund an entire family's livelihood.

2. Lack of Legal Recognition, affirming that these individuals must work paycheck to paycheck daily to ensure that their expenses and needs will be covered, as there is a lack of financial support and legal protection for the waste collectors.
3. Economic Instability, with corporate workers, there is a minimum wage that they receive. However, with the waste collectors, there is no guarantee that they can meet minimum wage; most of these individuals, through our interviews, earn far less than the minimum wage at a range of Rp. 800,000 to Rp. 4,000,000.

3.3 Past Actions by The Indonesian Government

The Indonesian government has been engaging and cooperative with local governments to ensure equality and stability in income and employment in rural areas. These are the 3 main and major policies implemented by the government specifically for the individuals employed in the Informal Waste Sector: Extended Producer Responsibility (EPR), National Health Insurance , and National Roadmap and Action Plan Circular Economy Indonesia 2025-2046.

First Policy: Extended Producer Responsibility (EPR)

EPR, formerly known as extended producer responsibility, are policies that address the main issues of social exclusion of informal waste workers and formalizing recycling systems across rural Indonesia, especially. The main aim of the Framework is to be financially responsible for products that are no longer actively sold and thrown away.

The Framework's objectives,

1. Enhance individuals' capabilities by increasing the training of informal workers within a safe waste handling environment and integrating these workers into the formal supply chain.
2. Reduce exclusion through a mandatory waste collection target that requires collaboration between major corporations and waste picker cooperatives.
3. Improve livelihoods by establishing a fair and proper price mechanism for collection through digital recycling platforms, formerly known as e-waste collection.

The effectiveness lies within the implementation. As the report has noted, implementation gaps within the policies in Indonesia as ground-level impact remains limited due to poor enforcement, lack of proper work-centric design, and minimal participation from smaller producers.

Successful cases, e.g., Public Relations Officers (PROs) in Maharashtra, India, have raised incomes by an estimated 30%²⁹. This EPR policy was successful due to dedicated funding for skill development and allocation of training skills towards specific roles to informal sector workers. The main key success of EPR policies lies in the dedication of producers and the participation of IWS workers.

Second Policy: National Health Insurance

JKN or Jaminan Kesehatan Nasional in Indonesia is a policy that has helped individuals through access to a wide range of healthcare services, reduced expenses from the individual's pocket, and financial security during illness. The main objective of JKN is universal healthcare coverage to ensure that all individuals, regardless of their socio-economic background or geographical location, can receive proper health care. With over 90% of the population¹¹, or 284 million citizens, enrolled in JKN by 2024 alone, allowing these individuals to have security in healthcare without taking it out of their own pockets, helping these individuals reduce their income spent.

However, the effectiveness of JKN remains a major issue due to financial sustainability, inequitable accessibility to care, and quality of service disparities. Due to budget deficits, the range of services is limited as healthcare costs are on a continuous rise, this implies individuals now must pay out of pocket. In conjunction with that, facility distributions between regions are extremely evident as remote areas face limited access to specialized services, e.g., heart surgeries, due to their geographical location, specifically Eastern Indonesia. Furthermore electronic identification is required, it is known as Elektronik-Kartu Tanda Penduduk (e-KTP) or Electronic Visual Identification, with e-KTP it allows individuals to access government benefits. By 2025, there is no data regarding the number of individuals without e-KTP. However, in 2019, over 4 million¹² voters all over Indonesia do not have an e-KTP, implying that these individuals are not able to acquire these public benefits and goods.

Third Policy: National Roadmap and Action Plan Circular Economy in Indonesia 2025-2045

The Roadmap and Action Plan is an outline of the framework that focused on the transition from a linear to a circular economy, inclusive for all individuals e.g. the Indonesian Government, Businesses and the public all transition to collecting waste for the environment and turning it into a circular economy where monetary benefits can be claimed.

The Framework's Policies, include Food strategies, Plastic Packaging strategies, Electronic strategies and construction strategies to create a more holistic policy plan to ensure on all the basis of waste are covered. Some of these policies are:

1. Food Strategy
 - a. Implementation of Organic Farming
 - b. Improvement of Supporting Food Infrastructure
 - c. Prevention & Utilization of FLW and Food Surplus
2. Plastic Packaging Strategy
 - a. Redesign & Increase Recycling Rates of Plastic Packaging
 - b. Development and Management of Biodegradable Plastic Packaging
 - c. Development of Reusable Packaging Ecosystem
 - d. Improved Collection, Recycling & Recovery of Plastic Packaging

3. Electronic Strategy

- a. Development & implementation of EPR Policy for Electronic Products
- b. Development of Circular Economy Infrastructure for Electronics
- c. Implementation of Ecodesign & Product Innovation
- d. Development of Circular Economy Ecosystem for New Technology and Battery-Based Electric Vehicle (KBLBB)

4. Construction Strategy

- a. Implementing Sustainable Principles in Design & Working Methods
- b. Utilization of Construction & Demolition Waste
- c. Increase in Resource & Energy Efficiency

The persistence of the effectiveness lies within the gaps of implementation due to the lack of waste collectors formally included within EPR chains and inequality with rural enforcement, some of these waste collectors being included only from specific areas, with only 15%²² of all waste collectors included. The main issue is the inclusion of individuals and areas, having the collection and connection between governments of different provinces and regions as the technology and waste-collection system differs in each region. This further perpetuates the need for proper waste infrastructure within each province, where it is equal and accessible for all provinces.

3.4 Digital Recycling Platforms for Waste Management

This review applies the Circular Economy Framework (Ellen Macarthur Foundation, 2019) to properly assess how digital platforms close the loop between waste generation and recycling. This framework aims to revolutionize the way of consumption, production, and distribution of waste materials. Due to a growing plastic crisis, waste management is crucial as it properly illustrates the potential for better infrastructure and environment that can be produced through these platforms.

Digital Recycling platforms are the primary solution for waste management due to the simple and enhanced accessibility towards these apps and anyone's ability to help with waste management. With the digital platforms and systems, it can provide real-time data on waste collected, waste volumes, material types, and recycling activities present, allowing for better traceability of recycling materials. This type of system fosters transparency between the user, buyer, and third-party accounts that are monitoring the application. Furthermore, digital platforms can create new job opportunities for those within the recycling industry, as they can absorb informal waste collectors and increase their pay. A study within Yogyakarta has shown that digitalization creates new jobs, which was 780 waste collectors during their period of research. On average, customers with an estimate of 15kg would sell their waste for US\$0.10/kg²³ or Rp. 1.638/kg whilst they could sell it for as estimated US\$0.29/kg or Rp. 4.751/kg when using digital recycling applications and platforms.

The effectiveness of these digital platforms lies within 2 main factors: the ability to adapt beyond urban areas and awareness of these digital platforms. Individuals who are being introduced, part of studies, or simply online. Though apps, e.g., Octopus connects over 8,000 waste collectors with 1,600 waste banks, the definitive number of waste

collectors is more than 3 million individuals who are unaware of these platforms due to the lack of awareness beyond urban areas. Waste collectors, who live further than areas such as Jakarta, Bali, Surabaya, Yogyakarta, and other urban areas, are unaware of these platforms because they live within rural Indonesia. Digital Recycling companies are more willing to stay within urban areas due to high implementation costs, lack of digital literacy, and lack of change, at times limiting the number of individuals who have access to this type of income.

Recycling platforms, including Waste4Change and Rapel are organizations within the waste management system that are exclusive to certain individuals with specific qualifications to join their organizations. Specifically, individuals would have less of an incentive to apply due to certain qualifications or expectations that they must meet to join these recycling platforms. Creating more exclusivity within these platforms, instead of being easily accessible to all waste pickers.

User-friendliness is an issue due to the low literacy levels within rural Indonesia, which causes individuals to encounter a difficult experience when trying to apply and sign up for these applications. Past issues within Rapel, Waste4Change, Octopus, and others are the lack of simplicity within the websites for these waste collectors, making it to become more challenging for these individuals to use. These waste collectors need a quick application that does not require a large number of steps, but rather, a quick way to post their recyclables for them to be able to generate a bit more income.

Further corroborating this, a case study exploring Waste4Change's UX design published on Medium has highlighted several pain points in the platform's interface. This indicates Waste4Change has failed to make their platform as user friendly as possible, which reduces their effectiveness toward the IWS workers. (See Appendix C for UX Case Study Findings)

4. METHODOLOGY

4.1 Research Design

This study employed a mixed-methods triangulation approach, using content analysis to analyze available evidence from past studies and using a qualitative, exploratory research design through semi-structured interviews to gather previously unavailable insights from independent waste collectors. This qualitative interview approach was chosen to capture the life experiences and perspectives of the waste collectors in their own words, which were not available on the internet's data sources. This research aimed to uncover previously undocumented information about their monthly income and personal assets, and to examine whether digital recycling platforms have had any impact on their work.

4.2 Participants

Participants were required to be active full-time waste collectors, working under informal private collection services. Those who declined recording or did not regularly operate in the area were excluded from the final selection. From a total sampling population of thirty waste collectors who operated in the Perumahan Kebon Jeruk Baru's Temporary Waste Storage area, the final sample included three male participants who were chosen using random sampling and interviewed. Random sampling was used to reduce selection bias and improve the generalizability of results. Before

participating in the study, every participant gave their full, informed consent that they were available, willing to participate, and would be subject to recording.

4.3 Interview Questions

Each interview lasted approximately 10-20 minutes and was guided by a pre-planned list of questions (For full interview questions, refer to Appendix B), covering four key areas:

- Income
- Work Conditions
- Digital Access and Assets
- Awareness and Usage of Digital Recycling Platforms

Provided consent to record was given, interviews were video recorded and later replayed for review and analysis.

4.4 Data Analysis

The interview recordings were reviewed manually, and responses were transcribed and coded thematically. Key themes such as "income variability," "digital platform awareness," and "assets owned" were identified and grouped.

4.5 Ethical Considerations

Ethical approval was obtained through consultation with the research supervisor. All participants provided informed verbal consent and were assured that their identities would remain confidential. Recording was only done after explicit verbal agreement.

4.6 Limitations of Research

Although random sampling was used to increase the generalizability of the findings, this representativeness was hindered by the small sample size of participants. Additionally, it is possible that the Hawthorne Effect—where participants change their responses because they know they are being observed—affected the reliability of the findings. Furthermore, some participants operated in areas outside Perumahan Kebon Jeruk Baru's Temporary Waste Storage area, and so results may not be entirely representative of the waste collectors within the targeted research area.

5. RESULTS

5.1 Income and Work Conditions

Interview results indicate that working hours ranged from 8 to 10 hours a day. Weekly income for Waste collectors varied significantly, ranging from Rp. 200,000 to Rp. 600,000. Two out of three participants stated that their collection performance affected their income, while all participants reported that the demand for the recyclable material constantly made prices fluctuate and affected their income.

Table 1: Income and Work Conditions (based on responses to interview questions in Appendix B)

Questions asked	What is your weekly income?	How many hours do you work daily?	Does your income depend on collection performance?	Does your income depend on material demand?
Interviewee 1	Rp. 200,000	9 Hours	No	Yes
Interviewee 2	Rp. 600,000	10 Hours	Yes	Yes
Interviewee 3	Rp. 250,000	8 Hours	Yes	Yes

5.2 Digital Access and Assets

While all participants had mobile phones, none of them could reliably access the internet. This indicates limited digital connectivity among the participants.

Table 2: Digital Access and Assets

Questions asked	Do you have access to		
	Mobile phone?	The Internet at work?	Electricity at home?
Interviewee 1	Yes	No	Yes
Interviewee 2	Yes	No	Yes

Interviewee 3	Yes	No	No
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5.3 Awareness and Usage of Digital Recycling Platforms

None of the participants showed any awareness of Digital Recycling Platforms such as Rapel, Octopus, or Waste4Change.

Table 3: Awareness and Usage of Digital Recycling Platforms

Questions asked	Have you heard of or used digital recycling platforms in the past?	If so, do you have any thoughts on digital recycling platforms?
Interviewee 1	No	N/A
Interviewee 2	No	N/A
Interviewee 3	No	N/A

5.4 Summary of Key Findings

- The income of waste collectors in the sampled area differs and is below the minimum wage.
- Factors such as collection efficiency and market demand can directly impact their income.
- All interviewees owned a mobile phone, but none had access to the internet at work, and only two out of three had electricity at home.
- None of the interviewees were aware of digital recycling platforms.

6. DISCUSSION

6.1 Interpretation of Results

The results reveal that the effectiveness of digital recycling platforms is hindered by low awareness, limited funding, and scalability constraints. Even with over 50,000 active users²⁴, Octopus hardly reaches out to a fraction of the IWS' estimated 3.7 million collectors¹⁹. Moreover, data shows that only 15% of the waste collectors in Jakarta use Rapel and that platforms such as Octopus and Waste4Change struggle with rural adoption, with only 35.9% of Indonesians in rural areas having access to the internet²⁵.

The interviews conducted in Kebon Jeruk confirmed this digital divide. Despite owning mobile phones, participants lacked reliable internet access and were unaware of what digital recycling platforms were. This demonstrates that access to technology alone is not enough to guide waste collectors to these platforms.

Additionally, fluctuating earnings based on global recyclable prices undermine user retention and do not allow these platforms to be a consistent tool for these waste collectors. For example, MallSampah users saw an income drop in 2022 due to falling plastic prices.

Key findings

1. Individuals who possess digital recycling platforms have reported an increase in their income due to larger accessibility within their geographical locations, as they can market their remaining recyclables. Individuals

within the outskirts of Jakarta, e.g., Tangerang, can earn a better income and a livable wage with the help of digital recycling applications. In turn, creating stability and economic benefits.

2. Within interviews that were conducted in the area of Kebon Jeruk, it was found that waste collectors within the area are unaware of these digital recycling platforms. Even though they acquired mobile and internet access, these recycling platforms were still unknown to them.
3. Digital divide and lack of awareness remain key challenges, as many rural regions still lack mobile devices with internet connectivity.
4. Inconsistent pricing is a common logistical issue that has been encountered by individuals who use these applications. This creates issues in trust and transparency between users, and directly hinders the growth of the application due to the mistrust in the application and stronger reasons for resistance to change.

6.2 Challenges Identified

Several recurring barriers have emerged that limit the effectiveness of Digital Recycling Platforms:

1. Digital divide – With only 35.9% of rural Indonesians having reliable internet access, the majority of rural Indonesians do not have access to devices or the internet; this limits digital platform outreach to urban areas such as Java and Bali, while excluding Eastern Indonesia.
2. Lack of awareness – The majority of the IWS is unaware of the existence of these platforms and their benefits.
3. Unstable earnings result in the effectiveness suffering since there is no standardized income baseline. Users lose trust in these systems.
4. Onboarding restrictions as the requirement for interviews and a screening process in order to become officially affiliated with these platforms may discourage participation among prospective waste collectors, particularly among informal or unregistered collectors who may lack the documentation, time, or confidence to complete such procedures.

6.3 EcoLinkID: Proposed Concept for Increased User-Friendly Platform Design

EcoLinkID is a conceptual platform designed to address key challenges identified in currently existing digital recycling applications. Unlike platforms such as Rapel and Waste4Change, which are typically operated by organizations with limited quotas for IWS workers, EcoLinkID adopts a decentralized model. It enables users to post recyclable waste available for collection, which can then be “reserved” by collectors. This structure encourages peer-to-peer interaction, removing formal employment limitations or platform-controlled collector limits.

EcoLinkID enhances user-friendliness through a simplified interface and English and Bahasa Indonesian translations of the platform. (See Appendix D for User Interface Mockup Design). Additionally, the most notable design choice is the elimination of onboarding procedures. By allowing any individual to register an account and begin posting or

collecting without formal interviews or verification steps, the platform increases accessibility for unregistered waste collectors who are often excluded from current systems.

Furthermore, the built-in messaging feature enhances communication between waste providers and collectors. This allows IWS workers to plan collections more efficiently and increase collection amounts before selling to private recyclers or waste banks, potentially increasing the volume and value of their transactions.

While EcoLinkID remains untested, its design principles—decentralization, increased digital accessibility, minimal onboarding, and enhanced communication—reflect a targeted response to the real-world constraints experienced by informal waste collectors. Future work should focus on field testing and evaluating its practical impact on income stability and user adoption.

6.4 Additional Recommendations to Improve EcoLinkID

1. Use Google Maps API to implement route planning for users to collect/deposit trash more efficiently and reduce commute times.
2. Collaborative efforts with transportation companies (eg. Grab and GOJEK) could be made to aid collection in remote areas by providing temporary vehicles to workers.
3. Improved gamification by incrementing points for each successful transaction, which could be used to exchange for money or other necessities.
4. Undergo Beta Testing to obtain feedback and effectiveness.

7. CONCLUSION

This study has explored the effectiveness of digital recycling platforms for waste collectors in rural Indonesia. The literature review and primary interviews of Indonesian IWS workers revealed that while these platforms can improve incomes and contribute to environmental sustainability, several barriers, such as a lack of awareness and income instability limit their full impact. Among the digital divide, many rural waste collectors lack consistent internet access and digital literacy, preventing them from properly participating in these platforms.

Moreover, onboarding challenges and poor digital literacy reduce long-term platform engagement. Despite these obstacles, the platforms show promise in areas with better literacy and documentation, such as parts of Jakarta and Tangerang, where workers report increased income. Addressing these challenges requires coordinated efforts between platform developers and local communities.

Conceptually, EcoLinkID improves upon these challenges faced by users, however field tests would need to be conducted to determine effectiveness and find further challenges in the concept.

In conclusion, digital recycling platforms can continue to improve for increased sustainable development, but only if inclusion, infrastructure, and trust are prioritized. With thoughtful integration, Indonesia can create a more circular, equitable waste economy that uplifts both people and the planet.

8. ACKNOWLEDGEMENTS

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10. APPENDICES

Appendix A - MPI Breakdown (Human Development Reports, 2024)

										SDG 12			SDG 11	
										Contribution of deprivation in dimension to overall multidimensional poverty ^a			Population living below monetary poverty line (%)	
Country	Year and survey ^b	Multidimensional Poverty Index ^a	Population in multidimensional poverty ^a						Population vulnerable to multidimensional poverty ^a	Health	Education	Standard of living	National poverty line	PPP \$2.15 a day
			Headcount (thousands)		Intensity of deprivation	Inequality among the poor	Population in severe multidimensional poverty							
			Value	(%)										
Sao Tome and Principe	2019 M	0.048	11.7	25	27	40.9	0.007	2.1	17.0	18.7	36.6	44.6	55.5	15.7
Senegal	2019 D	0.263	50.8	8,313	8,972	51.7	0.019	27.7	18.2	20.7	48.4	30.9	..	9.9
Serbia	2019 M	0.000 ^{sp}	0.1 ^{sp}	8 ^{sp}	8 ^{sp}	38.1 ^{sp}	.. ^e	0.0 ^{sp}	2.1 ^{sp}	30.9 ^{sp}	40.1 ^{sp}	29.0 ^{sp}	20.0	1.2
Seychelles	2019 N	0.003 ^{da}	0.9 ^{da}	1 ^{da}	1 ^{da}	34.2 ^{da}	.. ^e	0.0 ^{da}	0.4 ^{da}	66.8 ^{da}	32.1 ^{da}	1.1 ^{da}	25.3	0.5
Sierra Leone	2019 D	0.293	59.2	4,579	4,902	49.5	0.019	28.0	21.3	23.0	24.1	53.0	56.8	26.1
Suriname	2018 M	0.011	2.9	17	18	39.4	0.007	0.4	4.0	20.4	43.8	35.8	..	1.1
Tanzania (United Republic of)	2022 D	0.221	47.2	30,554	30,554	46.9	0.014	18.3	23.1	24.2	22.6	53.2	26.4	44.9
Thailand	2022 M	0.002 ^g	0.5 ^g	352 ^g	352 ^g	37.0 ^g	0.003 ^g	0.0 ^g	4.7 ^g	31.2 ^g	54.0 ^g	14.7 ^g	6.3	0.0
Tonga	2019 M	0.003	0.9	1	1	38.1	.. ^e	0.0	6.4	38.2	40.7	21.1	20.6	0.0
Trinidad and Tobago	2022 M	0.002 ^h	0.5 ^h	8 ^h	8 ^h	38.8 ^h	0.005 ^h	0.1 ^h	0.8 ^h	64.2 ^h	23.7 ^h	12.1 ^h	..	..
Tunisia	2023 M	0.003	1.0	119	118	35.2	0.002	0.0	2.8	28.1	61.8	10.1	16.6	0.3
Turkmenistan	2019 M	0.001 ^d	0.2 ^d	17 ^d	18 ^d	34.0 ^d	.. ^e	0.0 ^d	0.3 ^d	82.4 ^d	15.5 ^d	2.1 ^d	..	..
Tuvalu	2019/2020 M	0.008	2.1	0	0	38.2	0.002	0.0	12.2	36.5	43.6	20.0	..	..
Uzbekistan	2021/2022 M	0.006 ^{hr}	1.7 ^{hr}	604 ^{hr}	604 ^{hr}	35.3 ^{hr}	0.001 ^{hr}	0.0 ^{hr}	0.2 ^{hr}	94.5 ^{hr}	0.0 ^{hr}	5.5 ^{hr}	14.1	2.3
Viet Nam	2020/2021 M	0.008 ^h	1.9 ^h	1,899 ^h	1,913 ^h	40.3 ^h	0.010 ^h	0.4 ^h	3.5 ^h	22.9 ^h	40.7 ^h	36.4 ^h	4.3	1.0
Yemen	2022/2023 M	0.188 ^s	37.4 ^s	14,740 ^s	14,303 ^s	50.2 ^s	0.019 ^s	17.0 ^s	22.5 ^s	28.4 ^s	31.7 ^s	39.9 ^s	48.6	19.8
Zambia	2018 D	0.232	47.9	8,610	9,654	48.4	0.015	21.0	23.9	21.5	25.0	53.5	60.0	64.3
Zimbabwe	2019 M	0.110	25.8	3,940	4,146	42.6	0.009	6.8	26.3	23.6	17.3	59.2	38.3	39.8
Estimates based on surveys for 2012-2017														
Angola	2015/2016 D	0.282	51.1	14,914	18,211	55.3	0.024	32.5	15.5	21.2	32.1	46.8	32.3	31.1
Armenia	2015/2016 D	0.001 ⁱ	0.2 ⁱ	6 ⁱ	5 ⁱ	36.2 ⁱ	.. ^e	0.0 ⁱ	2.8 ⁱ	33.1 ⁱ	36.8 ⁱ	30.1 ⁱ	24.8	0.8
Barbados	2012 M	0.009 ^j	2.5 ^j	7 ^j	7 ^j	34.2 ^j	.. ^e	0.0 ^j	0.5 ^j	96.0 ^j	0.7 ^j	3.3 ^j	..	..
Belize	2015/2016 M	0.017	4.3	16	17	39.8	0.007	0.6	8.4	39.5	20.9	39.6	..	..
Bolivia (Plurinational State of)	2016 N	0.038	9.1	1,013	1,094	41.7	0.008	1.9	12.1	18.7	31.5	49.8	36.4	2.0
Bosnia and Herzegovina	2011/2012 M	0.008 ^j	2.2 ^j	80 ^j	70 ^j	37.9 ^j	0.002 ^j	0.1 ^j	4.1 ^j	79.7 ^j	7.2 ^j	13.1 ^j	16.9	..
Botswana	2015/2016 N	0.073 ^u	17.2 ^u	385 ^u	420 ^u	42.2 ^u	0.008 ^u	3.5 ^u	19.7 ^u	30.3 ^u	16.5 ^u	53.2 ^u	16.1	15.4
Brazil	2015 N ^v	0.016 ^{ghv}	3.8 ^{ghv}	7,748 ^{ghv}	8,080 ^{ghv}	42.5 ^{ghv}	0.008 ^{ghv}	0.9 ^{ghv}	6.2 ^{ghv}	49.8 ^{ghv}	22.9 ^{ghv}	27.3 ^{ghv}	..	3.5
Burundi	2016/2017 D	0.409 ⁱ	75.1 ⁱ	8,641 ⁱ	10,004 ⁱ	54.4 ⁱ	0.022 ⁱ	46.1 ⁱ	15.8 ⁱ	23.8 ⁱ	27.2 ⁱ	49.0 ⁱ	64.9	62.1
China	2014 N ^x	0.016 ^{sa}	3.9 ^{sa}	53,922 ^{sa}	55,369 ^{sa}	41.4 ^{sa}	0.005 ^{sa}	0.3 ^{sa}	17.4 ^{sa}	35.2 ^{sa}	39.2 ^{sa}	25.6 ^{sa}	0.0	0.1
Colombia	2015/2016 D	0.020 ^h	4.8 ^h	2,299 ^h	2,507 ^h	40.6 ^h	0.009 ^h	0.8 ^h	6.2 ^h	12.0 ^h	39.5 ^h	48.5 ^h	36.6	6.0
Congo	2014/2015 M	0.112	24.3	1,237	1,465	46.0	0.013	9.4	21.3	23.4	20.2	56.4	..	..
Egypt	2014 D	0.020 ^{dt}	5.2 ^{dt}	5,109 ^{dt}	5,900 ^{dt}	37.6 ^{dt}	0.004 ^{dt}	0.6 ^{dt}	6.1 ^{dt}	40.0 ^{dt}	53.1 ^{dt}	6.9 ^{dt}	29.7	1.5
El Salvador	2014 M	0.032	7.9	484	494	41.3	0.009	1.7	9.9	15.5	43.4	41.1	26.6	3.4
Guatemala	2014/2015 D	0.134	28.9	4,613	5,155	46.2	0.013	11.2	21.1	26.3	35.0	38.7	59.3	9.5
Haiti	2016/2017 D	0.200	41.3	4,464	4,747	48.4	0.019	18.5	21.8	18.5	24.6	57.0	58.5	29.2
Indonesia	2017 D	0.014 ^h	3.6 ^h	9,675 ^h	10,091 ^h	38.7 ^h	0.006 ^h	0.4 ^h	4.7 ^h	34.7 ^h	26.8 ^h	38.5 ^h	9.4	1.9
Kazakhstan	2015 M	0.002 st	0.5 st	82 st	91 st	35.6 st	.. ^e	0.0 st	1.8 st	90.4 st	31 st	6.4 st	5.2	0.0
Lao People's Democratic Republic	2017 M	0.108	23.1	1,619	1,744	47.0	0.016	9.6	21.2	21.5	39.7	38.8	18.3	7.1
Libya	2014 P	0.007	2.0	128	144	37.1	0.003	0.1	11.4	39.0	48.6	12.4	..	..
Maldives	2016/2017 D	0.003	0.8	4	4	34.4	.. ^e	0.0	4.8	80.7	15.1	4.2	5.4	0.0
Moldova (Republic of)	2012 M	0.004	0.9	33	29	37.4	.. ^e	0.1	3.7	9.2	42.4	48.4	31.1	0.0
Myanmar	2015/2016 D	0.176	38.3	19,731	20,597	45.9	0.015	13.8	21.9	18.5	32.3	49.2	24.8	2.0
Namibia	2013 D	0.185 ^t	40.9 ^t	921 ^t	1,181 ^t	45.2 ^t	0.013 ^t	13.1 ^t	19.2 ^t	31.6 ^t	13.9 ^t	54.4 ^t	17.4	15.6

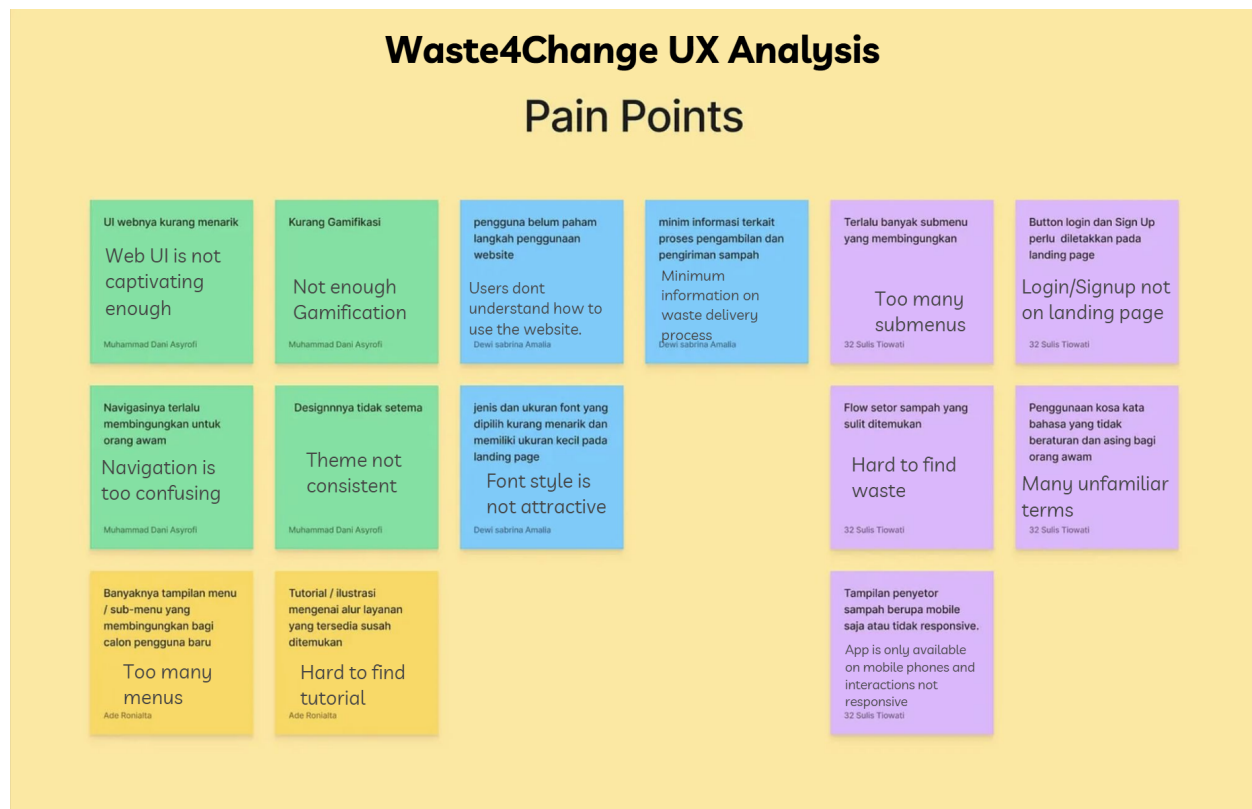
Appendix B - Interview Question Guide

The following questions were used to guide the semi-structured interviews with participants:

1. Who or where do you send your trash collection to?
2. Do you keep the trash over a period of time and then send it all at once? If so, how often and where do you store the trash?
3. How much money do you make from selling this trash?
4. Does your income fluctuate from time-to-time? Is it affected by your performance?
5. How much do you earn in a week and a month?
6. Do you have adequate access to a telephone, electricity, and the internet?
7. Have you ever used a digital recycling platform for recycling waste transactions?

Appendix C - Waste4Change UX Analysis Results

The following image shows the pain points identified from a UX Case Study on the Waste4Change App conducted by Medium.com:



Appendix D - EcoLinkID User Interface Mockup Design

The following images are conceptual designs intended to improve the platform's user friendliness through fully translatable pages in both the Indonesian and English Languages:

Jelajahi Material

All Items

Plastic

Paper

Glass

Metal

Electronics

Other

📍 Lokasi

Terbaru Dulu



Sepatu Karton Recyclable

Berbagai ukuran kotak kardus bersih, sempurna untuk penyimpanan atau pengiriman.

📍 Southeast Portland

📦 15 boxes

Minta Reservasi

Connect with recyclers in your area and make a positive impact on the environment.



Quick Links

Home

Browse

Post Recyclables

How It Works

About

EcoLinkID connects recyclers in Indonesia to build a sustainable future together.

Recycle together, one item at a time

Connect with recyclers in your area and make a positive impact on the environment

Post Recyclables

Browse Items

Ready to Start Recycling?

Create an account or login to view featured recyclables and start connecting with recyclers in your community.

Create Account

Login

How It Works

1

Post Materials

2

Connect & Arrange

3

Make an Impact

Behind the Facade of Prosperity: Understanding and Addressing Poverty in Singapore

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Abstract

Singapore ranks highly on the Human Development Index. Despite this, poverty remains a significant issue for many of its citizens. Approximately 3% of Singapore's population lives in absolute poverty, struggling to meet their basic needs. In addition, about 15% of Singaporeans experience relative poverty, unable to participate in social activities that most others can enjoy. Specific demographics are particularly affected. For example, a 2022 survey by the SMU Centre for Research on Successful Ageing, which polled 6,839 Singaporeans aged 57 to 76, showed a rise in the number of seniors expecting their financial situation to worsen, highlighting growing insecurity among older adults. In addition, among the 13,871 low-income families the Ministry of Social and Family Development (MSF) approached in December 2023, only 66% agreed to participate in ComLink+, reflecting the difficulty in engaging this demographic despite available support.

To address poverty, the Singapore government has introduced several initiatives to support these vulnerable groups. However, these schemes do not fully close the gaps, and many individuals still struggle to achieve financial stability or long-term progress. This leaves some individuals without a clear path out of poverty.

Poverty is a global issue, not just a local one. Inspired by innovations in science and technology, our proposed solution aims to complement current government policies by providing more personal, accessible, and empowering support. With further development, it could also be adapted for broader use beyond Singapore.

Keywords

Poverty alleviation, STEM solution, Mobile application, Gamification, Social inclusion

1.0 Introduction

1.1 Singapore's Economic Growth and the Persistence of Poverty

Singapore, which gained independence in 1965, has transformed from a humble fishing village to one of the most economically prosperous countries, ranking 4th globally in terms of nominal Gross Domestic Product (GDP) per capita. Globally, absolute poverty refers to the inability to meet basic needs such as food, shelter and clothing through one's financial resources. Absolute poverty is virtually non-existent in Singapore due to widespread access to these necessities. However, relative poverty, the lack of financial resources to attain a standard of living that allows full engagement in society, remains a perennial problem. Relative poverty persists due to several structural and social factors such as high cost of living, exclusion from the government's support programmes due to strict eligibility criteria and a lack of societal understanding of poverty, which further entrenches social exclusion.

1.2 Gaps in Global Poverty Measures for High-Income Countries

1.2.1 Why the Multidimensional Poverty Index (MPI) Falls Short in Singapore

The Multidimensional Poverty Index (MPI) assesses poverty by measuring deprivation across health, education, and standard of living. Its primary purpose is to capture the different aspects of poverty in developing countries [1]. Although Singapore classifies itself as a developing country under the World Trade Organisation framework for strategic reasons [2], its socioeconomic indicators, such as high GDP per capita and near-universal access to basic services, align more closely with developed nations. The MPI relies on weighted factors, such as access to electricity, clean water and basic education, which are already met across the population in Singapore. In developed countries, these basic deprivations have largely been resolved, with absolute poverty rates estimated between 3% and 7.44% [3, 4]. Hence, most developed countries would score similarly well on MPI indicators, resulting in limited variation. This reduces MPI's usefulness as a comparative or diagnostic tool in such contexts, including Singapore, where relative or hidden forms of poverty may be more pressing than the absolute deprivations the MPI captures.

1.2.2 Alternative Measures of Inequality and Relative Poverty

One commonly used measure of development is the Human Development Index (HDI). Like the MPI, this index also considers three dimensions: (health, education and standard of living). However, unlike the MPI, which focuses on deprivations, the HDI measures how well a country performs relative to a theoretical maximum in each dimension. This allows for more meaningful comparisons between developed countries. Despite its usefulness, HDI does not sufficiently account for various countries' diverse contexts. For example,

Singapore and Egypt have reported similar expected and mean years of schooling in 2023 for calculation in the HDI, of 16.7 and 13.1 expected years, respectively, and 12.0 and 10.1 mean years, respectively [5]. However, Singapore has a literacy rate of 97.5%, while Egypt has one of only 73.1% [6]. This discrepancy highlights HDI's limitation, where years of schooling do not necessarily directly correlate with actual education quality or literacy outcomes, which are more directly relevant to poverty and inequality. Hence, while the HDI offers a broad overview of development, it cannot be interpreted as a definitive indicator of poverty levels.

A more precise method of capturing inequality is the Gini Coefficient, which summarises income dispersion across an entire population [7]. A value of 0 represents perfect equality, while a value of 1 represents perfect inequality, providing an indicator of income inequality not addressed by the HDI and MPI.

In addition, relative poverty can be measured by the percentage of the population earning below 50% of the national median income, an approach used by the Organisation for Economic Co-operation and Development (OECD) [8]. This indicator is frequently cited in studies on Singapore [3,4] and helps identify individuals who, while not living in absolute poverty, may be excluded from full participation in society due to income gaps. This measurement should not be confused with an absolute poverty line, which defines the income required to meet basic needs such as food, shelter and clothing.

1.2.3 Comparing Singapore's Income Inequality and Relative Poverty with Global Peers

Singapore ranked 13th out of 193 countries in the 2023 HDI survey, with a score of 0.946 [5]. Although this indicates strong overall development, it does not mean that poverty has been eradicated. The HDI does not account for within-country inequalities or relative poverty. Therefore, alternative indicators must be considered.

Singapore's 2023 Gini Coefficient was 0.435 before government transfers and taxes and 0.364 after adjustments [9]. This placed Singapore 86th out of 163 countries, meaning income is still unevenly distributed even after support measures.

As shown in Figure 1, when comparing Singapore with the top 6 countries with the highest Gross National Income (GNI) per capita, with Singapore ranked 7th [10,11], where Singapore, Iceland, and Denmark had comparable GNI per capita, being \$70,590, \$79,840, and \$73,360, respectively, and GNI (PPP) of \$118,710, \$79,290, and \$79,390, respectively [11]. However, Singapore has a significantly higher Gini coefficient compared to Iceland's (0.261) and Denmark's (0.283), indicating that income is more unevenly distributed. This suggests that the GNI per capita alone does not fully represent wealth distribution across a population.

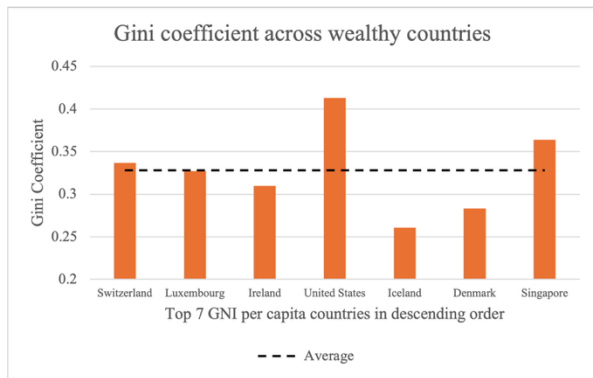


Figure 1: Gini Coefficient across the top 7 countries in terms of Gross National Income per capita [10,11].

As mentioned earlier, another indicator used by the OECD to measure relative poverty is the percentage of the population earning below 50% of the median household income. In 2024, Singapore's median household income per household member, including Central Provident Fund (CPF) contributions, was \$3,615 in resident-employed households, where the household reference person is a Singaporean or Permanent Resident, and there is at least one employed person [9]. Half of this value is S\$1807.50, which falls between the second (S\$1,722) and third (S\$2,340) income deciles [12]. Based on this, an estimated 21.61% of Singapore's population earns below 50% of the median income [12]. To account for tax and government transfers, we apply a 6.3 percentage point adjustment, referencing Hong Kong's adjustment adhering to OECD international standards [3,13] since Hong Kong has a similar economy and income distribution [3]. This results in a final approximate value of 15.31%, placing Singapore 50th out of 169 countries surveyed [14].

As shown in Figure 2, despite ranking 7th globally in GNI per capita, Singapore ranks 2nd highest among these nations in terms of relative poverty, trailing only the United States. In contrast, countries like Denmark (6.3%) and Iceland (7.2%) had much lower figures, ranking 22nd and 15th, respectively. Singapore's 15.3% is more than double these values. This suggests that relative poverty in Singapore is real and widespread, affecting people's ability to engage in everyday social life worry-free, such as leisure and dining out, or engaging in cultural activities.

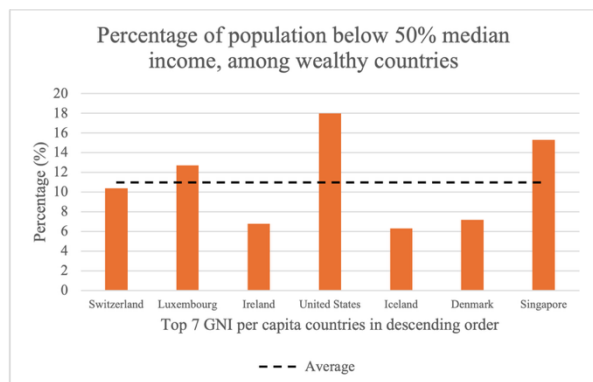


Figure 2: Percentage of population below 50% median income across the top 7 countries in terms of Gross National Income per capita [12,14].

When comparing Figures 1 and 2, consistent trends emerge. Countries like Iceland and Denmark consistently score low on both the Gini coefficient and the proportion of the

population earning below 50% of the median income, suggesting more equitable income distribution and lower relative poverty. Meanwhile, countries like Switzerland, Luxembourg and Ireland fall closer to the average in both measures. In contrast, the United States and Singapore have high scores on both metrics, indicating a correlation between the two methods of looking at relative poverty. Most importantly, a high GNI per capita does not suggest a country is free from relative poverty.

In conclusion, although Singapore does not appear prominently in global absolute poverty indexes like the MPI, substantial hidden relative poverty remains. These findings highlight the importance of adopting more locally context-sensitive indicators to understand and address poverty in Singapore.

2.0 Challenges Faced by Vulnerable Groups in Singapore

2.1 Low-Income Families

In Singapore, households are primarily categorised into high, medium and low-income groups. Although no official poverty line exists, eligibility criteria for government assistance typically define low-income households as having a per capita income between S\$500 and S\$3,000 [15]. Low-income families represent one of Singapore's largest and most significant vulnerable groups. According to recent data, 12% of households in Singapore do not have sufficient income to meet basic consumption needs, and 24% fall below the relative poverty threshold, meaning they lack the income needed to keep up with the norms of Singaporean society [16].

However, insufficient income is only one aspect of these families' numerous challenges. Many low-income individuals juggle multiple jobs to make ends meet. In September 2022, Manpower Minister Tan See Leng mentioned in Parliament that 53,200 Singaporeans held multiple jobs, with half earning below S\$1,500 per month from each job [17]. These individuals are often sole breadwinners, limiting their time to upskill, care for family members, expand social networks, or pursue opportunities for social mobility. More importantly, poverty not only constrains their own development but also weakens their ability to support their children's growth and development, perpetuating cycles of poverty across generations.

Despite a wide range of government programmes and subsidies, many low-income families remain underserved. For example, under the ComLink+ programme, only 26% of eligible children attended preschool regularly as of December 2023, reflecting the programme's limited reach. The lack of time often prevents families from navigating the complex application process. Moreover, unclear eligibility criteria and implicit policy assumptions, such as equating employment with housing security, may unintentionally exclude some vulnerable demographics from support. When individuals repeatedly encounter barriers to accessing help, despite appearing to meet the intent behind the eligibility criteria, it reinforces the belief that their efforts are futile.

Over time, this can give rise to a debilitating psychological condition known as learned helplessness.

Learned helplessness, first documented by Martin Seligman in the 1960s, is a mental state where individuals who have experienced repeated setbacks believe that they lack control over their circumstances, undermining the capacity to act to improve their situation. In the context of poverty, this occurs when individuals internalise their belief that no matter how hard they try, whether by applying for aid, seeking better jobs or upskilling, their situation will not improve [18]. As a result, they may disengage from opportunities that could otherwise improve their well-being. Learned helplessness not only impairs adult motivation but also negatively influences children who grow up in such environments. When children observe their families exhibiting helplessness, they may adopt a similar mindset, losing motivation in their academic and personal development, potentially becoming more likely to remain trapped in the cycle of poverty as they grow older.

Social stigma and exclusion further compound the difficulties faced by low-income families. A study by SMU found that 71.5% of Singaporeans believe poverty results from poor financial decisions, such as overspending [19]. This belief fosters the harmful perception that these vulnerable individuals are irresponsible or overly dependent on government support, reducing public empathy and deepening social divides, leading to emotional isolation and loneliness. For example, a study on elderly residents in public rental housing found that 30% experienced loneliness, significantly higher than the 6.4% reported among community-dwelling adults and 23% among those aged 60 and above [20], highlighting that social stigma can affect even those in the most basic housing that the government provides.

A key factor contributing to this misunderstanding is the invisibility of poverty in Singapore. With only an estimated 530 rough sleepers in 2022, visible homelessness is rare [21]. As a result, with poverty largely hidden, many Singaporeans may not come face-to-face with signs of deprivation, leading to the perception that poverty is not a pressing issue. This "out of sight, out of mind" mentality not only downplays the severity of poverty but also discourages efforts to advocate for more generous and inclusive policies. Shame and fear of discrimination also discourage low-income individuals from openly sharing their struggles, limiting their ability to build support networks and participate in community life, hence reinforcing their social exclusion.

2.2 Elderly Population

As of 2020, 1 in 6 Singaporeans was aged 65 and above. By 2030, this figure is expected to rise to 1 in 4 Singaporeans [22]. Despite this growing demographic, elderly Singaporeans continue to face a range of challenges that limit their economic independence and social inclusion. These challenges, such as declining health, workplace age discrimination and mental health struggles, contribute to systemic social exclusion.

One of the biggest concerns associated with ageing is poor health. As individuals grow older, their risk of chronic illnesses such as diabetes and heart disease, as well as

physical injuries, increases. According to the US National Diabetes Statistics Report, the prevalence of diabetes increases significantly with age. In 2024, the percentage of diabetics aged 18-44 was 4.8%, 18.9% for those aged 45-64 and 29.2% for those aged 65 and above. Chronic conditions reduce the quality of life and work productivity due to the extended time spent recovering. A 2018 MIT study showed that health problems can lead to a 20% drop in earnings and an 11% drop in employment among adults aged between 50 and 59. This loss of income, combined with rising medical expenses, can rapidly deplete savings, affecting financial stability. Consequently, elderly Singaporeans with poor health may be excluded from full economic and social participation in society.

Ageism or age discrimination is another challenge that elderly Singaporeans in the workforce face. Many employers assume older workers are less adaptable, technologically skilled or productive than younger employees [23]. As a result, they may prefer younger candidates, especially for roles that require digital skills. In 2023, 37.9% of job seekers aged 50 and above felt discriminated against because of their age, compared to only 12.2% of those below 50 [24]. Ageism in the workplace can manifest in various ways, such as overlooking older employees during interviews, excluding them from meetings, or even pressuring them to retire early. These experiences can undermine the dignity and confidence of older workers and prevent them from accessing fair and meaningful employment, further contributing to social and economic marginalisation.

Additionally, mental health challenges are also prevalent among the elderly. According to a study conducted by the Institute of Mental Health, approximately 5.5% of the elderly in Singapore experience depression. Loneliness is another serious concern. As the elderly outlive their spouses, siblings and friends and their children grow up and become preoccupied with their own families, they are left with smaller social circles. Such struggles are often not voiced, as they do not wish to burden their families. Over time, this emotional isolation can lead to self-neglect, loss of purpose, and disengagement from community life. This further reinforces social exclusion, where individuals are excluded from economic participation and communal support.

While the Singapore government has tried to address these challenges through schemes such as the Silver Support Scheme, gaps remain. Complex eligibility criteria and limited awareness contribute to lower take-up rates. In the case of ageism in the workforce, while laws in Singapore may protect older employees from being dismissed based on age, no laws prevent age-based discrimination in hiring and promotion. As a result, older job seekers remain vulnerable to unfair treatment even before they enter the workforce.

3.0 Policy Evaluation: Singapore's Strategies to Alleviate Poverty

3.1 Workfare Skills Support (Basic)

The Workfare Skills Support (WSS) scheme (Basic) was introduced by the Singapore government in July 2017 to enhance the career mobility of lower-wage workers by

equipping them with industry-relevant skills and recognised certifications. Its main goal is to empower individuals to lift themselves out of poverty through training and upskilling [25]. WSS (Basic) supports both employees and employers by offsetting costs and compensating for time spent on training. This reduces the financial burden on learners and lowers resistance from employers, making it easier for workers to enrol in courses. The scheme also incentivises trainees to complete and pass their enrolled courses, which encourages long-term self-improvement and progression, strengthening trainees' sense of autonomy and self-worth. The scheme's support for both employer-sponsored and self-sponsored training makes it more flexible and accessible to a wider range of workers. In 2023, the programme was enhanced. The income ceiling was raised to \$2,500 a month, and the maximum annual payout increased to \$4,200. As a result, 388,000 lower-wage workers received around S\$914 million in total disbursements. Additionally, trainees also experienced an average wage premium of 5.8% one year after training relative to a control group, indicating the scheme has had a measurable impact on earnings, highlighting the effectiveness of this initiative [26].

While WSS (Level-up) will be rolled out in 2026 to improve the policy, there are still limitations. The WSS scheme primarily benefits individuals with steady employment and a regular income history, overlooking those with unique circumstances of self-employment, such as those in the gig economy, making it difficult for such individuals to qualify for support. One way to make the scheme more inclusive would be to pilot a branch of WSS specifically for self-employed individuals or adjust the eligibility criteria to better reflect today's work patterns. Another issue is time. WSS (Basic) and WSS (Level-up) focus on medium to long-term training programmes, which may not be realistic for workers with caregiving responsibilities or working multiple jobs. A more supportive model similar to ComLink+ would be beneficial. The scheme could reach people currently left out by offering wraparound services such as counselling, financial coaching, childcare support, and training.

While the WSS scheme is already a well-established and effective policy, continued refinements will allow it to become an even more comprehensive solution for improving employment outcomes and further reducing employment inequality in Singapore.

3.2 ComLink+

ComLink+ is a support programme launched by the Ministry of Social and Family Development (MSF) in November 2023. It aims to improve social mobility for families living in rental flats, especially those with young children, by offering personalised services and encouraging stronger partnerships between government agencies, social workers and the community. The goal is to help low-income parents build financial security and provide their children with better access to early education [27]. Eligibility is based on both the family's financial situation and the educational needs of the children [28].

According to MSF, over 9,000 low-income families enrolled in ComLink+ have achieved greater stability since the programme began [29]. This scheme supports low-income families in multifaceted ways, for example, by helping them

secure stable employment and housing, improving their CPF savings and children's schooling. It also provides direct financial assistance, including debt repayment support and quarterly cash top-ups to incentivise employment. These features make ComLink+ more than just a short-term assistance scheme. It is designed to help individuals build a path towards long-term self-reliance.

However, ComLink+ has several limitations. For instance, the scheme heavily relies on volunteer coaches, who are in short supply. As of 2023, only 760 volunteer coaches were available to support 3500 families [30]. Many of these volunteers may not be formally trained in social work and thus may lack the necessary knowledge and skills to adequately support families' complex needs [31]. This shortage of trained support limits the outreach and the programme's quality. In addition, ComLink+ depends heavily on partner organisations to fund and deliver its support packages. These partners may have various levels of understanding, buy-in, and commitment, and because data is not always shared across organisations, programmes may be designed and executed based on their own knowledge base and assumptions of ComLink+ families, rather than actual family needs. This may lead to inefficiencies that could impact the programme's ability to provide equal support for families.

Another consideration is school attendance. In 2024, 74% of ComLink+ families did not send their children to school at least 75% of the time [32], suggesting that financial incentives alone may not suffice. Other factors beyond finances, such as caregiving responsibilities and logistical challenges, may introduce hurdles for parents prioritising their children's education.

There are several ways to strengthen ComLink+. Partnering with educational institutions to recruit more volunteers could help expand support. These volunteers should also be equipped with practical skills through a government-funded certification course. To strengthen understanding and collaboration across partners, a secure digital portal could be developed for information sharing and coordination. Additionally, developing and implementing Standardised Operating Procedures can ensure more consistent service delivery by partner organisations. Finally, trained staff can be deployed to identify why some families struggle with school attendance barriers and recommend tailored interventions accordingly.

Although the ComLink+ initiative is relatively new, its success in helping over half of its families achieve greater stability demonstrates its potential. With further refinements, ComLink+ has the potential to be a key pillar of Singapore's long-term strategy to reduce intergenerational poverty.

3.3 Silver Support Scheme

The Silver Support Scheme (SSS) was introduced in 2016 to provide additional income for elderly Singaporeans with low earnings during their working years and accumulated limited savings. The scheme targets the bottom 20% of seniors by offering quarterly cash payouts without requiring any application. Eligibility is automatically determined based on income levels and housing type, specifically senior citizens with low lifetime wages living in 1-to-5-room Housing

Development Board (HDB) flats. Since its launch, the SSS has supported over 290,000 seniors, helping to supplement their retirement income [33].

The impact of the SSS has been significant. Upon receiving the SSS cash payouts, beneficiaries increased their consumption, which had previously been suppressed due to financial constraints. On average, recipients spent 73% of the subsidy received, suggesting that the scheme effectively stimulates consumption for daily needs. Compared to earlier programmes that disbursed medical and health insurance vouchers, the SSS resulted in a greater post-payout increase in household expenditure, suggesting that direct cash assistance is more effective in improving the quality of life for seniors [34].

Nevertheless, the scheme still has its limitations. Despite high contribution rates to the CPF, many seniors receive relatively low monthly payouts. Individuals aged 65-69 received only \$350 per month, while those aged 70 and above received less than \$300 monthly. These amounts fall short of the estimated \$1,379 per month required for a basic standard of living in Singapore [35]. As a result, even with SSS payouts, many elderly continue to remain in relative poverty.

To address this issue, monthly cash payouts could be raised to between \$500 and \$600 monthly, providing recipients greater flexibility to meet essential living expenses. To fund this adjustment, the government could allocate an additional \$700 to \$800 million, a small fraction of the \$3.5 billion revenue generated after the Goods and Services Tax increase, without placing pressure on the national budget [36].

There are also shortcomings in the scheme's eligibility criteria. In particular, the inclusion of housing type as a key criterion means the flat's economic value, rather than the financial well-being of the applicant, is being considered. It assumes that owners of larger flats, such as 5-room units, are financially secure. However, many seniors purchased these homes decades ago at significantly lower prices and may now be asset-rich but income-poor. This assumption could unfairly exclude seniors who are in genuine need. A more accurate method could be to use lifetime CPF contribution history to measure financial vulnerability [37].

While the SSS can provide financial relief to low-income elderly, its current design limits its effectiveness. Revisions to both the payout amount and eligibility criteria are necessary to ensure more comprehensive support for vulnerable seniors in Singapore's ageing population.

4.0 Proposing a STEM-based Solution to Reduce Poverty

4.1 Gaps in Current Digital Support for Low-Income Families

A key challenge faced by low-income families in Singapore is the cycle of learned helplessness and social exclusion. These issues are exacerbated by a lack of time to pursue

improvement opportunities and low uptake of government aid, policies, and subsidies. While current programmes like ComLink+ and KidSTART offer financial incentives such as quarterly payouts and structured programmes, they do not help individuals build lasting motivation or address low self-efficacy.

For example, ComLink+ connects individuals to volunteer coaches and provides access to resources. However, it lacks features that allow users to meaningfully interact with community members on their own terms. It also lacks mechanisms to track personal and social development, making it harder for users to measure progress. Moreover, due to a shortage of volunteers, the programme's limited reach affects its ability to scale nationally. In December 2023, only 66% of the 13,871 low-income families approached by the MSF agreed to participate [32].

The LifeSG app, launched by the government in 2018, tries to consolidate nearly every government service into a website to streamline the process of finding government aid. Nevertheless, the volume of eligibility criteria and options may overwhelm users, especially those from a lower-income background. Without personalisation, families may not be aware of the relevance of the policies and subsidies shown. As such, we believe a new solution is required, targeting the vulnerable group, which is more personal, supportive and fuss-free to use.

4.2 Designing a Mobile App to Build Motivation and Connection

To overcome the limitations above, we designed a mobile app to reduce social exclusion, support mental health, and encourage personal growth through goal setting. It aims to address barriers such as the reluctance among low-income families to take up government aid, as well as the effects of learned helplessness and low self-esteem.

The 2023 Household Expenditure Survey showed that 99.1% of Singaporean households owned a mobile phone [38]. Hence, our application has the potential to reach a broad audience, including low-income individuals, thereby increasing its impact.

Our app is grounded in well-established psychological principles to support personal growth, resilience and emotional well-being. It incorporates Self-Determination Theory, which explores the innate human drive for curiosity, autonomy and motivation toward proactive action. Additionally, it leverages Operant Conditioning to reinforce behavioural patterns through consequences [39].

To further empower users in managing their thoughts and emotions, the app integrates progress journaling, a tool that helps declutter their minds, keep track of their growth and reinforce learning [40].

Our app uses event-driven programming to trigger rewards, such as growing a digital tree. Cloud-based systems efficiently manage and store user data, including progress, interactions and affirmations. Furthermore, cloud computing ensures scalability for handling large volumes of information across a diverse user base. As personal data is involved,

security is a top priority, with encryption, access control and authentication, safeguarding its confidentiality.

To optimise user engagement, the app leverages analytics and modelling. Gamification relies on mathematical models to compute reward distribution, leaderboard ranking and engagement metrics. Machine learning algorithms analyse user behaviour, optimising recommendations and creating personalised affirmations for motivation. Data visualisation tools help track and gain usage insights, so that algorithms can be adjusted to maximise user experience.

A core feature of our app is goal gamification. Users can set potential goals they aspire towards, each tagged with a difficulty level. As they progress, they gain points to grow their digital tree, offering a meaningful and visually engaging way to track personal development, while enhancing motivation and confidence.

Other key features include:

- A progress journal for self-reflection, emotional resilience and positive habit-building.
- Daily affirmations to build self-worth and reduce anxiety.
- Support circles to connect with others in the community and grow together.
- An anonymous success-sharing wall to inspire and motivate one another.
- A local bulletin board with recommended community events based on user preferences.
- A simplified hub for government aid and policies relevant to their goals with AI-driven personalisation.

Figure 3 shows a typical user engagement with the app.

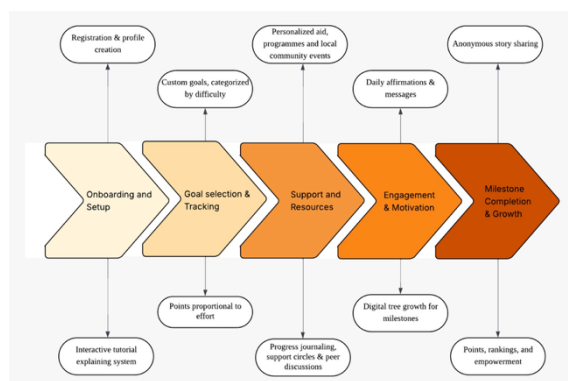


Figure 3: Engagement stages during use of our application.

By blending mental wellness, community connection and practical support, this app aims to offer a more holistic support path out of poverty. This app is also extensible to other vulnerable groups beyond those mentioned in this paper, for example, former convicts, people with disabilities, and single-parent families.

4.3 Anticipated Outcomes and User Benefits

Our solution is designed with convenience at its core, allowing users to access it anywhere, anytime. Even features like goal setting can function offline without an internet connection, ensuring seamless engagement. As users complete their goals, their tree grows and evolves, offering

customisation options that make progress feel tangible and rewarding. By associating goal completion with a fun and visually engaging experience, users break free from the cycle of learned helplessness and develop a sense of accomplishment.

Another key feature is daily affirmations, which have been shown to significantly boost self-esteem and life satisfaction, as demonstrated in a study on college students who received virtual daily affirmations through an application [41]. We aim for a similar positive impact, helping users build resilience and a growth mindset as they navigate their personal challenges.

To further enhance accessibility, our app integrates community and government initiatives to improve transparency and ease of access. Policy transparency refers to the availability and accessibility of information to the public. Research indicates that when policies become more transparent, awareness and impact increase [42]. Our app empowers users to make informed decisions and benefit from available support systems by streamlining access to resources.

4.4 Limitations of the Proposed Solutions

While our solution offers significant advantages, it also has limitations. One key challenge is that the app excludes individuals without access to smartphones. As highlighted earlier, although mobile phone ownership in Singapore is high, some individuals may still lack access. To support them, we propose deploying kiosks at community centres to serve this group of users.

Furthermore, while our app streamlines applications for support, it cannot fully address emotional readiness, which is crucial for long-term progress. Financial struggles profoundly impact mental well-being, with studies showing that greater economic hardship is linked to lower family resilience and diminished hope. Low-income families also face multiple intersecting challenges, including financial instability, poor health and severe time constraints.

MSF's 2024 report shows that families often struggle to sustain progress due to the "complexity and unpredictability of needs." [31]. These factors may undermine the key features of the app. Users experiencing severe emotional exhaustion may struggle to use the app regularly or stay engaged over time, making it difficult for them to set and pursue goals.

Moreover, our solution is not designed to address urgent crises or layered socio-economic hardships. During distress, individuals may prioritise survival over self-help, which could limit the app's overall effectiveness.

Lastly, our app does not provide direct human interaction and professional support, meaning users facing more serious emotional difficulties may require external assistance beyond what the app can provide.

5. Conclusion

Despite Singapore's reputation for effective poverty mitigation, significant challenges remain. While only 3% of residents face absolute poverty, an estimated 25% still reside in relative poverty. Compared to international standards, Singapore excels in virtually every category, yet it has not eliminated poverty.

The government has made commendable efforts to support vulnerable groups. Programmes such as Workfare Skills Support (Basic) aim to improve employability through upskilling, while ComLink+ provides guidance in areas such as employment, early childhood development, and long-term financial planning for households. The Silver Support Scheme also provides quarterly cash payouts to seniors who had low incomes during their working years and now have little or no family support. However, these initiatives face limitations, such as complex eligibility criteria, dependency on volunteers, limited personalisation and a lack of sustained long-term engagement.

Low-income families and the elderly continue to face significant hurdles not just financially, but socially and emotionally. Compounding these challenges are time constraints, worsening physical health stigma, lack of support networks and limited access to customised guidance. These factors contribute to learned helplessness, resulting in intergenerational poverty that is difficult to escape.

Our proposed app aims to narrow these gaps using STEM to offer these individuals more holistic and personalised support. It serves as a complementary tool for users to build confidence, stay motivated and better engage with the resources already available to them.

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Feeding the Future in Nashville: How Hydroponics Can End Food Insecurity

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Abstract

In 2023, 13.5% of the United States suffered from food insecurity, or the lack of accessible high-quality food to satisfy basic needs. High food prices represent the greatest barrier to meeting necessary nutritional requirements. The financial burden incurred by these prices precludes impoverished people from economic advancement. Hydroponics, a soilless method of agriculture, remedies this artificial scarcity of food by reducing tilling expenditure for industrial agriculture. By using nutrient-rich water, farmers can cultivate plants in any environment, tapering the cost of land development. While some hydroponic systems have already been created, they lack the economic feasibility needed to compete with existing agricultural practices. This research suggests that, to balance both economic viability and environmental sustainability, the federal government should adopt a job guarantee to construct hydroponic systems in the public sector. Not only would this legislation kick-start innovative methods of agriculture to eventually supplant traditional methods, but it would also add jobs in historically less agrarian regions. Moreover, it would guarantee both higher-paying employment and affordable food prices that can compete with those of the private sector, relieving economic instability.

Keywords:

Hydroponics, soilless, water-based, food insecurity, job guarantee

1. Introduction

Food insecurity is among the most pressing socioeconomic challenges facing millions of Americans each year. Defined by the U.S. Department of Agriculture (USDA) as “a household-level economic and social condition of limited or uncertain access to adequate food,” food insecurity often results in hunger—“a potential consequence... that, because of prolonged, involuntary lack of food, results in discomfort, illness, weakness, or pain” [1]. In 2023,

approximately 13.5% of U.S. households, or nearly 18 million families, experienced food insecurity—the highest level in almost a decade [2]. This trend has been steadily rising since the end of enhanced federal food aid programs implemented during the COVID-19 pandemic.

The root causes of food insecurity in the United States are largely economic. Low wages, high living costs, and structural poverty make nutritious food inaccessible for many families. According to the U.S. Census Bureau, the official poverty rate in 2023 was 11.1%, encompassing 36.8 million people [3]. However, this metric fails to fully capture the breadth of deprivation. Although the U.S. is not included in the global Multidimensional Poverty Index (MPI) due to methodological concerns, similar tools such as the Multidimensional Deprivation Index, derived from the American Community Survey, reveal that nearly 13% of U.S. adults suffer from multiple, overlapping forms of deprivation—including poor health, lack of education, inadequate housing, and economic insecurity [4].

A variety of structural issues further contribute to food scarcity in the U.S. These concerns include shifts in land use due to industrial agriculture and urban development, which have reduced arable land for local crops [5]. Rising food prices, exacerbated by inflation, labor shortages, and the high cost of land and machinery, put nutritious foods out of reach for low-income households [5]. Moreover, supply chain inefficiencies—exposed during the COVID-19 crisis—have caused food distribution delays and increased waste [6].

Furthermore, food insecurity follows distinct geographic and demographic patterns. Vulnerable populations—particularly Black and Hispanic households, single-parent families, and children—face disproportionately high rates of food insecurity [7]. In the Nashville area, 12.4% of people are affected by food insecurity, but rates rise to nearly 20% among children and Black and Hispanic populations [8]. Additionally, “food deserts”—areas with limited access to affordable, nutritious food—are common in both rural regions and urban low-income neighborhoods, further intensifying the crisis [9].

To tackle these issues, grassroots organizations around the world are stepping up in meaningful ways. For example, The Nashville Food Project, in our hometown, grows fresh fruit and vegetables across the city and prepares nutritious meals so that our community is healthier. Per Allison Thayer, director of Community Engagement at TNFP, “Nashville needs us, and people are excited to help. Food insecurity is one of the biggest problems around the world, and we are working together with local organizations like churches and food banks to make a real difference” (A. Thayer, personal communication, 29 May 2025). Another impactful non-profit is Elijah's Heart in East Nashville. As Papa Joe, founder and director of Elijah's Heart, puts it “Our mission is to assist underserved children and their

families with a primary focus of hunger relief" [10]. We've had the privilege of volunteering with Elijah's Heart, helping pack food and participating in the Walk of Love, where we hand-deliver food bags to families in need within our community. Organizations like these two are vital to the well-being of our neighbors but even their work has limits. For this reason, we felt inspired to find new ways to tackle this problem on a larger scale – to try to solve hunger once and for all.

To address this issue of food insecurity, this paper proposes a federal job guarantee program centered on hydroponics, a highly efficient form of agriculture that does not require soil. By examining the potential of hydroponic systems to reduce costs, maximize land and water use, and decentralize food access, we argue for a publicly funded, environmentally sustainable approach to ending hunger in the United States.

2. Our Investigation Process

Before we dive into the results of our research, we would like to briefly describe the scope of our findings and the methods we used to reach them. In terms of scope, hydroponics is the perfect solution as it revolves around creating a controlled environment not only to maximize growth, but also to minimize, if not completely eliminate, the problems stemming from meteorological variations. Therefore, the changes that we will describe can be employed anywhere across the country, regardless of the land, climate, or any other geological characteristic. Moreover, in addition to reviewing countless other research papers and online sources, we also took the time to meet with local companies here in Nashville that share our passion for solving food insecurity. These include Greener Roots Farm LLC, a longstanding hydroponics operation run by William Crenshaw, Elijah's Heart, an organization dedicated to assisting the underserved members of our community, and The Nashville Food Project, a non-profit organization "with the goals of cultivating community and alleviating hunger in our city" [11]. We have then provided our own analysis of the data, weighing the pros and the cons of hydroponics to justify the plan that we have proposed.

3. What is Hydroponics?

Hydroponics is the cultivation of plants in nutrient-enriched water, with or without the mechanical support of an inert medium such as sand, gravel, or perlite [12]. Unlike traditional agriculture which depends on arable land and the perfect climate conditions, hydroponic farming enables efficient food production in any environment from hot

deserts to air conditioned rooms. By optimizing variables like space and water usage, hydroponics systems can produce yields more efficiently and consistently [13].

3.1 History of Hydroponics

The earliest known use of hydroponic techniques dates back to ancient civilizations with the Aztec chinampas and the Hanging Gardens of Babylon being notable examples. However, hydroponics gained widespread recognition in the 1920s when Dr. William F. Gericke of UC Berkeley successfully scaled laboratory experiments in plant nutrition for commercial agriculture [14]. He coined the term "hydroponics," derived from the Greek words *hydro* (water) and *ponos* (labor), meaning "water working." His work laid the foundation for modern soilless cultivation systems.

3.2 Scientific Principles of Hydroponic Cultivation

All hydroponic systems share three core elements: water, nutrients, and oxygen. In the absence of soil, water becomes the primary delivery medium for macro- and micronutrients like nitrogen, phosphorus, potassium, magnesium, and iron [15]. Precision control over nutrient concentration and water pH allows for optimal growth conditions tailored to specific crops [16]. Oxygenation is another critical factor. Plant roots require oxygen to perform cellular respiration, which is why hydroponic systems often use air pumps, diffusers, or misting techniques to ensure adequate aeration [17]. Light, usually in the form of full-spectrum LEDs in indoor systems, is also tightly regulated to support photosynthesis year-round [18]. Electrical conductivity (EC) and pH meters are used to monitor nutrient balance and ensure system health [19].

3.3 Main Types of Hydroponic Systems

1. Wick System

The wick system is the simplest form of hydroponics, ideal for beginners. It employs a passive mechanism where a wick draws nutrient-rich water from a reservoir to the plant roots through capillary action. This system requires no pumps or electricity, making it low-cost, easy to maintain and space efficient. However, it is best suited for small, non-fruiting plants as it has limited nutrient delivery capacity [20].

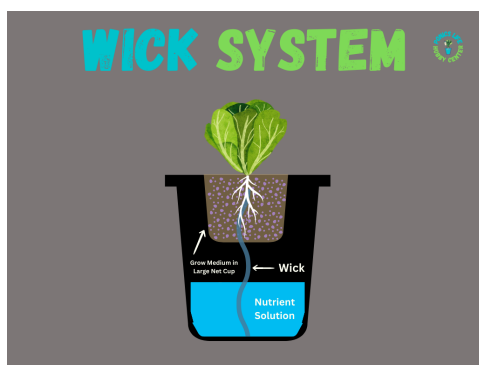


Fig. 1. Diagram of a Wick System

2. Deep Water Culture (DWC)

In DWC systems, plant roots are suspended deep in a nutrient-rich, oxygenated water solution 24/7. Air pumps provide continuous oxygen to the roots, promoting rapid growth. This method is efficient and relatively easy to set up, making it popular among both beginners and experienced growers [21].

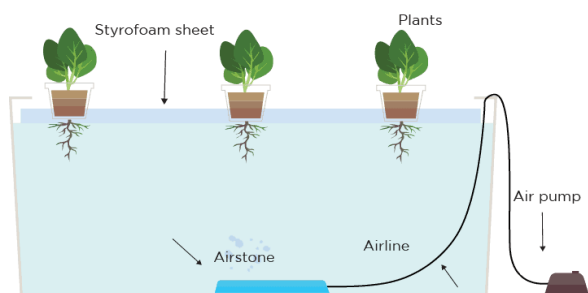


Fig. 2. Diagram of a Deep Water Culture system

3. Ebb and Flow System

This system periodically floods the plant roots with nutrient solution and then drains it back into the reservoir. The cycle provides plants with nutrients and oxygen efficiently by using air and water pumps hooked up to a timer. An Ebb and Flow system is perhaps one of the most popular methods for hydroponic gardening, because it requires little labor, gives excellent results and provides an ideal environment for roots to thrive [22].

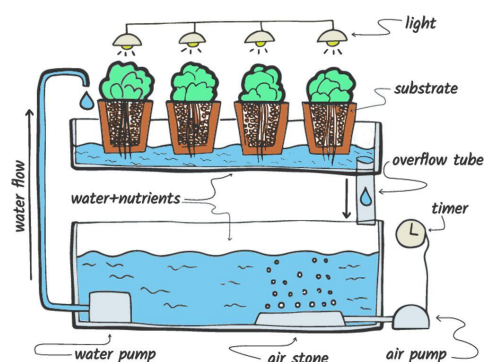


Fig. 3. Diagram of an Ebb and Flow System

4. Drip Systems

The drip system delivers nutrient solution directly to the top of each plant through a network of tubes and drip emitters. It is highly customizable and suitable for various plant types, including larger and fruiting plants. Drip systems can be set up as recirculating or non-recirculating, depending on whether excess solution is reused [23].

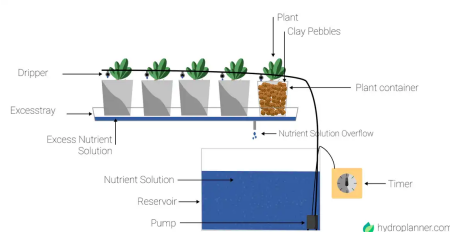


Fig. 4. Diagram of a Drip System

5. Nutrient Film Technique (NFT)

The NFT is a hydroponic technique in which the plants stand in a shallow stream of water containing all the dissolved nutrients necessary for plant growth. This water flow is circulated through growth tanks containing the roots of the plants. The plants absorb the nutrients through the roots, and because the stream is shallow and the roots are also suspended in the air, the roots can also absorb oxygen. NFT is efficient and conserves water but requires precise setup and monitoring to prevent system failures. NFT is very good for vertical farming as well, an "agricultural technique in which crops are grown indoors in vertical, stacked layers with no soil" [24, 25].

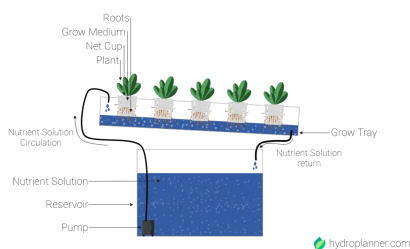


Fig 5. Diagram of a Nutrient Film Technique system

6. Aeroponic System

Aeroponic systems suspend plant roots in the air and mist them with a nutrient-rich solution. This method allows for maximum oxygen exposure and efficient nutrient absorption, leading to rapid plant growth. While highly effective, aeroponics requires precise control and maintenance, making it more suitable for advanced growers [26].

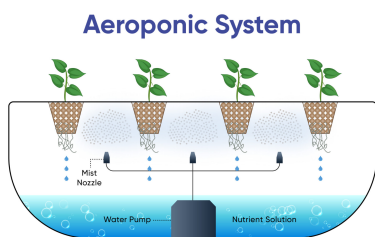


Fig 6. Diagram of an Aeroponic system

Table 1: The following table summarizes the differences between Nutrient Film Technique systems and Deep Water culture systems

<u>Nutrient Film Technique (NFT)</u>	<u>Deep Water Culture (DWP)</u>
Definition: A hydroponic method where a thin film of nutrient-rich water flows continuously over plant roots, which are suspended in a shallow channel.	Definition: A system where plant roots are submerged directly into a deep, oxygenated nutrient solution.
Cost to build: \$200-250 USD	Cost to build: \$100 USD or less

Benefits: - Very efficient use of water and nutrients - Ideal for fast-growing, leafy greens - Great for vertical farming or space-constrained environments	Benefits: - Easy and inexpensive to set up - High oxygen levels promote fast plant growth - Low maintenance
Drawbacks: - Requires constant monitoring and electricity (pump failure can kill plants quickly) - Not ideal for large or heavy fruiting plants	Drawbacks: - Limited to smaller-scale systems - Water temperature and oxygen levels must be carefully controlled

4. Why Hydroponics?

Perhaps the most evident benefits of hydroponics systems is their soil-less nature. It is often difficult to find optimal soil conditions, especially when it varies by region. The variation in soil texture, mineral content, and wetness leads to a wide variation in plant output. Soil degradation is a big problem specifically in the Midwestern United States, where soil has been found to be eroded at a rate 10 to 1000 times faster than it forms [15]. Hydroponics eliminates any need to worry about soil quality or quantity, allowing more control and better predictions as to plant growth. Soil-less agriculture also eliminates the risk of soil-borne pests, diseases, and weeds, allowing plants to mature faster and with higher quality (i.e., optimal flavor and nutrition) than field-grown plants [27]. The lack of soil also allows plants not to be washed and removes the need to use pesticides or herbicides, which often leads customers to trust and buy the produce more readily, increasing food security [28].

Similar to regional differences in soil, hydroponics systems are independent from climate and extreme weather. Most are situated indoors or in covered areas; the effects of rainfall, wind, and other environmental phenomena are negligible when compared to traditional agriculture [29]. Growers can set ideal temperatures, humidity, and light for ideal growth — including during the winter and droughts. While plants grown in soil typically have a non-negotiable growth schedule, hydroponics allows flexibility and the opportunity for multiple harvests throughout the year, regardless of the season — in turn, increasing the potential yield [28].

As noted above, among the greatest advantages of hydroponics systems is the ability to precisely control nutrient quantities [27]. Traditional soil varies by region in nutrient content, with factors such as distance from buildings, factories, railroads, and water sources impacting nutrient content [30]. Hydroponics, on the other hand, allows for the nutrients to be monitored and controlled precisely. Plants require 17 main nutrients, which can be sorted into macronutrients and micronutrients. Table 2 summarizes this data.

Table 2. Summary of the nutrients required by plants and their relative percentages by dry weight. Data from PennState Extension [31]

Nutrient	Percent Dry Weight
Carbon	90+ %
Hydrogen	
Oxygen	
Nitrogen	2-4 %
Sulfur	0.50 %
Phosphorus	0.40 %
Potassium	2.00 %
Calcium	1.50 %
Magnesium	0.40 %
Manganese	0.02 %
Iron	0.02 %
Molybdenum	0.00 %
Copper	0.00 %
Zinc	0.00 %
Boron	0.01 %
Chlorine	0.1-2.00 %
Nickel	0.000005-0.0005 %

In a hydroponics system, each quantity shown in the chart can be adjusted as necessary for optimal plant growth. By controlling these conditions, crops can grow up to 50% faster than those grown in soil according to Resh, 2022 [32]. Moreover, plants grown in these systems have been found not only to match nutrition levels of other methods (such as total soluble solids and sugar levels), but in some cases, levels of antioxidants lycopene and β -carotene—which are beneficial to human health—have been higher [33].

Reduced water usage is another advantage [27]. All plants require water to grow. In traditional agriculture, much water is required to catalyze growth in the large fields of plants. Hydroponic farms can achieve 80-90% less water usage than soil farming while often producing 11 times the yield of their soil-based counterparts [34]. Nutrient-rich water may also be reused more readily in hydroponics systems, allowing them to operate more efficiently than other practices. The ability to reuse water also contributes to a smaller environmental footprint [27].

Hydroponics also maximizes the ratio of crop yield to land use. The multi-tier vertical stacking method allows plants to be grown in only ~10% of the land as in traditional soil-based agriculture [28]. Instead of stretching out acreage horizontally, stacking more layers of plants multiplies output. Due to their soilless nature, hydroponics also allows plants to be cultivated on rooftops or indoors [29]; the addition of these locations allows plants to be grown in a wider area. This increased area, combined with greater crop yields, results in an immensely larger potential output.

Not only are hydroponics systems the most space-efficient method of growing crops, they can be created and scaled at a fast rate. Rapid modular deployment refers to any structure that is standardized, predesigned, and can quickly be built in any location [35]. Companies such as AgriLED in South Africa have created standardized shipping containers in which plants grow via hydroponic systems. These containers can be driven to communities in need of food—especially during crises—while the plants are growing and deployed to feed individuals and grow more plants [36]. Traditional soil-based agriculture requires thorough preparation of land that often takes months, and a simple climate shift can render the plot useless. Hydroponics is a safer method that not only can replace soiled fields permanently but can also be utilized as a quick method to reverse hunger crises in any location.

Modern technology has also made hydroponics more reliable than soil-based techniques. Unlike the sun, which can be unpredictable at times, grow lights offer the ability to change light spectrum to optimize photosynthesis in plants. An arduino controller, which can process inputs

(like sensors) and control outputs such as water level, moisture, temperature, pH, etc., allows easy customization of conditions for plants to grow most efficiently. All data can be transferred instantaneously via the Internet of Things (IoT), which refers to a network of physical devices connected to the internet that can collect, share, and act on data without requiring direct human input, including sensors, controllers, and smart appliances. IoT allows for remote monitoring, meaning that farmers do not need to constantly check acres of land. Instead, they can use a cloud-based system to monitor and adjust conditions for ideal plant growth [37]. Fig 1 is an example of a hydroponics system integrated with the Internet of Things.

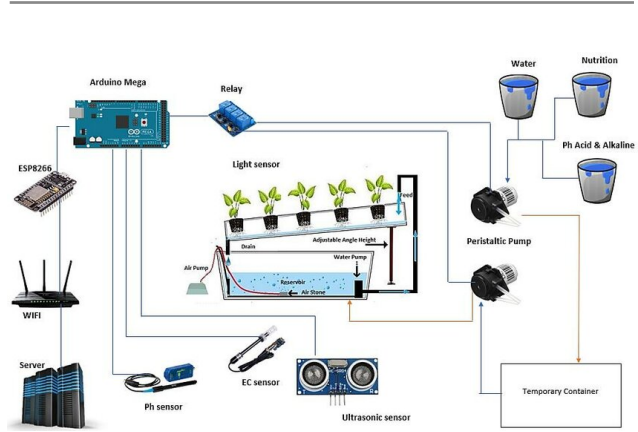


Fig. 7. Diagram of the Internet of Things

5. Potential Drawbacks and Mitigations

Nevertheless, it is important to address the potential drawbacks to replacing traditional agriculture with hydroponics. A commonly cited issue is the technical expertise required for workers as they are tasked with maintaining a multitude of conditions to keep the environment ideal for growth. These include the water quality (pH and nutrients levels), temperature, lighting, and more. However, this problem is overstated as evidenced by William Crenshaw. In his own words, "most job skills can be taught on that job," and their training burden is lightened by making them "task-oriented." No degree or outside education is necessary at all. This flexibility allows the underprivileged to work these jobs as well.

Additionally, not all plants respond well. Hydroponics systems are mainly suited for vegetables, fruits, and herbs. Tubers, grains, and other deep-rooted staples (potatoes, onions, carrots, etc.) are impractical or untested [38]. Although this challenge has led hydroponics operations to restrict their produce variety, the benefits that we mentioned earlier are not only present, but maximized.

Furthermore, the concern about limited crop variety in traditional agriculture regarding nutrient depletion does not apply to hydroponics because it is not limited to the amount available in the soil.

Finally, the main problem is the cost, especially when traditional soil-based agriculture is the principal income source in a community and has been well-established for years. Initial capital expenses (infrastructure, equipment, etc.) are higher than for field farms [39]. Operating costs, such as electricity for lights and climate control, are also expensive, especially given their perpetual use. "Yearly maintenance can make up 5-10% of set up costs", and "energy used for artificial lighting in hydroponic systems can account for as much as 60% of overall energy use" [32, 40]. Moreover, power cuts that cause water pumps and sprays to fail can dry out roots and kill plants. Our plan addresses these economic concerns by providing federal subsidies directly to the companies, and they will be paid for by redistributing government funds and increasing taxes. However, existing hydroponics operations also demonstrate that additional funding is unnecessary. Take the following data from Greener Roots Farms for example which compares the yields and electricity costs of their greenhouse and vertical farms:

Table 3. Costs and yields data from 2024-2025 for Greener Roots Farm LLC. Data from an Interview with William Crenshaw on 21 April, 2025

	Electricity costs (October 2024 - March 2025)	Yields (January - December 2024)
Greenhouse	\$14,972	25,000 lbs of leafy greens
Vertical Farms	\$26,385	30,000 lbs of leafy greens 10,000 lbs of herbs 10,000 lbs of microgreens and edible herbs

As shown, to make up for the extra electricity costs, Greener Roots Farm not only grows leafy greens in their vertical farms, but also herbs and microgreens which are especially profitable because they take up less space and sell for more per pound. Smart business decisions like this one enable hydroponic operations to stay in business and expand their operations.

6. Weighing and Evaluating Arguments

Implementing a public-sector hydroponics initiative alongside a federal job guarantee offers a compelling, multi-dimensional solution to interlocking crises: food insecurity, economic inequality, and environmental degradation. While such a policy necessarily involves trade-offs—between short-term cost and long-term benefit, government coordination and private innovation, and environmental goals and economic feasibility—the job guarantee amplifies the proposal’s strengths and mitigates many of its potential weaknesses. The labor program is the mechanism that transforms this policy from a niche agricultural intervention into a transformative public good.

6.1 Short-Term Costs vs. Long-Term Gain

Launching a national hydroponics initiative with guaranteed public employment would require substantial up-front investment. Costs include land acquisition, infrastructure development, and training programs to equip workers with skills in controlled-environment agriculture [41]. Some people may view these costs as prohibitive, particularly when compared to less labor-intensive private sector models.

The job guarantee, however, reframes this trade-off. Rather than viewing labor as an expense, it becomes a productive asset: it is used not only to grow food, but to build economic capacity and community resilience. Job guarantee programs are inherently counter-cyclical: they reduce unemployment during downturns and ease inflationary pressures during booms by absorbing or releasing labor as needed [42]. When attached to a green industry like hydroponics, the job guarantee promotes both immediate employment and long-term economic stabilization. Moreover, investing in human capital yields compounding returns over time, through increased productivity, reduced crime, better health outcomes, and lower reliance on welfare programs [43].

In this context, the job guarantee does not just justify the initial costs of hydroponic expansion, it helps recoup them. By situating food production where it is most needed and ensuring stable incomes in marginalized areas, the job guarantee turns public spending into a virtuous cycle of demand-driven growth.

6.2 Government Efficiency vs. Private Innovation

One potential drawback with public-sector employment is a lack of the agility and innovative edge found in private firms, particularly in fields requiring constant technological refinement like vertical farming. Private companies such as

Bowery and Plenty have indeed led in automation and AI-driven cultivation [44]. The job guarantee, however, enhances, rather than hinders, innovation: by supplying a trained, stable labor force that private firms often lack and by allowing experimentation without the pressure of profit maximization.

Government programs excel in setting long-term priorities and investing in public goods, such as food security and climate resilience, that markets routinely undervalue. A public hydroponics workforce could pilot novel agricultural methods, monitor sustainability metrics, and share findings across a national network of sites. Moreover, local facilities funded under a job guarantee framework could partner with universities, nonprofits, and private vendors, creating hybrid models that combine public oversight with private technical expertise [45].

Critically, the job guarantee ensures inclusion in innovation. Whereas private firms may consolidate in wealthier regions or automate away low-skill positions, a job guarantee program mandates job creation in underserved communities. It democratizes access to the benefits of agricultural technology while embedding innovation within a broader social mission.

6.3 Environmental Benefits vs. Economic Constraints

Hydroponic farming is one of the most promising tools for sustainable agriculture. It reduces land degradation, pesticide runoff, and water usage by as much as 70-90% [46]. Yet its environmental potential is not automatically realized; systems require electricity for lighting and climate control, and their footprint can be high if powered by fossil fuels [47].

The job guarantee, therefore, is again crucial to strike this balance. A publicly-employed workforce can be tasked with ensuring that hydroponic systems are not just operational, but sustainable. Workers could maintain solar panels, manage closed-loop nutrient systems, monitor carbon outputs, and retrofit systems as technologies improve. In private settings, many of these tasks are minimized or deferred due to cost. In a public system guided by ecological stewardship, they can be prioritized, turning sustainability from a budget constraint into a job description.

Furthermore, the environmental benefits yield economic gains over time. Resilience to droughts and supply chain disruptions reduces long-term food prices. Fewer agricultural emissions and pollutants lower public health costs. Because hydroponics can be located anywhere, including urban centers and climate-stressed regions, the system decentralizes risk and increases food system redundancy [48].

Thus, while hydroponic systems may be more expensive initially, their integration into a job-guaranteed public infrastructure ensures that the environmental benefits are fully realized, equitably distributed, and economically justified.

7. Conclusion

The persistence of poverty in the United States is not simply a question of income; it reflects intersecting deficiencies in access to nutrition, education, housing, employment, and environmental security. In 2023, 11.1% of the population, more than 36 million people, lived in poverty, while nearly 18 million households experienced food insecurity, the highest level in a decade [49]. Traditional antipoverty tools have proven insufficient on their own, and expanded COVID-era benefits have expired without systemic replacement. As policymakers search for lasting solutions, one clear conclusion emerges: food insecurity is both a symptom and a driver of multidimensional poverty, and must be addressed as part of any serious antipoverty strategy.

This paper proposes a federal job guarantee to construct, operate, and maintain hydroponic food infrastructure as a targeted response to poverty. Rather than treating food insecurity as an isolated outcome, this solution recognizes it as interconnected with employment, housing, education, and environmental justice. By deploying a labor-based, environmentally-sustainable solution to food insecurity, the proposal directly confronts overlapping forms of deprivation with a single, scalable intervention.

7.1 Policy Proposal: A Job Guarantee for Hydroponic Infrastructure

At its core, this proposal introduces a federal job guarantee that employs individuals from economically distressed areas to develop and manage hydroponic farms. These farms would be publicly owned, community-centered, and embedded in areas with high levels of food insecurity.

Hydroponics offers several advantages particularly suited to these communities. Systems can be built indoors or vertically, reducing land dependency, which represents a key barrier in urban and gentrified spaces. They require 90% less water than conventional farming [17], and yield clean produce without pesticides or herbicides. With year-round productivity and location flexibility, hydroponics enables localized food production where it is needed most, even in rural “food deserts,” or dense cities where grocery options are limited.

The job guarantee would ensure that the construction and operation of these systems create meaningful, accessible

employment, rather than automating away local jobs or concentrating control in the hands of large agriculture firms. Workers would receive not only wages but also education and training, with federal funding supporting certifications in hydroponic system management, sustainability practices, and food logistics. Community colleges and land-grant universities could partner as educational anchors, offering pipelines into long-term employment.

Importantly, these jobs address more than food production. They are infrastructure jobs for the 21st century, comparable to those in renewable energy, public transit, and clean water. These sectors simultaneously create employment, serve basic needs, and decarbonize the economy.

7.2 Implementation Strategy

The program would begin with pilot projects in regions identified by high rates of food insecurity and multidimensional deprivation, areas where more than one basic need (such as food, housing, or economic security) is unmet. Initial funding could come from a combination of federal appropriations (via the USDA and Department of Labor), climate resilience funds, and potential partnerships with philanthropic foundations or local governments. These pilot sites—such as parts of rural Tennessee, for example—generate replicable models for job creation, sustainable food production, and cost-effective delivery of public services.

Metrics for success would include job creation rates, food price reductions in targeted areas, nutritional access improvements, and environmental performance (e.g., water saved, carbon emissions reduced). Crucially, poverty reduction would be assessed not just by income, but by deprivations removed, a multidimensional index that tracks whether households gain access to basic food, work, and environmental quality.

7.3 Global Relevance: Food Justice as Climate Justice

Globally, climate change is making conventional agriculture less reliable, threatening food security in both the Global South and industrialized nations. This proposal supports Sustainable Development Goal 2 (Zero Hunger) by promoting a model of food production that is not only resilient and localized, but also employment-generating and climate-aligned [47]. Hydroponics is already being used in nations like India, where urban and semi-urban systems are supplying both food and livelihoods in resource-constrained environments. A U.S.-led public

hydroponics strategy, built on equity and sustainability, could provide a framework for international adoption.

7.4 A Long-Term Vision

In the long term, this policy imagines a decentralized, democratized food system—one where communities control the means of food production, and food is treated as a public good, not just a commodity. A job guarantee linked to hydroponics represents more than a solution to hunger; it is a structural strategy to break the cycle of poverty by creating dignified employment, addressing overlapping deprivations, and building community resilience.

Poverty in the U.S. is not due to lack of resources: it is a crisis of distribution, exclusion, and political will. A public hydroponics program tied to guaranteed employment offers a rare opportunity to address all three. It is a vision not just of feeding the poor, but of eliminating poverty itself.

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Poverty in Germany: Situation, Political Policies and our STEM-Solution

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Keywords

risk of poverty, vulnerable groups, social exclusion, national policies, STEM-based solution: AIDLink

Abstract

Our research focuses on identifying poverty in Germany, evaluating three implemented policies, and proposing a STEM-based solution.

Germany is not listed in the global Multidimensional Poverty Index (MPI) due to its economic strength. However, relative poverty exists in Germany. Over 16.7 percent of the population was at risk of living in poverty in 2022. The EU convention states that having less than 60 percent of the median-equivalized income of the population represents the threshold for poverty risk. In terms of earnings, this means having more than 1,189 euros per month to be above the poverty threshold.

Germany has adopted various measures to combat poverty, particularly social security reforms, minimum wage regulations, and family benefits. However, the poverty index remains nearly unchanged. Rising rental costs have disproportionately affected low-income households, increasing financial strain and contributing to social exclusion. This situation requires targeted policies that promote economic support, educational equity, and inclusive social programs.

To combat poverty through a STEM-based solution, we propose a mobile application that provides direct assistance and financial support. The app provides two key functionalities. First, an AI-powered matching system connects individuals-in-need with volunteers or organizations offering relevant support. Second, a donation feature allows users to contribute a percentage of their shopping expenses to those in need. Thus, the app aims to enhance social inclusion.

Introduction

Germany is often seen as one of the wealthiest and most stable countries in the world. With a strong economy, an extensive welfare system, and a high standard of living, many assume that poverty would be a marginal issue. However, when we take a closer look, it becomes clear that the risk of poverty is still a very real and persistent problem affecting millions of people across different demographics.

In this section, we examine Germany's poverty status and delve deeper into the challenges faced by vulnerable groups within the country. Our goal is to identify the risk of poverty and vulnerable groups who are being left behind—and why.

Subject Matter Expert

We are pleased that we could secure **Muhterem Aras** as our subject matter expert. She is a well-known politician in the state of Baden-Württemberg and the president of the state parliament in Stuttgart. She built her career from scratch through unmatched determination and skill after she migrated to Germany from Turkey by car as one of 4 siblings at age 12 with her parents. She graduated in economics and went on to become a tax consultant. She has been active in politics since 1999. In 2016, she was elected as state president of Baden-Württemberg, where she held the position as the first female member of the ecological party Die Grünen (the Greens) in Germany as well as the first woman in this office in Baden-Württemberg.

Germanys Poverty Status

Germany is not included in the global Multidimensional Poverty Index (MPI) developed by the Oxford Poverty and Human Development Initiative (OPHI), which focusses on developing countries.

In Germany we have a relative poverty: over 16.7 percent of the citizens were at risk of living in relative poverty in 2022. The EU convention has stated that having less than 60 percent of the median-equivalized income of the population represents the threshold of poverty risk. In terms of earnings, this figure relates to have more than 1,189 euros per month in order to be over the poverty threshold (see 0).

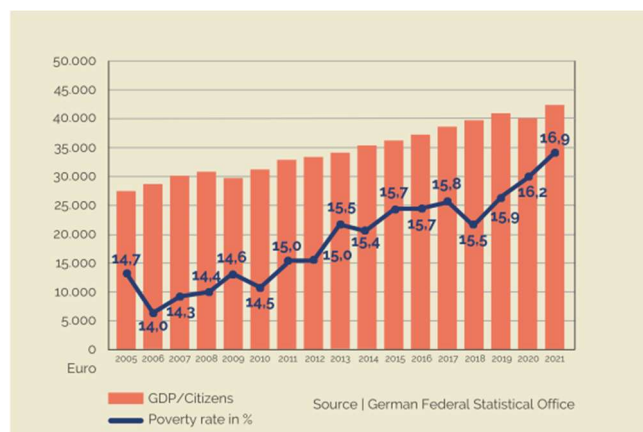


Figure 1: Risk of poverty rate in Germany.

Vulnerable Groups

Vulnerable groups in Germany face challenges: Despite an extensive social security network, certain groups in Germany are much more likely to experience poverty and social exclusion. Let's take a closer look at single parents, elderly individuals, long-term unemployed, and migrants and refugees.

Single Parents

Single-parent households, where the majority are led by women, are one of the most vulnerable groups in Germany (see 0).

Around 41% of single parents are at risk of poverty compared to only about 16% of households with two parents. Balancing work and childcare is often extremely difficult.

Many single parents work part-time jobs due to childcare responsibilities, which results in lower income and fewer career opportunities.

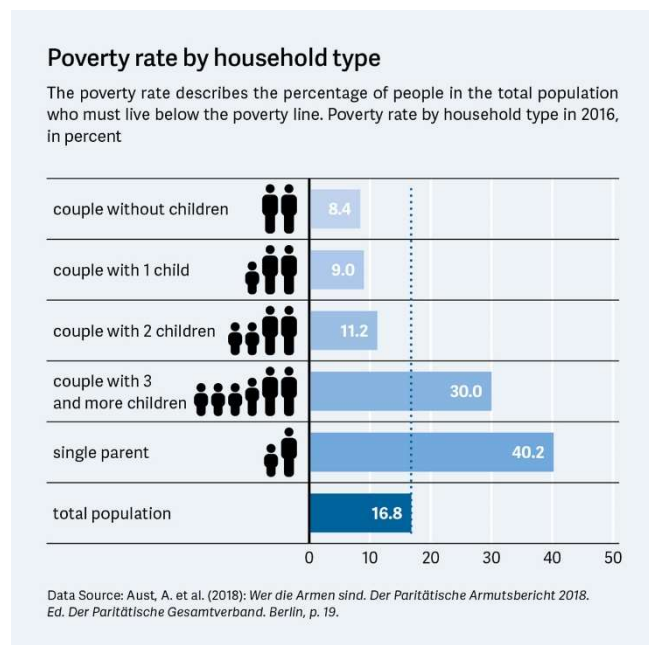


Figure 2: Poverty rate by household type

Childcare options, while improving, are still insufficient or too expensive in some areas, further limiting single parents' ability to participate fully in the workforce.

In short: being a single parent in Germany often means facing a near-permanent battle against financial instability.

Elderly Individuals (Especially Women)

Old-age poverty is a growing concern, especially among elderly women. Women's pensions are often much lower than men's due to career breaks for childcare or part-time work throughout their lives. According to data, around 17.9% of people aged 65 and older are at risk of poverty. The situation is particularly bad in urban areas where rents and living costs are rising faster than pension adjustments. Many elderly individuals must live very frugally or rely on additional support from social welfare programs like "Grundsicherung im Alter" (basic security in old age).

Long-Term Unemployed

The long-term unemployed (people who have been without a job for over a year) face unique challenges: they often suffer from skill gaps that make re-entering the job market difficult.

Mental health issues like depression and anxiety, partly caused by unemployment itself, further reduce their chances of finding stable work.

In addition, social stigma plays a large role: many employers are reluctant to hire someone who has been out of work for a long time.

While Germany's unemployment rate is relatively low, those who do lose their jobs and stay unemployed for long periods often fall into a poverty trap.

Migrants and Refugees

The groups of migrants and refugees also face a disproportionate amount of hardship when it comes to poverty. Individuals from these groups need to overcome significant hurdles in order to land high qualified jobs like language challenge, not having their foreign qualifications recognized, and facing discrimination in general. Many end up working in low-paying fields like cleaning, logistics, or construction. Often, entire families are crammed into small, overcrowded homes with limited resources to improve their lives. Even second-generation children of migrants often struggle with education and finding stable jobs, showing how poverty can be a cycle that passes from one generation to the next.

Degrees of Social Exclusion

Poverty isn't just about having less money; it also means being cut off from opportunities. Kids from poorer families are less likely to go on to pursue higher education paths. Families with fewer resources sometimes live in neighborhoods with problem schools, fewer public services, and higher crime rates. This creates a vicious circle in Germany: poverty makes it harder to access opportunities and the lack of opportunities keeps the cycle going.

Summary

Certain groups are still facing serious struggles with poverty and social exclusion. Single parents, elderly women, people who have been unemployed for a long time, and migrants are especially at risk.

Problems

Economic and Housing Challenges

Rising rental costs have disproportionately affected low-income households, particularly single parents and individuals living alone. Between 2010 and 2022, asking rents increased by 50% nationally and up to 70% in large cities while existing rents grew by 20%. Consequently, the poorest 20% of households spent over a third of their income on rent in 2021 compared to just a fifth for wealthier households. This financial strain contributes to social exclusion as these groups have less disposable income for other essentials.

Social Exclusion Indicators

Social exclusion in Germany is evident through various indicators including economic hardship, educational underachievement, and limited social participation. The persistence of these issues suggests that vulnerable populations remain marginalized, where their experiences often differ from those of the general population. Addressing these disparities requires targeted policies that promote economic support, educational equity, and inclusive social programs.

Understanding these issues is the first step. Moving forward, we'll look at how government policies are trying to address these problems and explore how technology might help bridge the gaps where traditional methods fall short.

National Policies to Combat Poverty in Germany

Germany has adopted various measures to combat poverty, particularly social security reforms, minimum wage regulations, and family benefits.

Bürgergeld (Citizen's Benefit)

The introduction of Bürgergeld in January 2023 is one of the most important steps Germany has taken to reduce poverty in recent years. The Bürgergeld replaced the older welfare system called Hartz IV, which had been in place since 2005 (see 0). Bürgergeld is a form of financial assistance provided by the government to people who are unemployed or do not earn enough money to support themselves. The aim is not just to cover basic living costs but to give people real chances to get back into work and live a self-determined life.

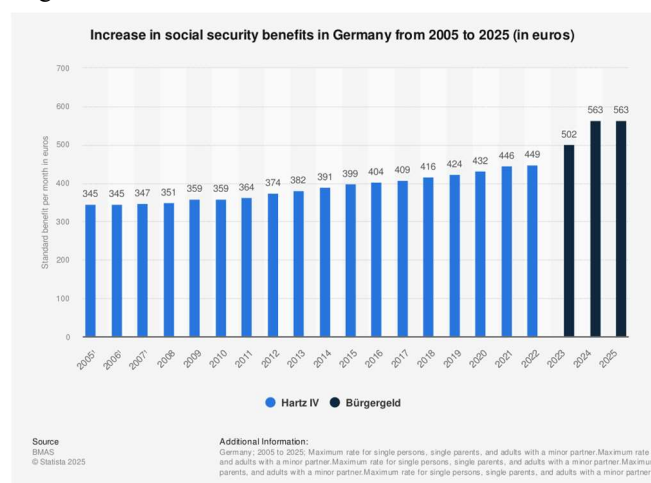


Figure 3: Citizen's benefit in Germany.

Bürgergeld is available to individuals in need and is handled by local so-called "Jobcenter" offices. It includes monthly payments, which are currently around 563 euros for a single adult (as of 2024), and it can also cover rent and heating costs if required. In addition to financial aid, Bürgergeld offers more flexible and personal support for people who are looking for work or who want to improve their skills. This includes paid job training, coaching, or educational programs. One of the biggest changes compared to Hartz IV is that people now have more time and fewer penalties if they focus on qualifications or long-term career goals.

In contrast, the older system Hartz IV was more focused on fast job placement and strict rules. The system offered less support for education or qualifications and was known for its harsh sanctions if people didn't follow certain rules. Bürgergeld allows people to keep more of their own savings without losing support. This approach is called Schonvermögen (exempt assets), which implements a way to protect a person's dignity and financial stability during difficult times. Also, the new system puts more trust in people and focuses on cooperation rather than punishment.

Considering the impact of Bürgergeld, we can see that it is already more effective than Hartz IV in some ways. According to the Bundesministerium für Arbeit und Soziales (BMAS, Federal Ministry of Labor and Social Affairs), more than 250,000 people took part in qualification programs in 2023, which is a clear sign that the new system encourages personal development. Giving people the opportunity to gain

skills improves their chances of finding long-term employment and escaping poverty.

Another important aspect is fairness. Bürgergeld is widely seen as a fairer and more respectful system than Hartz IV. It reduces the social stigma that many people felt before and allows them to feel more in control of their lives. The removal of harsh penalties and the increase in protected assets means that people don't have to fear losing everything when they ask for help. These approaches show that the system takes human dignity seriously, which is a core value in Germany's social system.

Lastly, if we consider how practical the system is to manage, Bürgergeld has made some improvements here as well. Although it is more complex and requires more coordination from Jobcenter employees, most of the offices have received better training and digital tools. The Bundesagentur für Arbeit reports that the switch from Hartz IV to Bürgergeld went smoothly in most areas. Some problems still exist, like long waiting times or complicated paperwork, but overall the system is working and made progress.

Overall, Bürgergeld represents a modern and humane approach to fighting poverty in Germany. Unlike Hartz IV, it supports people not only with money but with long-term opportunities. Bürgergeld is more effective, fairer, and more focused on people's needs. With further improvements and strong digital tools like the STEM-based app, which we propose in our project, this policy could become an international example of how to support vulnerable populations in a respectful and forward-looking way.

Minimum Wage

Preventing excessive wage dumping, Germany established a legally-binding minimum wage already in 2015. Originally fixed at €8.50 per hour, it has been periodically increased to match inflation to €12.41 in 2024 up to €12.82 per hour in 2025 (see 0). Full-time employees who earn this wage amount to approximately €2,161 per month in gross income. The goal of this policy is to alleviate in-work poverty and promote fair pay for labor.

Figure 1: Statutory minimum wage and 60 % of the median wage of full-time employees in Germany 2015-2025 in euros, per hour (annual averages)



* Data for 2024 and 2025 calculated on the basis of the [IMK autumn forecast 2024](#) on the development of effective wages
Source: OECD, own calculations

Figure 4: Minimum wage progressing in Germany between 2020 and 2024 (bundesregierung.de).

Requirements and Exceptions to the Minimum Wage in Germany

Certain criteria exists that are applied to and impose exemp- tions from the minimum wage in Germany. While the statu- tory minimum wage applies broadly, certain groups are ex- empt.

Minors under 18 without Professional Training Individu- als under the age of 18 years who do not have vocational training do not get the minimum wage:

Interns: Interns as part of a normal study program (e.g., university studies, school) and for no more than three months are exempted.

Apprentices: Apprentices are entitled to a minimum re- muneratation under paragraph 17 of the Vocational Training Act (BBiG), besides the minimum wage as laid down by law.

Long-term Unemployed Unemployed persons for 12 months and more are not covered by law for the first six months in employment with the minimum wage.

These exemptions aim to facilitate an entry into the labor market for specific groups and adjust to German educational and training systems.

The minimum wage is generally viewed as a fair policy be- cause it ensures that all workers receive a basic level of in- come for their labor. This approach helps to combat poverty, provides a more equitable distribution of wealth, and pro- motes fair pay for labor. However, there are concerns that it may not be sufficient to cover living costs in some areas.

The minimum wage promotes participation in the workforce by ensuring that jobs provide a liveable income. It encour- ages people to enter the job market, knowing they will re- ceive fair compensation for their work. However, some em- ployers may respond by reducing hours or hiring fewer workers, which could limit opportunities for some individu- als.

Family Benefits

Family benefits are generally considered a fair policy as they aim to support families in need. They help to reduce child poverty and promote equality among children from different socioeconomic backgrounds. However, some argue that the benefits should be more substantial to truly meet the needs of families.

Family benefits encourage participation by providing finan- cial support that allows parents to balance work and family responsibilities. Family benefits can enable parents to take time off work for childcare without facing severe financial strain. However, there may be barriers to accessing these benefits, which can limit participation for some families.

Germany’s Family Policy: From Tradi- tional Roles to Modern Work-Life Balance

Over the past two decades, Germany has fundamentally re- shaped its family policy framework. Up until the mid-2000s, family policy was largely influenced by the so-called “male breadwinner model”—a traditional family structure where the man worked full-time while the woman stayed at home to care for children. In this context, parental leave was short,

childcare infrastructure was underdeveloped, and financial support for working families was minimal. As a result, fe- male labor force participation remained relatively low, and many women faced long-term disadvantages in employment and income.

A pivotal shift occurred in 2007 with the introduction of Elterngeld (Parental Allowance), a reform that signaled a new era in German family policy. Elterngeld is a wage-re- placement benefit designed to compensate for income loss when a parent takes time off work to care for a newborn. Un- like earlier flat-rate benefits, Elterngeld is income-dependent making it especially attractive for dual-income households. Importantly, the reform also aimed to promote gender equal- ity in caregiving by offering bonus months if both parents share parental leave. This reform posed a clear step away from traditional gender roles and toward shared parental re- sponsibility.

In 2015, the introduction of ElterngeldPlus further expanded the support. This benefit allows parents who return to work part-time after childbirth to receive payments for a longer period—essentially half the standard monthly amount, but doubling the duration. ElterngeldPlus provides greater flexi- bility particularly for families seeking to balance caregiving and career progression.

Key Family Benefits in Germany

Germany provides its families with a full range of family benefits designed to support parents and provide work-life balance while also helping to reduce child poverty. One of the key factors is Elterngeld (Parental Allowance), through which eligible parents receive average monthly support be- tween 300 euros and 1,800 euros for a period of up to 14 months, such that they can better share responsibilities in the care of their child. ElterngeldPlus provides this parental backing up to 28 months for parents who go back to working part-time to help smooth their return to work. Another crucial benefit is Kindergeld, a universal child allowance of 250€ per month per child, regardless of income, until each child 18-25 if the child is still in education—which helps families with basic cost of living. Single parents benefit from Un- terhaltsvorschuss as an important means of livelihood whe the other parent does not pay the legally owed child mainte- nance, thereby contributing the child’s stability of the child until the child is 18 years old. Single parents can also claim tax benefits of an allowance of 4,260€ per year on the first child and 240€ per year on any other child which can signif- icantly lighten the financial load for such families. Together these policies represent a robust and inclusive familiy sup- port system that strengthens social equity and economic se- curity in Germany.

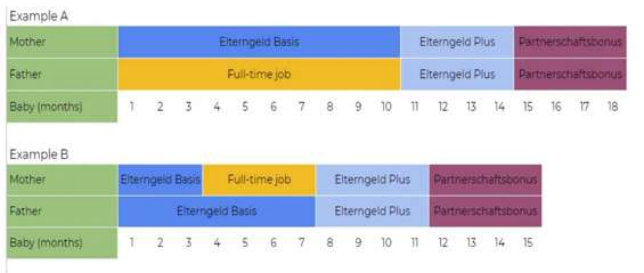


Figure 5: Sharing of caregiving duties between parents.

Summary

These benefits form a strong foundation for family support and help promote social equity in Germany.

Germany's family policy has evolved from a conservative, traditional structure to a modern, progressive system that values equality, flexibility, and inclusion. With measures like Elterngeld and ElterngeldPlus, the state not only compensates for income loss but also actively encourages the equitable sharing of caregiving duties between parents (see 0).

Universal benefits such as Kindergeld ensure that all families receive a basic level of support, while targeted instruments like Maintenance Advance and tax relief for single parents address specific vulnerabilities.

These reforms collectively reflect a broader societal shift: away from rigid gender roles and toward a culture of shared responsibility and work-life integration. Germany's family support model today serves as a robust example of how public policy can adapt to changing family dynamics, promote social equity, and support labor market participation—particularly among women.

Family benefits are designed to support families with children, helping to alleviate financial burdens. They have been effective in providing assistance to low—and middle—income families, which can improve child welfare and development. However, the effectiveness can vary based on the amount and accessibility of the benefits.

But all these policies can't eradicate the exclusion of vulnerable people.

How can we change the situation?

Our short-term approach is to support „Die Tafel“, a German NGO helping poor people through free provision of basic groceries and hygienic items. For example, the NGO distributes food that would no longer be used in the economic cycle and that would otherwise be destroyed due to regulations. In Germany, about 30% of those-in need are children and adolescents.

We proposed a collection campaign for „Die Tafel“, which is implemented by younger students. In our school, the 7th grade is organizing the collection. First, they discussed poverty in their ethics class and conducted research about ‚Die Tafel‘. They decided to collect non-perishable foods and hygiene items, like shampoo, shower gel, and toothpaste. Within three days, from June, 4th 2025 till June, 6th 2025, the items will be collected and handed over to “Die Tafel”.

And our long-term approach is our STEM-solution.

A STEM-Based Solution to Combat Poverty: The “AidLink” App

In our effort to develop a sustainable, technology-driven solution to help reduce poverty, we designed a mobile application called AidLink. The idea behind AidLink is simple but powerful: connecting people who need help with people who want to help. This ensures a direct, personal, and efficient approach. Our digital platform uses artificial intelligence (AI) and secure transaction technologies to support and

“match” low-income families and individuals in two essential areas: access to food and access to knowledge.

Direct Financial Support through Micro-Donations

One of the main features of AidLink is a donation system built into everyday purchases. Users who want to support people in need can register as donors. When they shop online or in certain local stores such as supermarkets, they can choose to donate a small percentage (like 1–5%) of their purchase amount. Alternatively, they can set a fixed monthly donation. The app then transfers this donated amount as a digital grocery credit to registered recipients who need help buying food. This process is fully automated and personalised. The recipient does not receive cash but store-specific vouchers that can only be used for essential items like groceries. This ensures that the help goes exactly where it's needed.

This donation model makes giving easier, more transparent, more regular, and more meaningful. Instead of sending large sums of money through big organisations, donors can support individuals directly creating a sense of personal impact and social connection. Because the system is based on everyday shopping behaviour, it encourages frequent micro-donations that add up to make a real difference.

Educational and Administrative Support

The second function of the app focuses on knowledge and empowerment. Many children growing up in poverty face major disadvantages in school especially when their families are unfamiliar with the education system or struggle with the German language. To break the cycle of poverty, educational success is key. AidLink matches students who need tutoring with volunteers or professionals who offer free or affordable lessons specifically in the German language, math, and the natural sciences. Sessions can be held online or in-person depending on the location and availability of both sides.

In addition to tutoring, the app also offers help with official paperwork. For many low-income households, especially those with a migration background, understanding and filling-out government forms can be a huge barrier. AidLink connects people who need help with administrative tasks, like applying for benefits or housing, with volunteers who have experience with the German system. These volunteers can offer language support, explain documents or help with appointments both digitally and in person.

AidLink as a Sustainable Solution

AidLink combines modern technology with human solidarity. The software utilizes AI technology to match needs and offers based on location, skill, urgency, and availability. It respects data privacy and facilitates access to help without bureaucracy or judgment. In doing so, AidLink addresses two important aspects of social exclusion: lack of access to basic goods (like food) and lack of access to opportunities (like education or administrative support).

AidLink can easily be adapted to work internationally because the underlying concept—matching offers and needs—is universally applicable. The app also encourages civic en-

agement and community-based aid, thus showing that technology can strengthen social bonds instead of replacing them.

Conclusion

Poverty in Germany remains a persistent issue despite the country's strong economy and extensive welfare system. Vulnerable groups such as single parents, elderly women, long-term unemployed individuals, and migrants continue to face significant social and economic challenges. While national policies like citizen's benefit, minimum wage, and family benefits have made meaningful progress, they are not enough on their own to eliminate social exclusion. Our proposed STEM-based solution, AidLink, aims to complement these policies by providing technology-driven support that is targeted and accessible. By connecting those in need with both financial and educational assistance, AidLink represents a modern and sustainable approach to reducing poverty and promoting social inclusion.

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