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A SYSTEMS MODELING APPROACH TO ANALYZING HUMAN TRAFFICKING

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ABSTRACT

This paper offers a process for understanding and analyzing the most effective interventions for eliminating human trafficking. The process consists of several methods for gathering, parsing and testing information about the Overseas Filipino Workers (OFW) economic system as it relates to trafficked persons. The methodology is comprised of a series of methods that include interviews, causal loop analysis, data collection, system dynamics simulation model, and scenario simulation runs. The last method, scenario simulation runs, tests the cause and effect relationships between government policies, overseas workers options, hiring companies, and the economy in which they all operate and interact. The importance of this process is that it is robust, repeatable, and efficient in a real-world setting.

1 INTRODUCTION

The original intent of this analysis is to determine methods for mitigating or preventing the trafficking of migrants throughout the globe. The United Nations (2000) Article 3, paragraph (a) of the Protocol to Prevent, Suppress and Punish Trafficking in Persons defines "Trafficking in Persons as the recruitment, transportation, transfer, harboring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation".

This definition casts a wide net over what it means for a person to be "trafficked". To contain the definition and thereby the problem, the focus of this analysis is financial in nature. The problem for this study is precisely the coercion of Overseas Filipino Workers (OFW) to forfeit part or all of their wages. A narrower definition is preferred to prevent over complicating and consequently over extending the project and ensuing results.

Wage embezzlement by coercive means is selected due to the access of available data as well as its size relative to other forms of trafficking. Data is more accessible and of a higher quality than many other migrant systems. The OFW program is considered the gold standard of migrant labor in the migrant worker industry because of its organization and self-policing relative to others with similar systems. A system in this case is "a set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviors, often classified as its function or purpose" as stated by Meadows (2008). Thus, if this set of elements can be transformed to prevent trafficking, it can be a model for many other migrant operations.

This paper reviews the process of understanding the OFW "system of slavery", the conversion of OFW population to trafficked OFW's (TOFW), and the testing of levers that can be altered to change the system. The "system of slavery" can be abstracted as simply a social system. Questions about social systems by nature can be highly ambiguous – the answers clouded and ephemeral. Pidd (1996) would refer to these as messes. Messes can be surmised as a problem that either (1) none of the stakeholders can agree that a

problem exists and if they do agree then (2) none of the stakeholders can agree what the cause or solution to the problem is.

The process is a composite of many well-known tactics and methods for analyzing social systems. The impetus for using multiple methods is that no one tool can solve the questions about such a complex system. Jolly (2015) describes multiple modeling methods as an agency giving insights into the because they "may give the analyst crucial insights into the market and perspective on their question."

The following section contains a review the (1) the problem statement. Next in section (2) the methodology is discussed in which specific details about the interviews, causal loop analysis, data collection, system dynamics model, and scenario runs are examined. Lastly in section (3) the conclusion is deliberated.

2 PROBLEM STATEMENT

MOSIMTEC engaged in a joint effort with a non-governmental organization (NGO) over four cumulative weeks to uncover factors affecting the global human trafficking system. The primary questions the group was attempting to solve was "how does the current system work". The NGO needed a strategy to work from that would enable them to provide strategic direction and eventually funding to mitigate the trafficking. Without a methodical and scientific means of understanding and explaining the system, the NGO might prescribe an unsustainable correction to the system and possibly leave the system in a worse state than when the engagement began.

The follow-on question was "what potential leverage points are to transform that system." The first question is a primer for the second, that is to say that in order to answer the second question, the first must be answered. As much as can the leverage points needed to create the maximum amount of positive change, they needed to be sustainable and require nominal effort.

3 METHODOLOGY

A systems modeling approach is used to answer both questions described in the problem statement. In a systems approach the problem is viewed as being the undesirable effect of the system. Therefore, the solutions found must be tested on the system, i.e., localized cause and effect assumptions and conclusions will miss key and unintended results. A systems approach takes into account the combination of relevant factors impacting the current real scheme of players.

A general process description is shown in Figure 1. The first step is to gather information about the system via first person interviews. The next step is to begin the development of the Causal Loop Analysis. The thirds step is to construct the System Dynamics model. The data collected from the interviews and other sources will be used to build the System Dynamics model. Lastly, scenario runs are constructed to analyze different policies. Solving the problem is characterized by deliberate, iterative refinement of questions and hypothesis manly in the scenario runs but equally important in the causal loop analysis. Each part of the process is discussed in the following sections.

3.1 Interviews

Various subject matter experts are interviewed to obtain an understanding of the perceived cause and effect relationships of the OFW trafficking situation.

The interviews consist of several questions surrounding three areas as shown in Figure : events, trends, and system structure. Much of this design and the 'basic language of systems thinking' for the purposes of extracting pertinent information from the subject matter experts (SME) comes from Stroh (2015).

The SME's explain their views of the real system as they understand it. They are asked what they think the root cause of the problem was as well as what aspects they thought would have the most dramatic impact. They are also questioned as to what realistic measures might have the most immediate improvement on the system.

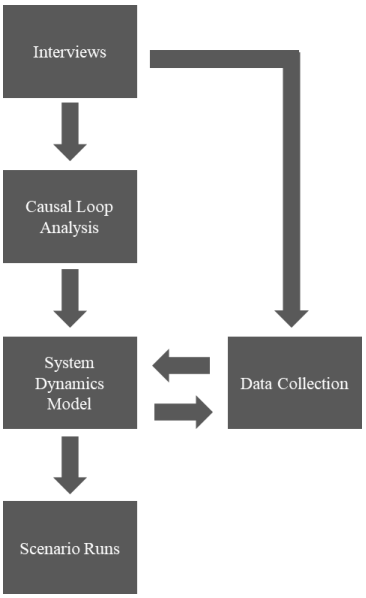

Figure 1: Human trafficking systems modeling process.

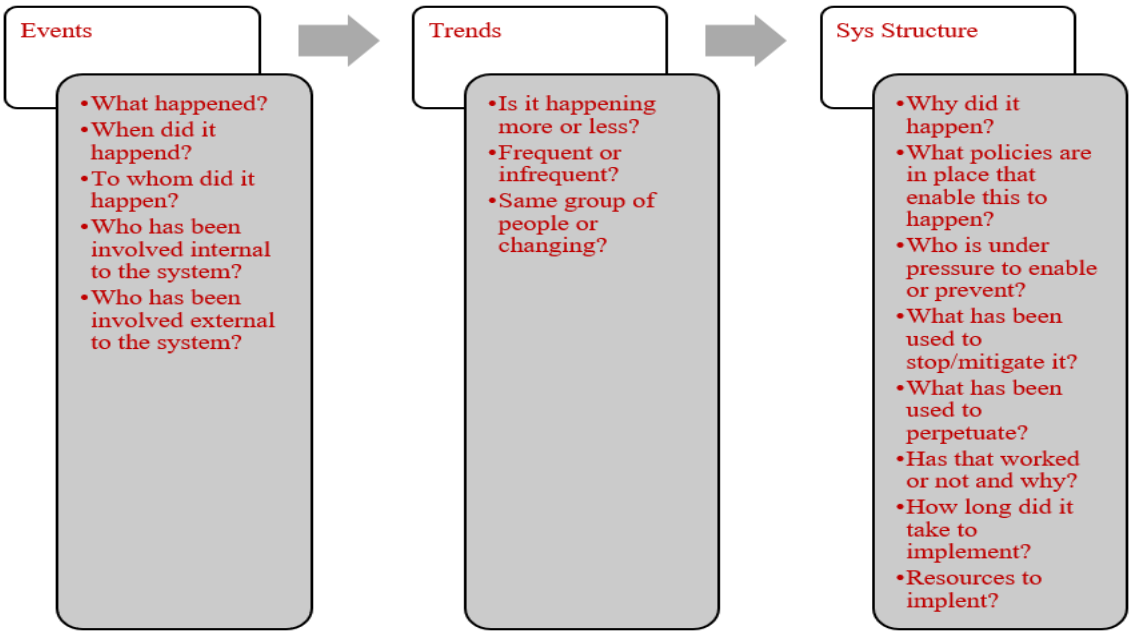

Figure 2: Interview category and questions.

3.2 Causal Loop Analysis

After the interviews are conducted and the information from those interviews is consolidated, a series of causal loops are generated. A causal loop is a diagram that shows the relationships between cause and

effect variables and those variables sole purpose is to help answer a specific question. The nodes are connected by links and those links depict whether the relationship causes a change in the same direction or causes a change in the opposite direction.

The reason causal loop analysis is useful is threefold. First, they are developed so we can visualize the mental models of teams working on understanding the system. Second, they convey feedbacks that are responsible for the issues and unintended consequences. Thirdly, causal loop diagrams capture the hypothesis about changing events – the causes of the undercurrents in social activity.

The guidelines provided by Kim (1992) are used to construct the causal loop diagram, and those guidelines include (1) theme selection, (2) time horizon, (3) behavior over time, (4) boundaries (5) level of aggregation, and (6) delays. A portion of the extensive graph is depicted in Figure .

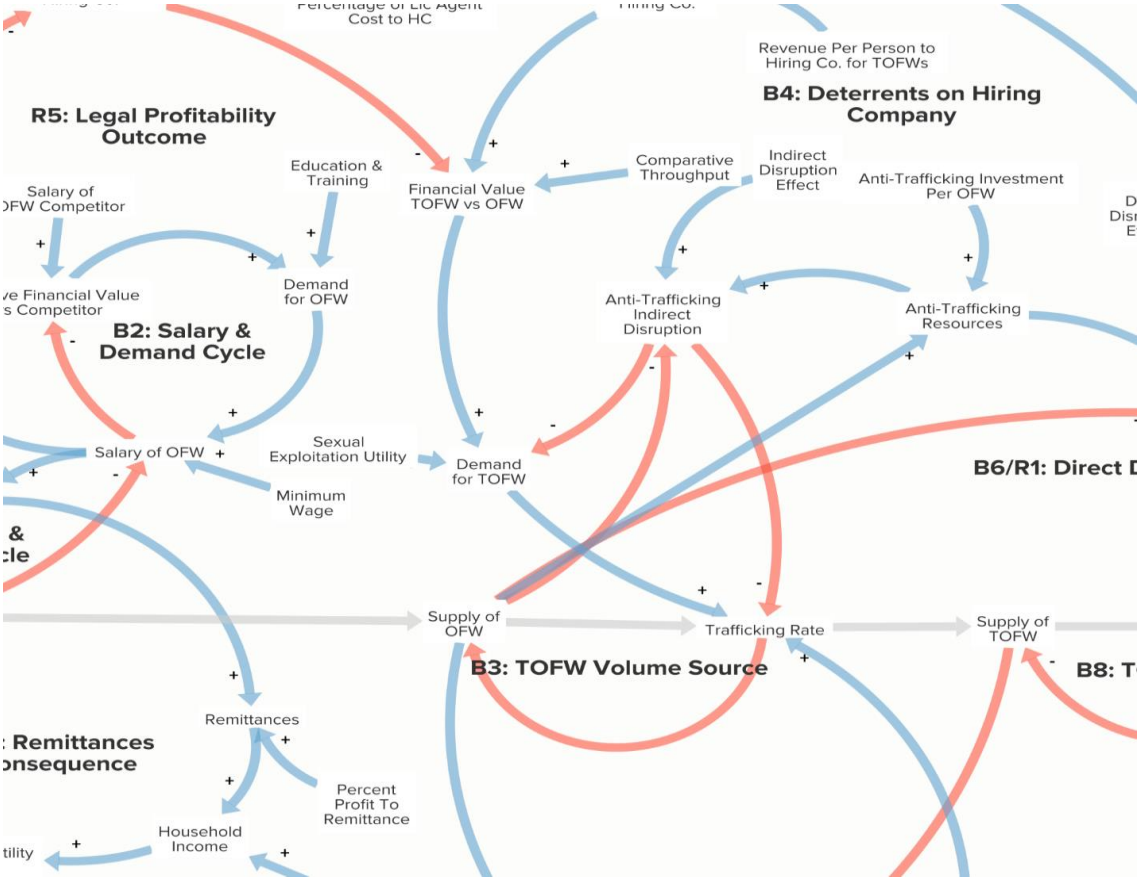

Figure 3: OFW trafficking causal loop diagram.

The loops in causal loop diagrams can be categorized into one of two types. They are either balancing or reinforcing loops. Balancing loops counter the original direction of any starting point in the loop thus creating a "balanced" trend. Reinforcing loops continue the original direction and often strengthen the effect. The primary loops in this model design are:

1. Salary & Desire Cycle – the OFW profit gain versus the domestic population.
2. Salary & Demand Cycle – the demand cycle for the OFW considering salary and education.
3. TOFW Volume Source – the direct effect on the trafficking rate.
4. Deterrents on Hiring Company – the public attention driving government action and subsequently the penalties on hiring companies.

5. Deterrents on Licensed Agents – the government penalties on licensed agents caused by a change in perception of the OFW program.
6. Direct Disruption - the Anti-Exploitation Resources for the EOFW to impact the behavior of the system. This variable represents the tools and opportunities for workers who have not been exploited
7. TOFW Exit Cycle – the number of exploited workers leaving the system.
8. Word of Mouth Fallout – the attractiveness of being in the OFW system is dependent upon the number of TOFW and thus the perceived utility of being an OFW.

The relationships are designed using an economic theme of supply and demand. The supply of legal workers, and the demand by legal agents is one interoperating subsystem. The other economic subsystem is the underground economy of the trafficked OFW in which demand is primarily motivated by the profit differential between legal or agreed payments versus a lower salary payment to the OFW.

The graph requires many iterations in which debate between the SME's are needed to formulate a satisfactory model.

3.3 Data Collection

Data collection is never a straightforward operation in which the entities involved have pristine figures that are concisely organized. What data that is available is collected either at the meeting or afterwards in various forms. Both qualitative and quantitative data are gathered from various sources such as the Philippe Overseas Employment Administration (POEA), Overseas Workers Welfare Administration (OWWA), Inter-Agency Council Against Trafficking (IACAT), World Bank, International Labour Organization (ILO). Once scrubbed for errors and missing values, a total of 23 different datasets are used for model runs and analysis.

A significant portion of project time is required to sort, clean, and understand the data. Data collection is driven both by causal loop analysis as well as the development of a system dynamics model. Both causal loop analysis and system dynamics modeling require the data as inputs and as validity to the defined relationships. Some of the same types of data may contradict each other. Accordingly, where the data is counterintuitive or contradicts, the reason could be (1) the data is erroneous (2) there is a wrong cause and effect relationship (3) the data is the wrong type to describe that relationship.

The actual process of developing the system dynamics model helps some of these data shortcomings. The system dynamics model is about relationships and feedback over time, so we can both infer some variables and accept consistent deviations. Additionally, large datasets can be corrected against smaller, more accurate samples from the same group.

In this project there were a few contradictions generated after studying the data. For example, a dataset of OFW's covering ten years showed that there was a continued decrease in trafficked persons. The trend implied that the problem would eventually correct itself. The contradiction is obvious in that stakeholders agreed there was a problem, but this data set showed there was not a problem. In this case the contradiction is assumed to be created by the data being the wrong type to describe that relationship.

In another case a dataset showed that while trafficked persons increased, the conviction rate increased by 685%, the prison time increased by 2,335%, and fines increased by 596%. These values might indicate that prosecutions have no effect. The values might also indicate that while still growing, trafficking lessened far more than it should have been. It could also mean that only recently more reliable data has been collected. The point of both of these examples is to show that this part of the process – data collection – has significant challenges associated with it. Large social systems and particularly those that operate in the shadows provide very little in the way of clean, consistent, and readily available data. Considering the time it takes to conduct data exploration, a balance must be negotiated that allows for good interrogation of the data prior to model use and good incorporation of the data during model runs.

3.4 System Dynamics Model

Once the causal loop analysis is complete, a system dynamics simulation model is built in conjunction with the data collection. The reason this type of model is required is because mapping mental models is an insufficient exercise. Mental models are easily driven by dogma and not by analysis. The modeled system's complexity can exceed a human's capacity to understand implications of the causal relationships, and ultimately there is a level of 'bounded rationality' (Simon 1997) derived from that suboptimal decision making that that negatively affects outcomes. Real social systems generate an environment that is not tractable and require variables (however quantitatively or qualitatively captured) to be included. Lastly, building a dynamic model speeds up and strengthens learning process for the stakeholders.

The system dynamics model is constructed using guidelines and examples from Sterman's (2000) seminal work regarding systems approach to business dynamics. Graphically, the model mirrors the causal loop diagram, but with stocks at the points of measurement. Those points of measurement are the OFW and TOFW populations. The following sections discuss the results of several scenario runs.

3.5 Scenario Runs

A Base Case simulation run is first created in which the model was calibrated to the real data. The two primary outputs of the model are the population of OFW's and TOFW's. The run length was for 132 months and the calibration attempted to match ten years of historic data. The results for the base case simulation run can be seen in Figure 4 and Figure 5.

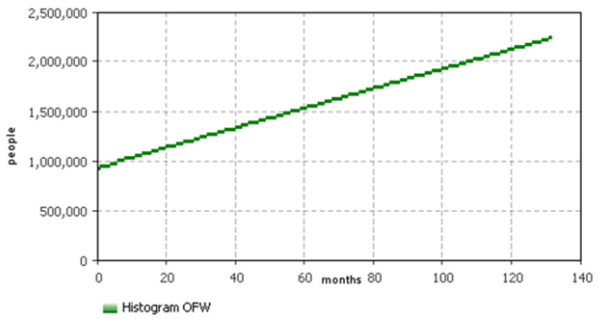

Figure 4: OFW population for base case.

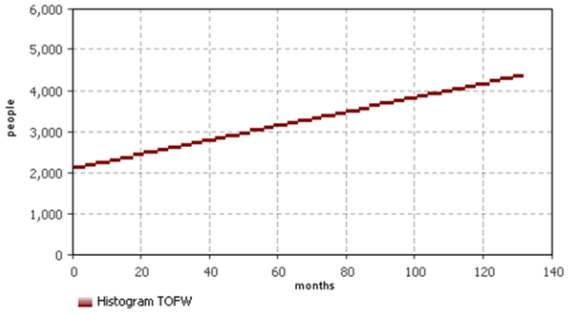

Figure 5: TOFW population for base case.

The entire exercise of developing and executing this process took place in a short amount of time. The rapidity of the project meant that only a small number of scenarios could be simulated and explored. That caused the focus to be on those parts of the system that the NGO sensed it could immediately impact. As much of the scenario developing process as outlined by Schoemaker (1995) and the learnings from Cavana (2010) were applied to these scenarios, but the time constraints made scenario development challenging.

The first component is the hiring company. These are companies that higher OFW's to work for them. They might be a large multinational or a single individual. The second lever is the licensed agent. These are individuals or organizations that recruit for hiring companies and act as the broker for labor.

3.5.1 Scenario One – Hiring Companies

The motivation for the first scenario is that the combination of fines, convictions, imprisonment can increase the cost of business for sub-system economy. The input parameter that is changed is the average monthly fine for hiring companies. The parameter was changed from $0 (-100%) to $46 (100%) The base case of the penalty to hiring company was $23 and is in unites of $ per OFW per Month.

What occurred when the penalty was decreased showed an upward pressure on TOFW population. When the penalty was increased, the model showed a downward pressure on TOFW population, crosses 0 between months 74 and 132. Both Figure 6 and Figure 7 illustrate these results.

The conclusion is that profitability for hiring companies is reduced when fines increase. The Profitability of TOFW compared to OFW decreases. The downward pressure on TOFW demand decreases trafficking rates. As the TOFW to OFW population decreases, the attractiveness of the system increases, and this increases the perceived utility which puts upward pressure on the OFW supply rate.

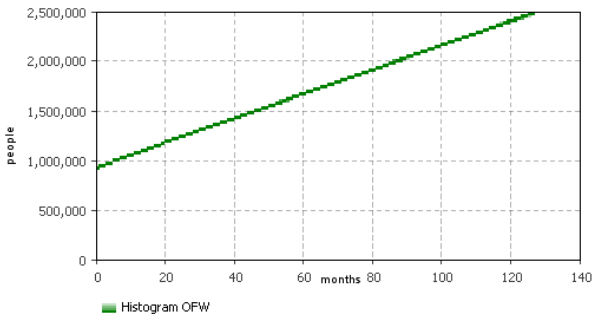

Figure 6: OFW population for scenario 1.

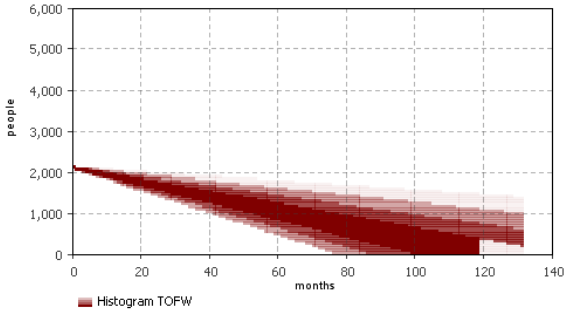

Figure 7: TOFW population for scenario 1.

3.5.2 Scenario Two – Licensed Agents

For the second scenario the stakeholder concern is with fines, convictions, imprisonment and how they can increase the cost of business for sub-system economy. This scenario is similar to scenario one but instead of hiring companies as the focus, it is the licensed agent. The parameter to change is the ratio of convictions per 100 complaints about a licensed agent. The penalty ranged from 0.0 (-100%) to 0.4 (100%) for the licensed agent from a base case of 0.2 convictions per 100 complaints. The actual data shows ranges of 0.06 to 0.60.

Decreasing the penalty on licensed agents places downward strain on the TOFW population, and upward pressure on the OFW population. Increasing the penalty, however, places upward pressure the on TOFW population and downward pressure on the OFW population. Figure 8 and Figure 9 depict these results.

The conclusion is that the feedback from licensed agent penalties drives up the costs for the OFW's. The OFW's profitability decreases and also consequently decreases the desire to enter into the OFW system. Simultaneously, those that do enter have a higher susceptibility to be trafficked the closer they get to the threshold amount thus driving up the TOFW population. Higher costs and lower profitability negatively affects the desire of the Licensed Agents to recruit, which is a proxy for licensed agent leaving the system due to loss of profit.

3.5.3 Scenario Three – Hiring Companies and Licensed Agents

In the third scenario the objective is to learn about predominate force used in the preceding scenarios that will change the TOFW population. The penalties on hiring companies is altered between $0 (-100%) and $46 (100%) and the licensed agent penalties changed from 0.0 (-100%) to 0.4 (100%).

The results show that higher penalties to the hiring companies and lower penalties to licensed agents cause the TOFW population to decrease. The results also show that lower penalties to hiring companies and higher penalties to licensed agents cause the TOFW population to increase. These results are illustrated in Figure 10 and Figure 11.

The conclusion is that the changes in either parameters negates the effect of the other regarding TOFW. The effect on OFW population, however, is decreased because of the greater impact licensed agents have on the cost of an OFW.

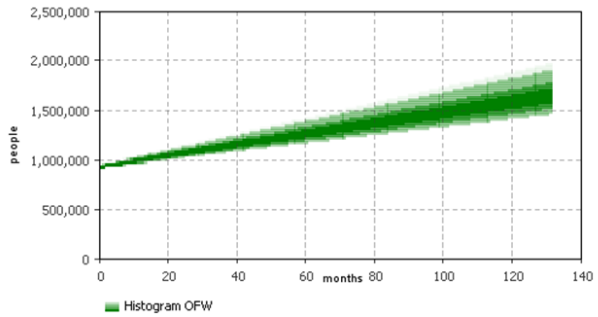

Figure 8: OFW population for scenario 2.

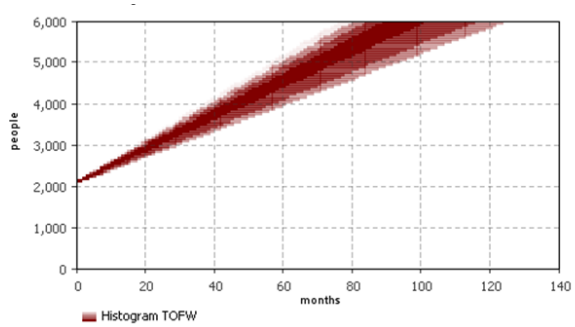

Figure 9: TOFW population for scenario 2.

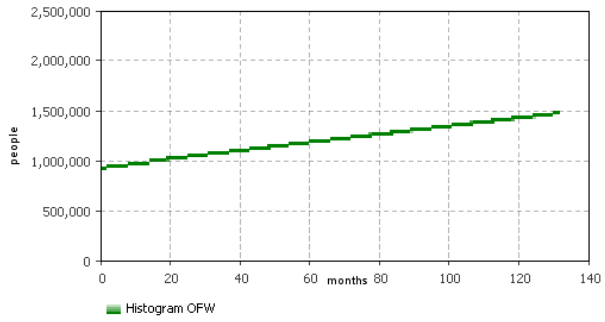

Figure 10: OFW population for scenario 3.

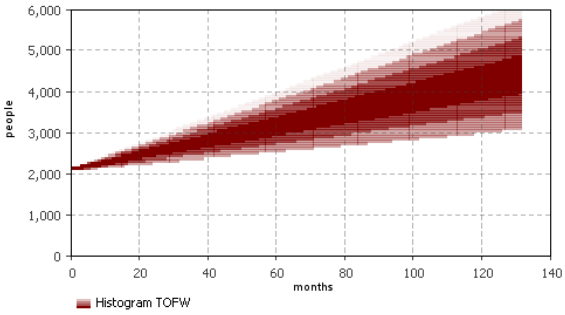

Figure 11: TOFW population for scenario 3.

3.5.4 Scenario Four – Minimum Wage

The focus of the last scenario is on altering the minimum wage. The hypothesis is that increasing the minimum wage helps to reduce the number of trafficked individuals. The minimum wage parameter was set between $200 (-50%) and $400 (+50%) in $50 increments.

Decreasing the minimum wage placed downward pressure TOFW population and, downward pressure on the OFW population. Increasing the minimum wage on the other hand placed upward pressure on TOFW population and upward pressure on the OFW population. Both of these results can be seen in Figure 12 and Figure 13.

The conclusion is that the lower minimum wage drives the average OFW salary down, which results in a lower cost and higher profitability to the hiring company. The TOFW population relative to the OFW population is less profitable, which means TOFW's are less advantageous to hiring companies, and subsequently lowers the trafficking rate.

When the minimum wage is increased, the model shows a sharp increase in the number of OFW and TOFW. The OFW improves profit, which increases the supply rate and thereby attracting more OFW's. The OFW consequently becomes more expensive than TOFW since the salary of the TOFW is set by the hiring company and not the market. The TOFW ultimately becomes financially more desirable to traffickers. Both of these results when the minimum wage is increased and decreased are completely counterintuitive to the expected results.

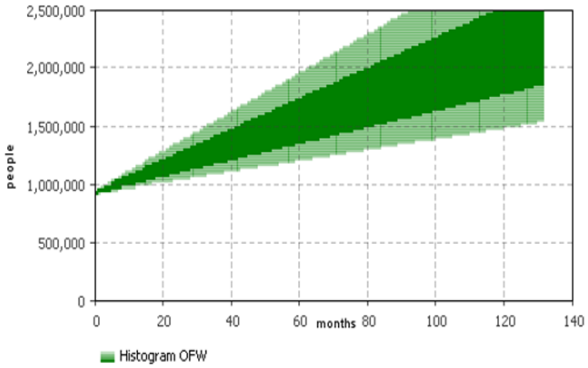

Figure 12: OFW population for scenario 4.

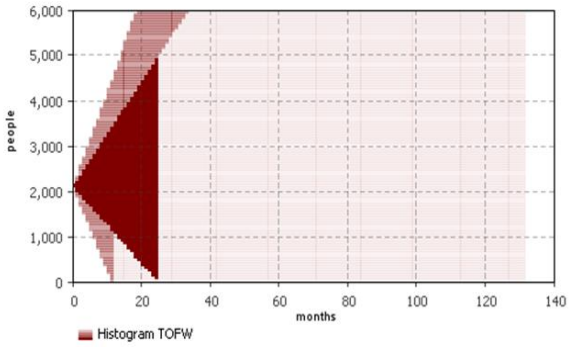

Figure 13: TOFW population for scenario 4.

4 CONCLUSION

This paper attempts to explain the process used to understand and analyze the most effective interventions for eliminating human trafficking, specifically as it relates to the OFW population. The process was created and performed when no process existed, and it was executed in an extraordinarily short amount of time.

The process consists of several methods, and each method in the process was derived from existing theories and practices. This process delivers insight about a very complex and messy social system. It allows the stakeholders to quickly realize the limitations of focusing on localized optimization and explores the potential effects of policy changes. The process is shown to be robust, i.e., it can be used in a system devoid of hardy data and structured in a high degree of complexity and 'messiness'.

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