



Massachusetts Institute of Technology
Engineering Systems Division

ESD Working Paper Series

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This case of study about the management of seasonal labor migration in Southern Europe was prepared by Rafael Marañón, Estrella Gualda and Ricardo Valerdi. The paper was submitted for the journal Technological Forecasting and Social Change in the special issue: Economic hard times: Impact on innovation and innovation potential

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Abstract

During economic crises, governments establish policies that facilitate the creation of jobs, goods and services that make their economies more resilient. Often, this requires innovative social programs that match global migratory trends to local labor demand. The implementation of such programs requires a significant degree of innovation that requires models that can capture the complexity involved. To explore this phenomenon, we provide a multi-disciplinary view of innovative social programs that shed light on the dynamic characteristics of the political, social, technological and economic aspects of circular migration. Our focus is a case study of the European Union-funded circular migration program to support the strawberry harvest in the province of Huelva in Spain. Covering the time period of 1999-2011, this paper provides a system dynamics model to represent the key elements that led to the success of circular migration from the standpoint of economic and social change. The model helps explain the key factors that make the program robust under recent economic crisis conditions. Based on a qualitative analytical approach, the model demonstrates how adaptive policies can enable macroeconomic equilibrium in environments where circular migration can be implemented. We also show that circular migration is not an impediment to economic recovery, in fact, it helps stabilize the labor supply in times of high uncertainty.

Keywords: circular migration, social innovation, system dynamics, Southern Europe.

1. Introduction

1.1. Reactions in economic crises

Countries and regions have different reactions during economic turbulence. Citizens propose immediate and sometimes drastic solutions to government. Social pressure is sometimes effective in driving decision makers to execute emergency policies that absorb the impact of the crisis and stimulate the economy in the short term. In Spain, during the crisis in 2008, one of the implemented policies was the promotion of the Sustainable Economy Law [1] through the Plan E (Spanish Plan for Economic Stimulus and Employment)¹. A second reaction was the reinforcement of social dialog between industry, labor unions, employment offices and regional governments at a national [2] and regional level [3]. That dialog focused mainly on encouraging businesses to hire local unemployed workers. A third reaction was the sudden stop of guest worker visas for labor-intensive jobs such as fruit harvesting. This policy was intended to help the local economy in the short term. But, as we will demonstrate in this paper, the result was much more complex to understand.

In order to meet the demands of labor-intensive jobs such as agriculture, it is sometimes necessary to use undocumented workers. This is due to two reasons: the lower wages associated with such jobs and the lack of interest of local Spanish workers to take on blue-collar jobs that have a low social status. In a proactive attempt not to utilize undocumented workers, there has been an emphasis on immigration policies in the European Union for combating illegal immigration by establishing a voluntary return policy for seasonal workers by creating circular migration and co-development policies [4]. Such policies introduce other economic effects that mediate the interaction between labor forecasting and social programs. These multi-dimensional interactions quickly approach a level of complexity that requires more disciplined modeling and rigorous analysis in order to be fully understood. Our objective is to shed light on such a scenario and provide a mechanism for understanding its effects over time so that policy makers can avoid pitfalls by making more informed decisions about such circular migration policies.

1.2. Theoretical Concepts Related to Immigration

The notion of migration has been an important global phenomenon for generations. The physical movement of humans from one geographic region to another – both voluntarily and involuntarily – has played an important role in the identity of countries and cultures, economic trends, civil wars, world wars, spread of disease, and the development of technological innovation. Specifically, the connection between migration and economics has been highlighted by many scholars across a variety of disciplines. Some scholars try to delimit what kind of factors are behind the origin of international migratory flows and the settlement of immigrants in different societies [5,6,7,8,9,10,11] [5-11]. Some of the more popular orientations concerning migrations in the Social and Human Sciences are based in neo-classical growth model [12,13], and human capital theories [14,15] that focus on long-run macro-level effects that are aimed at maximizing economic value. Meanwhile others focus on social and institutional factors, and the importance of power, and phenomena and processes such as migratory chains, social capital and social networks [16-17, 7, 18-20].

Some of these approaches based on neoclassical and human capital theories are insufficient for understanding the micro-level complexities of migratory flows and processes of integration in receiving

¹ Spain's equivalent to the "New Deal", a plan developed by U.S. President Franklin D. Roosevelt devised in response to The Great Depression in the 1930s.

societies. In particular, they fail to address the fact that the decisions for migration and settlement are strongly motivated by personal, family and social contexts (not necessarily by the effects of markets or by supply and demand). These types of decisions are also strongly affected by the influx of migratory policies, especially in the regulation of borders and policies for the integration of immigrants [16,7]. Additionally, some authors stress the role of the governments and states in the design of migratory policies, but also of employers and their organizations to influence the process of recruitment of workers to achieve a stable work supply, reduce costs and even promote future investment to remain competitive in a global economy [17, 21,22,16,23]. This complementary approach to exploring the micro-level complexities of circular migration exposes important issues that explain the success and failure of circular migration programs. We do not suggest that the macroeconomic theories are incorrect; instead we suggest that they do not account for important microeconomic foundations that are at the cornerstone of successful circular migration policies.

The example in Spain is a particularly interesting case to study because of its geographic proximity to Africa and the paradox that exists between the need to hire more local workers at higher wages in the presence of a labor supply of migrant workers willing to work for lower wages. Interestingly, the last 20 years have marked a transformational period in Spain from a region of emigrants leaving to other countries in search of higher wages to one in which immigrants make up 12 percent of the population, where 5.7 million foreigners were registered in 2010 [24]. The driving forces behind this change have been higher standards of education, higher employment aspiration from young people, and fast economic growth in the construction and service industries, prompted by Spain's entry into the European Union in 1986. In Andalusia, a region in southern Spain, growth in the agricultural sector prompted concerns about a labor shortfall. To address this shortfall, the local government adopted a circular migration program which has been cited by other countries as an exemplar due to its resounding success. Measuring this success, however, becomes an interesting activity which results in a variety of outcomes based on points of view. This issue, along with the challenge of modeling such a phenomenon, will be explored in the remainder of the paper.

1.3 Circular migration programs as social innovation

Circular migration is defined as a form of migration that is managed in a way that allows some degree of legal mobility between two countries [25]. Some refer to it as the fluid movement of people between countries that are dependent on seasonal conditions and performed only during part of the year [26]. This alone is not an innovative concept, but what introduces social innovation is the ability to control the supply of migration to match seasonal demand in industries like agriculture. This particular way of hiring temporary workers in the strawberry harvest in Spain is analogous to concepts of just-in-time logistics [30]. Regulating the supply of workers to arrive at the precise moment the strawberry is mature is needed to be picked requires extensive forecasting that is common in technical systems but less common in social systems.

The act of regulating a social system has its share of logistical difficulties, not to mention various economic, social, and political ones. For example, all of the processes required to have employment contracts and immigration visas need to be flawlessly orchestrated so that they can be responsive to uncertainties in related processes. Climate can be one of the largest sources of variation in this process since frosts accelerate the need for workers while it may delay their travel plans. The result it is a complex system rich with interesting questions and opportunities for understanding the dynamics between social agents (politicians, entrepreneurs, etc.) countries (Spain and Morocco) and individual actors (employers and guest workers).

Our particular case study is focused on the Strawberry harvest in the province of Huelva in Spain. Huelva is located east of Portugal and west of the Spanish city of Seville. Its closest neighbor to the south is Morocco which is in the northwestern region of Africa. A group of municipalities of Huelva have a strong agricultural specialization, based on intensive agriculture specializing in strawberry and citrus fruit. This province is the leading producer of strawberry and citrus fruit cultivations in Spain [27] and a leading global producer [28]. This has been the backdrop of an intense flow of immigrants since the 1990s. Understanding the dynamics of such seasonal migration requires an approach that accounts for the multiple interactions representing cause and effect relationships. Such an approach is described next.

1.4 Modeling the dynamics of migrations flows

In order to analyze the implications of abrupt changes in this legal migration flow during high unemployment rate and financial economic crisis, this paper provides a model that helps characterize the dynamics of labor supply management in the agriculture sector in Huelva. To this end, we focus this paper on the following research question:

What are the key factors in a circular migration program that must be dynamically adapted during an economic crisis?

To address the aforementioned question, further issues will be analyzed, including how to make the immigrant population respond instantaneously to the economy growth, recession and transition. The time period of analysis is 2001-2011, a time that provides ample variation in economic and migratory trends to demonstrate the dynamics of circular migration. Ultimately, our goal is to explore the underlying reasons why the circular migration program in Huelva can serve as a model for economic and social change in the context of labor supply management.

2. Background: The evolution of the strawberry and citrus fruit cultivations harvest

2.1 Agriculture labor shortfall

Until the late 1990s local workers and Spanish migrants who moved from other municipalities of Huelva, Cádiz, Sevilla, Córdoba, Extremadura and even Portugal [29] represented the majority of the strawberry and citrus fruit cultivation labor in Huelva. However, the overall development of the Spanish economy, specifically new opportunities in the construction and services industries, the decline of social status of working in agricultural fields, the increase of the educational level of young people, and the displacement of occupational aspirations to other industries contributed to the growing need for foreign laborers in the strawberry and citrus fruit cultivations fields.

2.2 Search for labor force abroad: Changing patterns of recruitment and dynamics of the migration system

The need for foreign workers for the support strawberry harvesting after the attrition of local workers led entrepreneurs to find ways to innovate socially and economically in the process of selection and search of laborers. The experimentation of contracting workers began to gain momentum and produced the substitution of labor in the region leading to significant changes in the sociological composition of agricultural workforce. This transition has undergone various phases: from Spanish nationals to foreign men, from Moroccan men to Eastern European women, and from Eastern European women to African women. All three phases occurred within a period of approximately 20-30 years.

Currently we are entering a fourth phase where ex-patriots are returning to Spain in search of employment.

Over time, one factor has remained constant: the instrumental need of employers to provide workers for an increasingly growing local agriculture industry. This need is driven, based on the year, , by the abandonment of agricultural jobs by Spanish nationals, the entry of Poland to the European Union, difficulties with the arrival of Romanian workers, and the insufficient supply of Bulgarian population. The perennial need for workers for a product which is extremely perishable, as is the strawberry, drives the recruitment that largely addresses the need for just-in-time labor to respond to variability in the climate. [30].

Strawberry farmers in Huelva have implemented the process of circular migration as a social innovation, according to specific guidelines to the movement of people. The main objective is the quest for certainty and planning, key to this time-sensitive business environment [17,23].

2.2.1 Phase 1: Replacement of Spanish men by African men

The departure by Spanish workers from agriculture created an important gap to be filled by other capable laborers. At this stage, the presence of migrant women had not taken place and, at the same time that people from Spain were abandoning the fields, there was a progressive entry of Guest and Algerian migrants for the agricultural season. In the late 1990s, the local press was aware of the personal needs that entrepreneurs had to complete a successful agricultural season. In those times, the majority of migrant workers were men.

2.2.2 Phase 2: Replacement of Moroccan men by Eastern European women

Different socio-political and cultural circumstances (international politics, new politics of immigration, Moroccan immigrant sit-ins, complaints of employers of the abandonment of the work, etc.) allowed hiring women, who from the beginning were conceived as more controllable workers because of their family connections in their country of origin [3]. Women were also preferred because they are attributed with better skills (economic and social ones) such as being more tidy than men, they do not foul fields, they quarrel less in daily life with others, drink less alcohol, thus making them better for hard work that begins very early in the morning. The farmers must also provide housing to workers that come from abroad. The majority of them decided to take only women, because it would be wrong to dwell people of different gender in the same house if they do not belong to the same family [31,32].

These factors highlight the importance for employers in the context of agriculture to find employees with flexible schedules and controllable traits [33]. Temporary '*contracts in origin*' became one answer to the necessities of circular migration. As a temporary contract, it provided the opportunity to work for a period of a few months with the possibility of repeating the following year but only if they returned legally. Employers' perceptions that, in general terms, women are employees that are easier to manage. In a sense, Abdullah [34] stressed the importance of the ideal worker to be '*the other docile, and disciplined*'.

The recruitment of women occurred starting in 2000 during the first major wave of women guest workers from Poland. The '*contracts of origin*' provided a temporary screening mechanism and eventually a permit for foreign workers. Local advocates of this policy [35,36] argued that this type of contract was the solution to the labor demand made by local entrepreneurs, for several reasons:

- It regulated workers by providing a signed contract after a selection process took place in the country of origin.
- The contracts had a fixed term which matched the season and their needs, requiring the worker to return home at its expiration.
- Workers who fulfilled the terms of the contract could be hired in subsequent seasons without going through the selection process.
- In accordance with the law, after the fourth return they could be eligible for resident and work permits in Spain.
- The employer is required to pay the workers' travel to Spain (with the employee paying their return)
- The employer is required to provide a house with minimum living conditions. All of this is implemented by the "Huelva Agreement for the Agriculture".

Over time, it increased the number of Eastern European women working in the agriculture section in Huelva. For example, during the 2007-08 season there was a need for approximately 60,000 workers, temporary contracts of origin provided 37,480 (62%). However, in the presence of economic crises (post-2008), there was a shift away from such policies and a decline in this type of hiring in order to promote local employment as shown in Figure 1. At the same time, Polish and Romanian women were contracted because of their entry in the European Union which eliminated the need for government bureaucracy.

After 2008, Polish women also substituted Moroccan men in other countries such as Romania, Bulgaria and the Ukraine. As Poland and Romania joined the European Union, they no longer needed to participate in guest worker programs which facilitated a more constant influx of female workers into the agriculture industry.

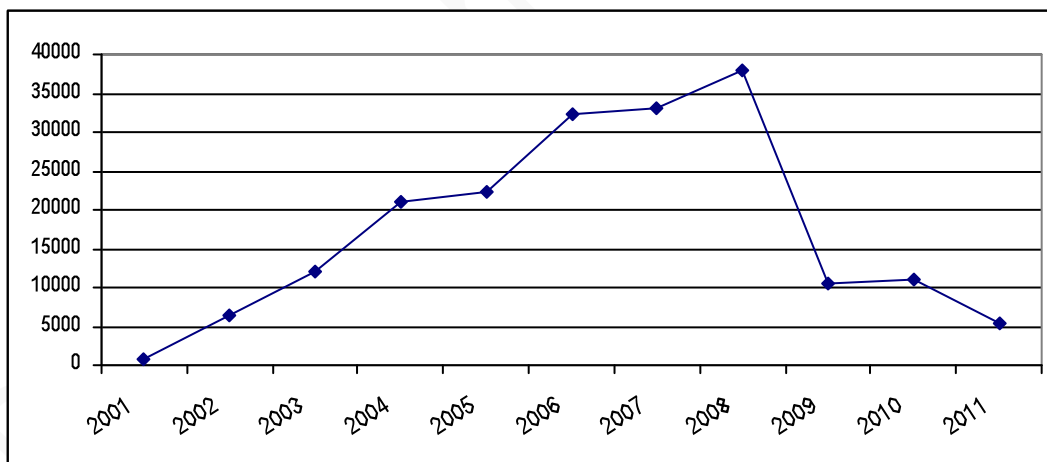


Figure 1: Number of temporary 'contracts in origin'
Compiled from [32, 37, 38, 39].

2.2.3. Phase 3: Replacement of Eastern European women by African women

The orientation towards Morocco in the contracts of origin is largely due to the difficulties of finding Polish and Romanian workers in 2005-2006. Furthermore, Bulgaria's inability to provide sufficient workers also contributed to the viability of Morocco once again. Furthermore, Bulgaria's inability to provide sufficient workers also contributed to the viability of Morocco. In this context, an international

agreement was signed between Morocco and Spain in 2005 for the recruitment of workers for the strawberry harvest in Huelva. It was the Aeneas Project-Cartaya-Kenitra that promoted the new recruitment of Guest women. [38,40].

The first group of Guest women worked in Huelva, Spain during the 2005-06 season. The following year (2006-07) some 5,000 Guest women worked in the agriculture in Huelva, in the 2007-08 season were around 16,000, and in 2008-09 the number grew to 10,400. In November 2010, the recruitment level dropped to 5,500 Guest women for the 2010-11 season [39].

Although in other traditional agricultural scenarios in Spain the contracts have been made predominantly to males, Huelva employers seem to have gravitated towards women, regardless of their country of origin. Whether it is greater docility [34,40], their best skills and work attitudes, the desirability of keeping persons of the same gender in accommodations provided by employers on farms, or other less humanitarian reasons suggested in public discourse and that remind some of the features of the famous Lewycka's book: *Two Caravans, or Strawberry Fields* [41] where trends clearly point towards the feminization of agricultural work when these contracts are made to foreign populations, at least by way of the recruitment at origin.

2.3 Social Conflicts in economy crisis context

Since the end of the 2007-08 season we can see the first signs of economic crisis through a shift of the Spanish people towards (re)incorporation into the agriculture industry [36,2]. Unemployment continued to grow in the province of Huelva and *'many families today want[ed] to return to work in the strawberry and citrus fruit cultivations'* (Spanish woman, focus group in Lepe, 2009)... *'I already work where it is needed: in the field, looking after elder, or whatever, my husband, he has almost finished the unemployment subsidy and found nothing ... with three small children that we have'* (Spanish women, focus group in Palos de la Frontera, 2009).

There is a significant change from previous seasons when the unemployment rate of the local population was not very high. Given the uncertainty that strawberry could remain uncollected, worker substitution and changes in gender and ethnic segmentation are purely instrumental strategies to reduce costs, of avoiding conflicts at work, and provide employers the opportunity to gain stability in a moment where labor would be critical for the harvest. The crisis shows that, beyond socio cultural discourses, the priority is the harvest collection, regardless of who is going to collect, provided that this continues to be profitable to employer(s).

It also shows that employers do not independently decide who to hire, intervening policies at the local and international level play a significant role. In this sense, if the Spanish want to return to the strawberry fields, it could happen if the economic crisis persists. However, for many entrepreneurs, with previous experience of the Spanish abandonment of the fields, the rehiring of Spanish workers is inefficient. This has led to a new innovation to carry out contracts in origin and even the reservation of a quota of contracts in Morocco in case the demand for labor increases [42]. In fact, for many the return of Spanish to the agriculture industry is regarded as temporary and it is expected that they will reactivate contracts with seasonal workers as soon as the economy recovers.

3. Research methodology

During growing economies, labor migration plays an important role. However an increase in the number of foreign workers has severe consequences in the society if this economy suffers recession. For that reason some countries around the world have implemented circular migration programs as a temporary solution to control migration flows depending on the labor shortfall.

However a well-designed circular migration program requires more than a logistical supply and demand approach. What is also required is a holistic approach that considers the social, political and economic implications of such programs. In this paper, we discuss the multi dimensional dynamics of a particular implementation on circular migration in Southern Europe. The case of Huelva in Spain represents a success story in social innovation but it was not by accident. We explain how a well designed strategy over the time can make the system respond favorably in a period of economic crisis.

In order to characterize the complexity of labor migration flow in southern Europe we used system dynamics² [43] to understand the structural foundations and related variables. Created by Forrester (1957), system dynamics has its roots in control system theory but has been applied to complex problems in social science, economics, politics and business management. The objective of system dynamics is to provide a mechanism for modeling and simulation to understand the dynamics of specific phenomena and then use that understanding to develop interventions that can improve outcomes.

System dynamics plays an important role in helping decision makers avoid suboptimal decisions, often referred to as policy resistance³ [44]. The concept is simple: when you introduce a disturbance into a natural system, the system may initially be able to cope with stresses and shocks. However, over time the system may react to the disturbance – or exhibit policy resistance – which may seem counterintuitive because of the time delays associated with the reaction.

Much of the art of system dynamics modeling is discovering and representing the feedback processes, which along with stock-and-flow structures, causal-loop diagrams, time delays, and nonlinearities, determine the dynamics of a system [44, 72-73]. The use of system dynamics helps overcome the limitations in people's intuition about complex problems and their often incorrect mental models. The resulting insights are intended to help scientists, policymakers, the media, and the public at large better understand complex multicause and multieffect relationships. This is accomplished through the use of building blocks that are mapped creating the model structure [75-76]

The process of building models in system dynamics allow decision makers to better understand the problem and identify possible side effects that could result from their decisions. One of the reasons side effects are underestimated is because the relativity effect⁴ [45] where we are looking at the things around us in relation to others to make decisions, instead of thing in the long run consequences.

² System dynamics is a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems -- literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality. [43].

³ the tendency for interventions to be defeated by the system's response to the intervention itself [44].

⁴ 'we not only tend to compare things with one another but also tend to focus on comparing things that are easily comparable – and avoid things that cannot be compared easily'. Dan Ariely. Predictably Irrational. 2008 [45]

Another reason is how previous assumptions can fill the gap of knowledge in the rational choice that we can find a behavioral model of the 'business man'⁵ [46].

To this end, we followed the following model building process:

- 1.1. Problem Statement: Formulated the problem statement and dynamic hypothesis and included drawings from reference modes of each variable identify as critical in order to describe the behavior of the system. Time horizon should also be defined.
- 1.2. Mapping: stocks, flows and variables are mapped establishing causality among them.
- 1.3. Analysis: Once causal loop diagrams are mapped we analyze the nature of the loops identifying those which generate reinforcing or balancing behavior. Beside a qualitative analysis, some equations are defined to facilitate the simulation.
- 1.4. Testing: In this part of the process the data is introduced in the exogenous variables and stocks are initialized.
- 1.5. Policies: After the simulation we validate the model and compare the results with the reference modes in the first step. In this step we have the opportunity to implement some recommendations from stakeholders that could make the system work in better conditions.

We used primary and secondary sources in order to identify the key variables in the model. As primary ones we interviewed several stakeholders in southern Spain such as the Foundation of Foreign Workers in Huelva (FUTEH) and the Chairman of the Committee of Municipalities with circular migration in the province of Huelva. We also did several focus groups in the area where local inhabitants told their experience. As secondary sources we used different kind of documents about the experience of circular migration in Huelva (reports, articles, statistical data, local press, and local surveys). All of this helped to produce the first qualitative model and the identification of variables.

To start building the model, we used a number of research methodologies such as stakeholder interviews and secondary sources, data collected from the University of Huelva⁶ and observation/discussion of this research group. Those sources of data were very valuable not in informing the model but also in understanding the dynamics involved in the processes along the last 20 years of social innovation in the province of Huelva. Once the basic structure of the model was built we incorporated additional exogenous variables and causal loop diagrams. Subsequently, we validated the model with new interviews of stakeholders from the association for the mobility (FUTEH) and a leader of the circular migration in Huelva and experts on circular. The model was presented so that stakeholders could provide additional feedback, which was incorporated into the final version of the model. This iterative process involved revisited the model based on feedback and discussion.

The procedure to work with a reliable model was the following. First, after an interview with government officials who described the nature of circular migration and how policies are implemented. This led to the development of causal loop diagrams. Also other variables were listed based on interviews with farmers. Second, we showed those diagrams to stakeholders such as the circular

⁵ The 'flavor' of various models of rational choice primarily from the specific kind of assumptions that are introduced as the the 'given' or constrains within which rational adaptation can take place. Some of the constraints are set alternative to choice, relationship that determine pay-off and preference-ordering among pay-offs. Simon, Herbert 1957. Models of Man [46].

⁶ Social Studies and Social Intervention Research Center, www.eseis.es.

migration program management team, and provided them with the opportunity to add more factors or just do some correction to the model.

The effect of increasing in one factor of the model can be seen on the wide range of socio-economic variables. This is one of the important advantages as compared with other methodologies particularly when multiple assumptions can be examined therefore further policy implications can be extracted. Others have used system dynamics to build social models and determine the optimal employment and production policies in the Iranian agricultural sector [47] and labor migration [48].

In system dynamics perspectives from sociology, macroeconomics, migration, industry and public policy come into play. In order to formulate the hypothesis, inter administrative cooperation, temporary housing and guaranties for the return of guest workers will be considered as keys element to explain the benefits of implementing responsible labor supply management practices while having a just- in-time workforce.

In figure 3.1 we can see how decisions are made in the traditional management of social systems. The feedback theory provided by the system dynamics approach allow to add to the complexity principles for selecting information and basic structure as we will see in the results of this article. A broader model that consider non-linearity, time delay and feedback loops will help to understand the dynamics behavior and improvement of policies in the case of Huelva and foster further implementation in new settings.⁷

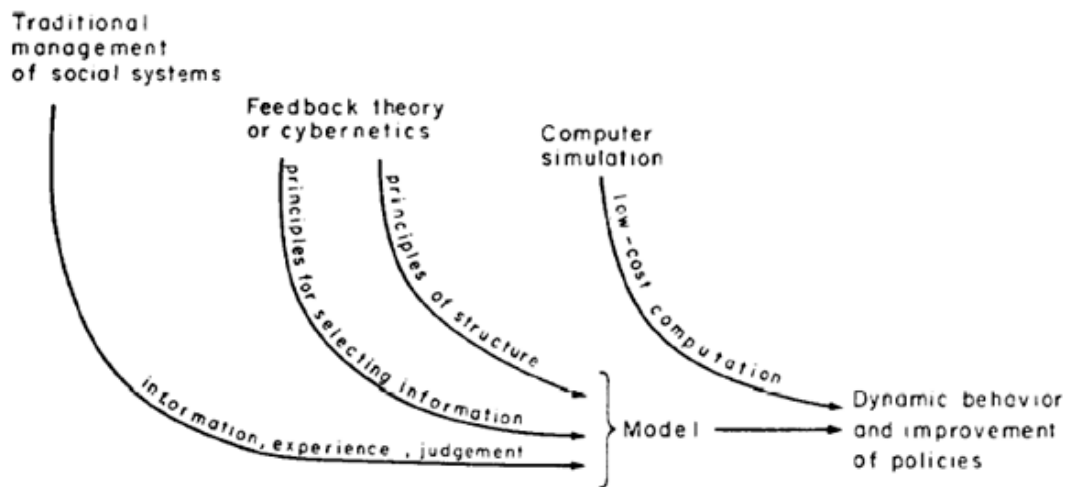


Figure 3.1: System Dynamics model help to understand dynamics behavior and improvement of policies. Source: Forrester, Mass, Ryan 1976 [49]

⁷ Although assumptions may be explicitly stated, the human mind is not well adapted to determining the future time-varying consequences of those assumptions. Different people may accept the same assumptions and structure, and then draw contrary conclusions. A consensus is hard to reach, and even a majority opinion may be incorrect... The system dynamics model is more explicit than a mental model, so it can be communicated with less ambiguity. FORRESTER [49]

4. Model/Results

In order to model the circular migration program to support the strawberry harvest in the province of Huelva in Spain, we set up the time horizon covering the past 13 years. Our model will approach mainly the labor supply management and will contain the key factors that make the program robust under economic crisis conditions. Following our framework declared before, in this part a list of stakeholders and variables involved in the circular migration process will be detailed. Also we include a basic structure of the model following by another one with the feedback processes. Finally the model will be simulated under certain scenarios and polices implemented: the results will be discussed in order to show how adaptive policies enable macroeconomic equilibrium.

The main objective in the agriculture business environment is the quest for certainty and planning of the harvesting. The continuing need for workers for a product which is extremely perishable as the strawberry drives the recruitment and harvesting loops of our model. In Figure 4.1 we can see a very basic conceptual model that point out the overall problem that farmers face every agricultural season: recruiting enough workers to complete the harvesting. Keeping those loops balanced is the goal of farmers that seek for success business and return of investment.

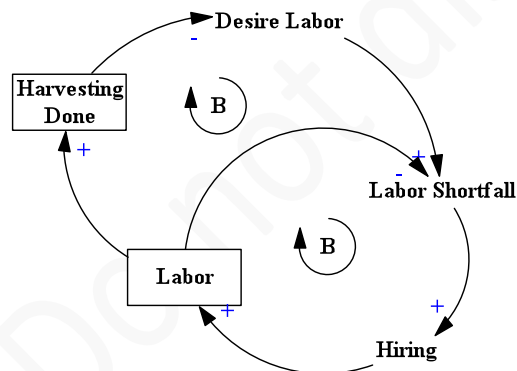


Figure 4.1: Harvesting and labor supply constitute the basic structure for the model on circular migration. Source: Authors. Solid arrows represent links of casual relationship. The polarity or sign (+ or -) determines if the independent variable cause an increase or decrease over the dependent variable respectively. The relationship between building blocks is governed by real-world phenomena. When linking several variable and closing the loop we can have either a reinforcing or snowball effect (R), as much we iterate bigger/smaller become the value of the variables on the loop, or balancing effect (B) where some variable absolve the change of others in every cycle. [44, 50-52, 71, 74]

The figure above contains two stocks or levels (variable surrounded by rectangles) and they represent the basic for the agriculture production: number of workers in the agriculture sector and number of harvesting task completed [53]. The plantation of the strawberry and citric is finalized in October and the harvesting starts approximately in January and finish as latest in June⁸. The decision to plant will depend on the result of the previous season and also on the availability of committed workers for the next year. Once the fruit is ready to be picked up, labor should be provided without delay. In the model in Figure 4.1 labor supply is simplified, however there are mainly two types of workers: local and immigrants with a temporary work permit. The main concern for farmers is the need for a sufficient harvesting rate according to weather conditions that make the fruit mature at unpredictable time. Farmers do not have

⁸ There are variations depending on climate factors.

preference about who pick up the fruit; they just need committed workers able to finish the harvesting either early in May or late in June according with the weather conditions.

Next we will describe the stakeholders and variables used to model the circular migration process. We will use them to map structure and feedback processes of the management of agricultural labor supply in the province of Huelva.

4.1. Stakeholders

Before mapping the different variables involved in the circular migration process, a brief description of the stakeholders is provided in Table 4.1. It is evident that such an initiative requires an important collaboration among multiple parties at different levels of government and non-government organizations.

Table 4.1 Stakeholder descriptions

STAKEHOLDERS	DESCRIPTION
ANAPEC	Morocco's National Agency for the Promotion of Employment and Skills: they pre-select candidate to be hired in origin by Huelva farmers. ANAPEC coordinate with FUTEH and Spanish visa department in Morocco.
COALITION OF MUNICIPALITIES	Group of agricultural municipalities in Huelva which every year need a larger quantity of foreign labor force for the strawberry and citrus fruit cultivations. For instance: Beturia
FUTEH	Foundation of foreign workers in Huelva: circular migration Management Program Office. FUTEH coordinates action among all stakeholders.
NGOS	Labor Integration Program Foundation. This non-government organizations aims to improve the employability and access to the labor market and facilitate the maintenance and quality of employment of the immigrant population. They also support immigrants in Health and other Social issues.
SAE	Andalusian Employment Service
EUROPEAN UNION	EU Funding: The Social European Fund provides fund under the European Pact on Immigration and Asylum.
UNIONS	Trade Unions, supervising labor conditions at work (i.e. CCOO, UGT, etc.)
COMI	Huelva's Commission of Municipalities with Immigration
REPRESENTATIVES OF CITY COUNCILS WITH IMMIGRATION	Representatives of city councils with immigration. At least there are 15 municipalities involved
IMMIGRATION OFFICE	Representative of this office specialized in dealing with Visas.
AENEAS AGENTS	Experts in the Aeneas / or other projects dealing with circular migration
FARMERS ORGANIZATIONS	Farmers' organizations that promote circular migration and select personnel in third countries. They represent small farmers.

4.2. Variables in the system dynamics model

In the modeling process we begin by identifying variables, stocks and flows based on stakeholder interviews and secondary sources. In Table 4.2 we describe three variable types in stock-and-flow diagrams: stock variables, flows variables and auxiliary variables [44, 55].

Table 4.2 Variables used in circular migration system dynamics model

Stock (Level) variables	Description
Guest Agricultural Workers	Number of guest workers available and ready to travel to Spain
Local Unemployed Workers	Number of local workers registered as unemployed
Agricultural Workers	Number total of workers (local and guest) hired by farmers
Other Sectors Local Workers	Number of local workers hired in service/construction sectors
Flow variables	Description
Contracts in Origin	Spanish governmental instrument designed to recruit non-EU origin agricultural workers
Voluntary Return	Workers contracted in origin must return to their home country once the harvesting is done
Pre-selection	Employment office in the home country selects the candidates for the circular migration program. They will be waiting with a temporary work visa to be hired by farm employers
Hiring Agriculture	Rate of hiring local unemployed workers in the agriculture
Attrition Agriculture	Rate of attrition in the agriculture by locals workers. It can be because the harvesting season is finished or because local workers found another job in the tourism sector for example.
Hiring Other Jobs	Rate of hiring of local workers in service/construction sectors
Attrition Other Jobs	Rate of attrition in the service and construction sector (e.g. in the tourism sector at the end of the summer most of the workers finish their temporary contract)
Hiring Illegal	Rate of hiring workers without work permit during the harvesting. Season
Illegal Entry	Immigrants that decide to cross illegally the border
Deportation	Illegal immigrants those are caught and deported
Escape	Guest workers do not voluntary return to their home country after harvesting.
Voluntary Return of Illegal	Illegal immigrant that voluntary return (e.g. financial crisis)
Auxiliary variables	Description
GDP	Gross Domestic Product as a measure of the financial crisis effects
Pressure to Prioritize Agricultural Jobs to Locals	The government reduces the number of temporary work visas in order to give priority to agriculture jobs to local workers
Planted Hectares	Number of hectares planted (normally during October and November)
Pressure to Farmers to Hire Local Workers	Effort spent in convincing farmers to hire local workers instead of guest workers
Farmers' Fear of Running Out of Workers	Percentage of farmers willing to decrease plantation next year as a consequence of the perception that without enough guest workers the

	harvesting will not be done
Relative Attractiveness of Agricultural Jobs	Attractiveness of agriculture jobs among local population relative to jobs in the service and construction sector
Employment Creation	Service and construction sector new job creation

4.3 Model structure

The basic structure of the circular migration system dynamics model is presented in Figure 4.2. It illustrates the people that flow from one stage to another in a rate determined by migration policies. In this part of the model we have identified the types of workers available which include immigrant workers (on the top) and local workers (on the bottom). Both contain stocks of people working in the agriculture industry. In the immigrant variables in the model we differentiate between legal immigrants (guest workers) and illegal immigrants. The guest worker program in Huelva is designed just to satisfy agriculture labor demand when the local labor supply is insufficient. Therefore, immigrants with temporary work permits can be hired into the agriculture sector to handle the increased demand. However, local workers⁹ can either work in the agriculture or in the service/construction sectors. Farmers control the number of employees by increasing or decreasing the inflow rate (variable attached to a valve and pipe symbols representing activity between two different stocks or levels) coming from the local agricultural workers stock. They also request the government to increase the number of visa authorizations for guest workers thus increasing the inflow of guest workers. Occasionally, when labor shortfalls occur, farmers take the risk of hiring illegal workers to address the immediate need. This is only a temporary solution because it jeopardizes the farmers' ability to participate in the guest worker program in the future by putting them at risk of immigration violations.

⁹ Remember that local workers here mean mainly two types of workers: nationals and immigrants with permanent work permits or without necessity of them after the last enlargements of the European Union in 2004 and 2007 (i.e. Poland, Romania, Bulgaria, etc).

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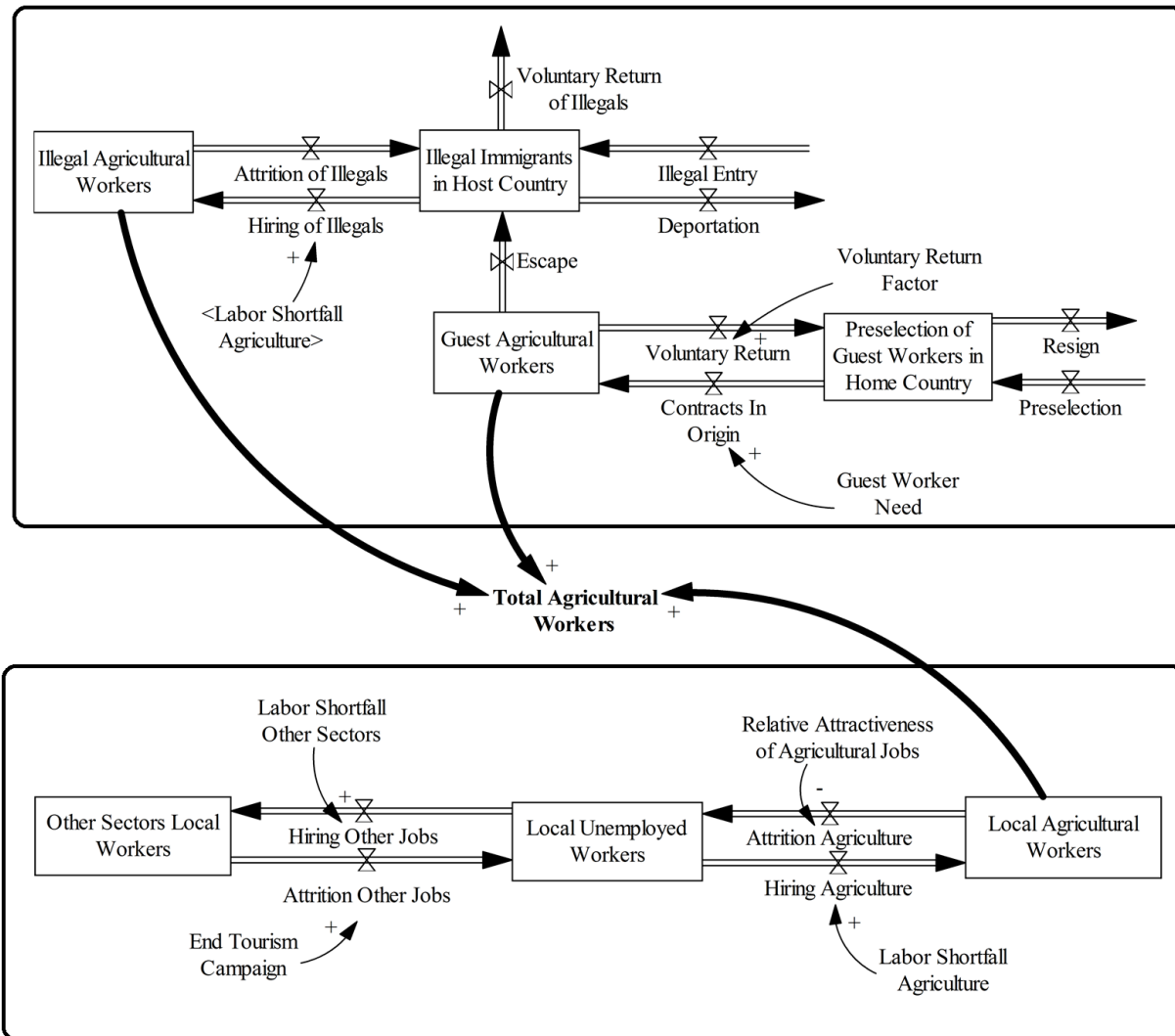


Figure 4.2: Model Structure

Before the development of the service sector took place in Huelva, local workers used to cover most of the labor need in the agriculture. However, after Spain became part of the EU, the province of Huelva began experiencing rapid development in tourism and construction sectors. As the service sector accelerated and more employees were needed, fewer locals wanted to work in farms due to hard work and low wages. To solve the problem of labor shortfall in the agriculture sector, and to avoid illegal immigration, implementation of contracts in origin strategies allowed to hire a large number of guest workers for the agriculture sector in Huelva. In addition to the hardness of the agriculture jobs, one of the more important problems was the overlap of the agriculture harvesting with the seasonal tourism activity, especially in coastal municipalities. Since strawberry harvesting takes place mainly between January and June (see Figure 4.3), and tourism season peaks between April and September, the overlap from April to June is significant. This overlap factor depends of climate conditions which is a parameter that we will modify during the simulation to illustrate the dependence to meteorological variables.

Table 4.3: Main agriculture season in the province of Huelva [56]

Season	Start-End
Strawberry Plantation	Oct-Nov
Strawberry Harvesting	Jan-Jun
Citric	Sept-July

During the financial crisis in 2008 the number of construction and service sector jobs decreased and, thus an overshoot in unemployment alarmed some local people who thought that circular migration program was an impediment to economic recovery. Forcing to stop hiring guest workers was not enough to decrease the local unemployment. Local workers that had been educated and got used to service sector jobs before did not find attractive agriculture jobs anymore. Also, farmers were still demanding guest workers arguing that local workers did not commit to finish the harvesting season until June because previous commitments with restaurants, hotel services jobs that increase with milder weather. Others, however, found it physically difficult to finish the harvesting season because of the hardness of the job. That created an additional labor shortfall, or at least farmers were afraid to experience the same labor shortfall that previous years ago before circular migration programs existed. This reaction of farmers made some of them plant much less that previous years if the local government did not guarantee a minimum number of guest workers [39]. As we will show later, this is one side of the effect that proponents of circular migration programs try to avoid. By implementing national policies that eliminate circular migration programs, it is unclear whether in the long run more jobs are available to local workers. If we consider the side effect of a plantation reduction because farmers fear of running out of available workers, then we can argue that these policies have a counterintuitive behavior because in the long run less job could be available for locals.

Instead of completely eliminating circular migration programs, proponents of its implementation in Huelva decided to apply two policies simultaneously:

- a. Encouraging farmers to hire local workers instead of relying on the number of guest workers for the next harvesting (that keeps the program alive while providing a responsible social practice for farmers to hire locals. Also this eliminates uncertainty in farmers by providing a steady supply of available labor)

- b. Increase the attractiveness of agricultural job among the population, and foster commitment of local workers to finish the harvesting season (that will decrease the number of abandonment in the middle of the harvesting).

The agriculture industry also looked for integration and future planning of human resources. After the two policies came into effect, industry played a more active role in communicating with social agents and governments to identify labor demand and forecast future demand depending on certain time periods and sectors. Industry became truly committed to their joint success with society and the country [57].

As the Chairman of the Huelva's Commission of Municipalities with circular migration declared when we were showing him the benefits of their policies: 'it is necessary to maintain circular migration working even with a little activity because it keeps international relationships active [58, 59]¹⁰, build trust with immigrants, prevent the future in case of high economy activity, and have a backup in case tourism season start early' April. At the beginning of the plantation period of the strawberry and citrus fruit cultivations in October (see Table 4.3) farmers have to forecast how many acres are going to plant that year. This decision is mainly based on the forecast of availability of workers. At this point the number of Visas committed by the government to offer to guest worker is critical. Even though the employment office announced to farmers the availability of a large number of local workers listed as unemployed, due to previous experience, farmers perceive this labor supply as not committed to finish the harvesting and thus decide to decrease the plantation if the government do not provide a minimum of guest workers.

During the financial crisis, where the agriculture industry played an important role in the economy, a decrease in the number of acres planted became an additional problem. For this reason the system dynamics model shows a gap between the surplus of local unemployed workers that do not wish to commit to finish the harvesting season, and a reduction in the number of visas to guest workers. Figure 4.3 provides the casual loop diagram that describes this behavior over time creating a reinforcing loop. The Causal Loop Diagram (CLD) that relates the variable identified above, explains our dynamics hypothesis. The CLD communicates the essence of the structure and highlights the most important feedback responsible for dynamics of this particular system. The model is relatively simple, but captures the key drivers of project dynamics. If the labor is supplied and the harvesting is finished successfully, then farmers decide to increase the subsequent year's plantation. However, if local workers do not finish the harvesting season, farmers experience decrease in sales and react by reducing their forecast for next year. Another factor important in the model is the reaction of farmers to reduce plantation, even when the sales are going well, when the authorization of visas to guest workers is reduced. That drives down plantation and thus reduces the need for workers and the reinforcing loop creates a dynamic where the harvesting and need for workers jointly decrease. Finally local unemployed workers are affected by this over protection of local employment by the effect of reducing the number of acres, and a decrease in business in other sectors.

¹⁰ This is very important, and do not forget the international scenario with international political conflicts between Morocco and Spain –Ceuta, Melilla, Saharais... [58,59].

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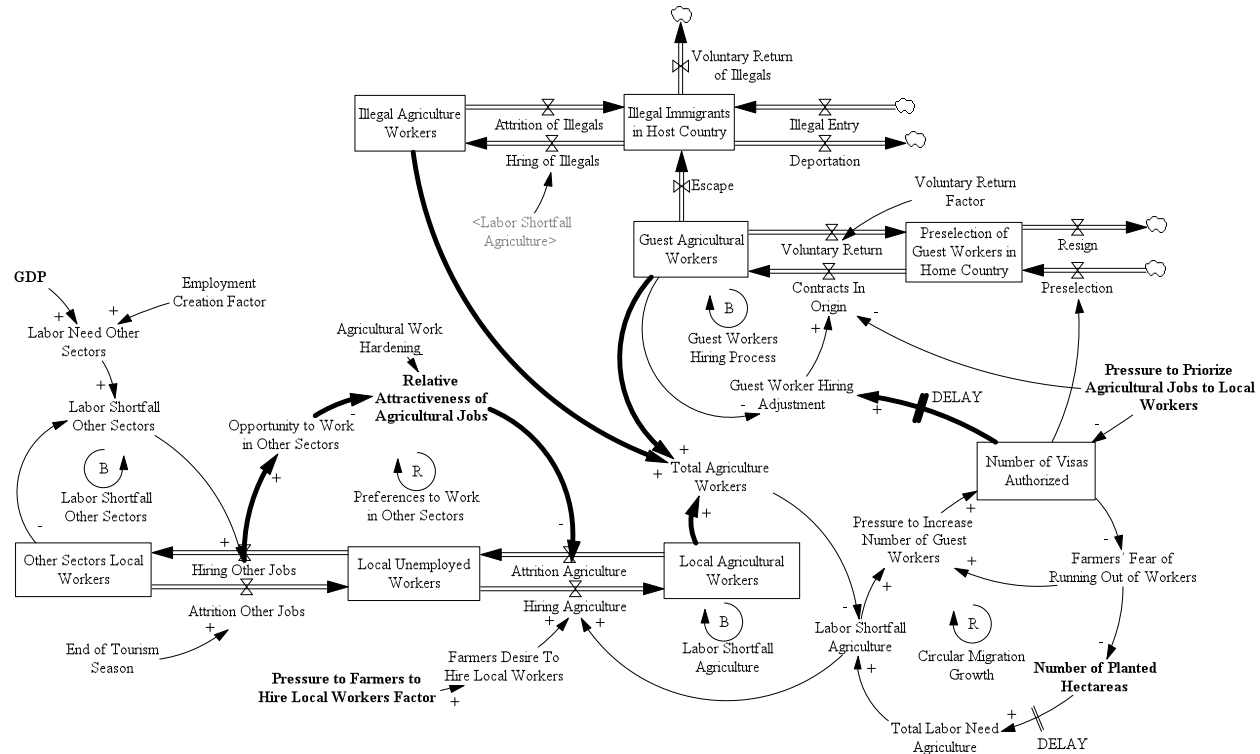


Figure 4.4: Model structure and feedback processes

In figure 4.4 we observe two important feedback reinforcing loops: one of them drives an exponential growth on the number of immigrants. As farmers get used to this type of labor force they tend to continue using it. We can also observe that increasing the number of guest workers decreases the labor shortfall. However, it also decreases the number of local agriculture workers, and thus increase the number of local unemployed workers. Controlling the number of guest worker visas authorized every year appears to be a significant variable in this reinforcing loop that can balance and avoid side effects. Also in the diagram we can see another reinforcing feedback loop as the one that enables a high flow of people from agriculture to service and construction sectors. According to the calibration of this model, and assuming that the overlap of harvesting season is between April and June, this high flow rate created a labor shortfall in the agriculture industry (some farmers use this experience to justify their decision to hire only immigrants – legal or illegal).

Another interesting effect that can be observed from the simulation is the residual labor shortfall. In the more flexible scenario where we have unlimited unemployed workers and relative attractiveness to work in farm is the unit (there is no preference to work in farms or service sector). In this case because the time to hire people takes one week, there is a residual labor shortfall. Sometimes this creates awareness in the farmers and creates oscillations similar to the bullwhip effect created in supply chain with inventory[62]. To minimize this effect one recommendation is to use pre-selection also with local workers. With respect to guest workers, Visa processing at the Spanish consulate in home countries has to respond quickly to satisfy the supply for immigrant labor force just for harvesting. All of those factors and the numerous policies together with their implementation are what make the case of Huelva unique in terms of social innovation.

4.4 Simulation results from the circular migration system dynamics model

Finally demonstrate the calibration of the circular migration system dynamics model based on the interviews with stakeholders that provided clarification and corrections to some of the loops. Via exogenous variables, and systematic comparison of model outputs we executed changes in structure, parameters, correcting the data, and decisions to ignore (sometimes using exogenous effects).

For the simulation we assumed that the need of workers was 60,000 workers for the harvesting season starting in January and ending in June. The service/construction season will start however in April and end in September the demand will increase to 60,000 workers as well. Because of the 3 month overlap, both sectors will compete for workers during situations of economic growth.

We simulate four scenarios introducing diverse inputs that illustrate the dynamics and response of the system. The first one represents good economic conditions where there is not circular migration (guest workers factor=0), but with high rejection to work in the agriculture industry (relative attractiveness=1.9). The second one we introduce the guest worker program. The third scenario we include the financial crisis effect by decreasing the GDP variable and we suspend the circular migration program. In the fourth scenario we re-open the circular migration program but more conservatively while increasing the attractiveness of agriculture jobs among the local population. For this simulation we will not include effects of illegal migration.

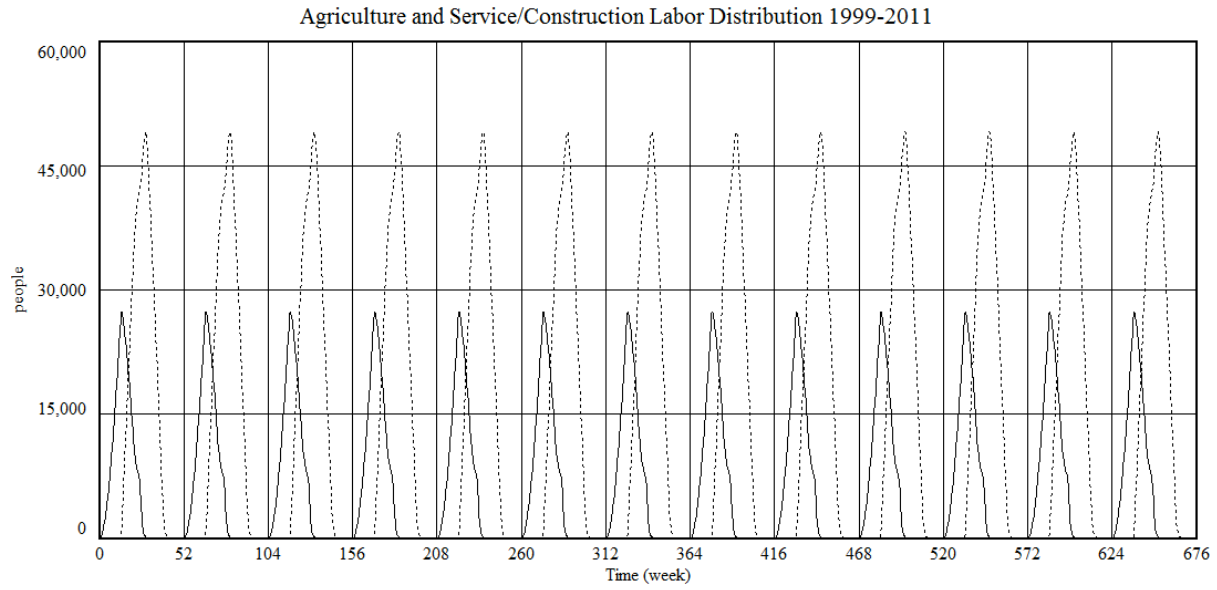
Table 4: Four scenarios for the circular migration simulation

Simulations	Gross Domestic Product	Relative Attractiveness	Guest Workers Factor	Initial Number of Unemployed Workers
Scenario A	1	1.9	0	50,000
Scenario B	1	1.9	1	50,000
Scenario C	0.5	1.9	0	50,000
Scenario D	0.5	1.5	0.5	50,000

As mentioned before, there is a relative attractiveness factor of working in the agriculture industry that will tend to make unemployed workers decide to wait for opportunities in other industries rather than taking the first available agricultural job. Setting this parameter high (1.9 which we assume that 90% of the workers prefer to go to other jobs) we observe in Figure 4.5 (a) how over the last 13 years how other jobs are filled but agriculture jobs are not. Two main characteristics in this graph are that both sectors only compete for workers during the overlap months (April to June). However we see that having enough available local unemployed workers during the months of March-April only 28,000 local workers are in the agriculture industry. This effect is produced by the lack of attractiveness of agriculture by local society. In Figure 4.5 (b) we can observe the same effect but considering the year 2008 (the model has been simulated considering one time unit to be a week). In 2008 simulation we observe the labor shortfall in the agriculture industry. Also we observe how the initial period of service and construction jobs season are also affected by the competition for workers and the adjustment they need to hire new workers.

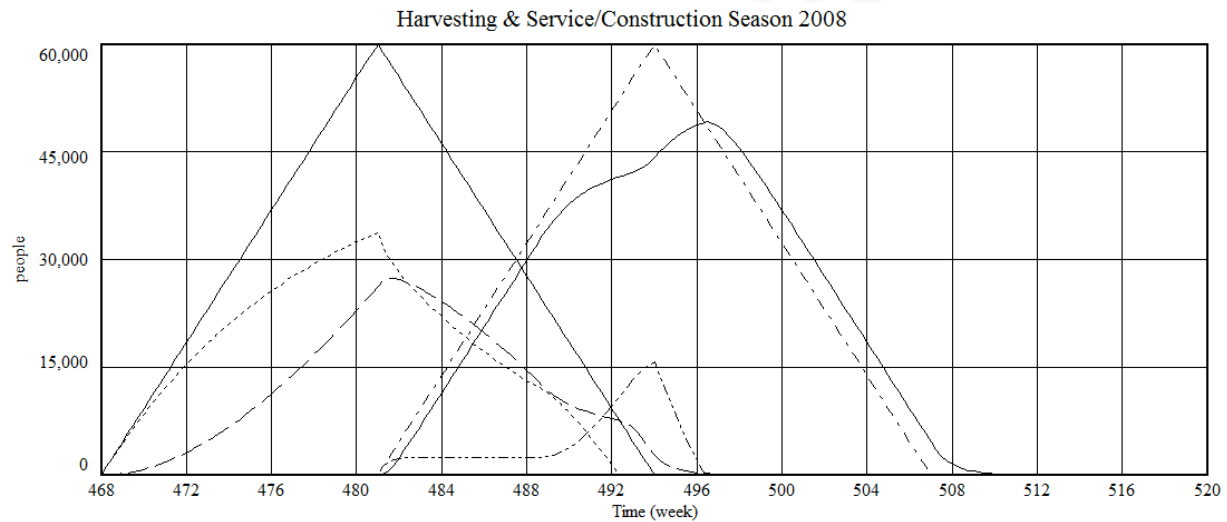
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Total Agriculture Workers : GDP=1 Attrat=1.9 Guest=0
 Other Sectors Workers : GDP=1 Attrat=1.9 Guest=0

(a)



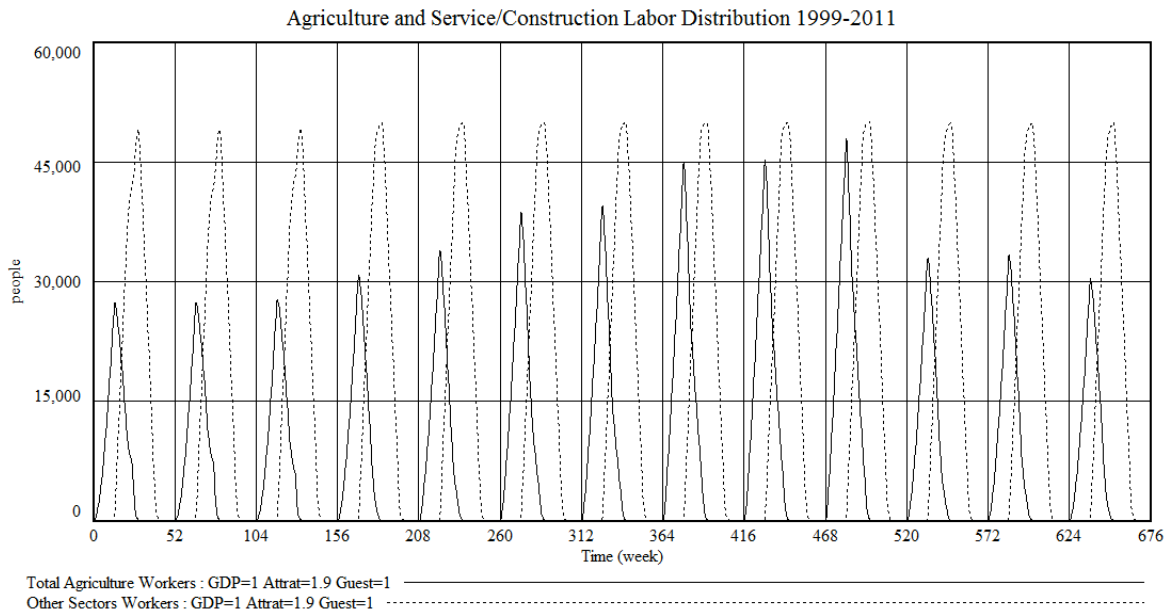
Total Labor Need Agriculture : GDP=1 Attrat=1.9 Guest=0
 Labor Shortfall Agriculture : GDP=1 Attrat=1.9 Guest=0
 Local Agricultural Workers : GDP=1 Attrat=1.9 Guest=0
 Total Labor Need Other Sectors : GDP=1 Attrat=1.9 Guest=0
 Labor Shortfall Other Sectors : GDP=1 Attrat=1.9 Guest=0
 Other Sectors Workers : GDP=1 Attrat=1.9 Guest=0

(b)

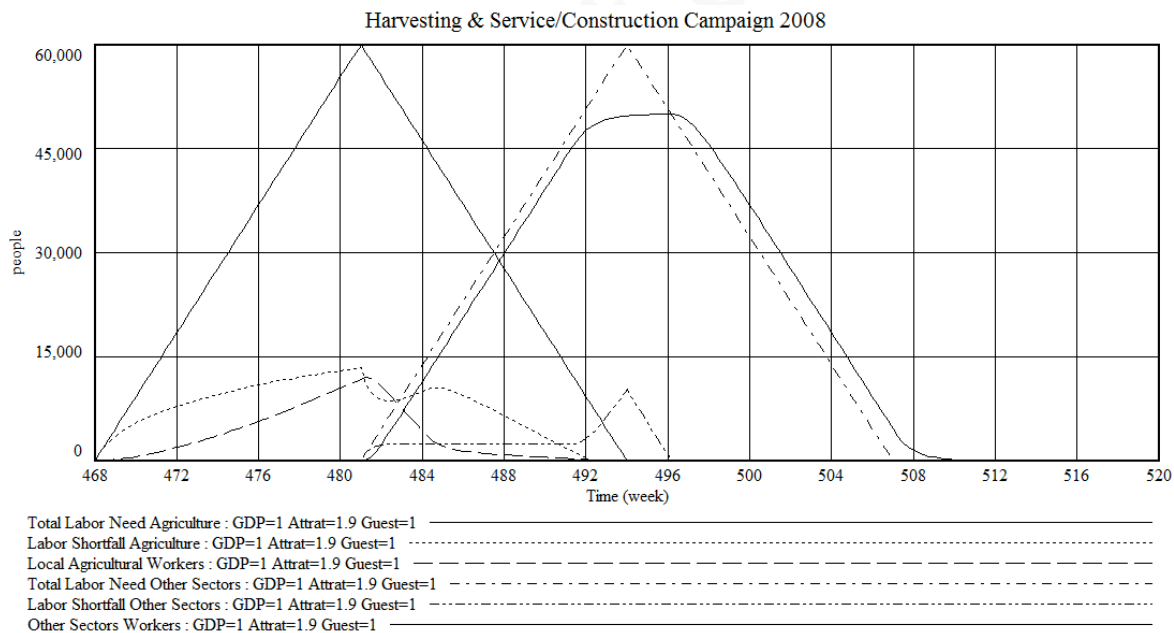
Figure 4.5: Scenario A simulation for a period of 13 years: 1999 – 2011 (a): and year 2008 (b).
 Relative attractiveness=1.9 and GDP=1. Guest Worker Factor=0

In the next simulation (Figure 4.6) we include guest workers to see how the agriculture shortfall decreases according to the number of contracts in origin authorized for that specific year. In this simulation we observe how circular migration not only reduces labor shortfalls in agriculture but

also accelerates the service and construction seasons (having more available local workers makes the incorporation to this sector easier).



(a)



(b)

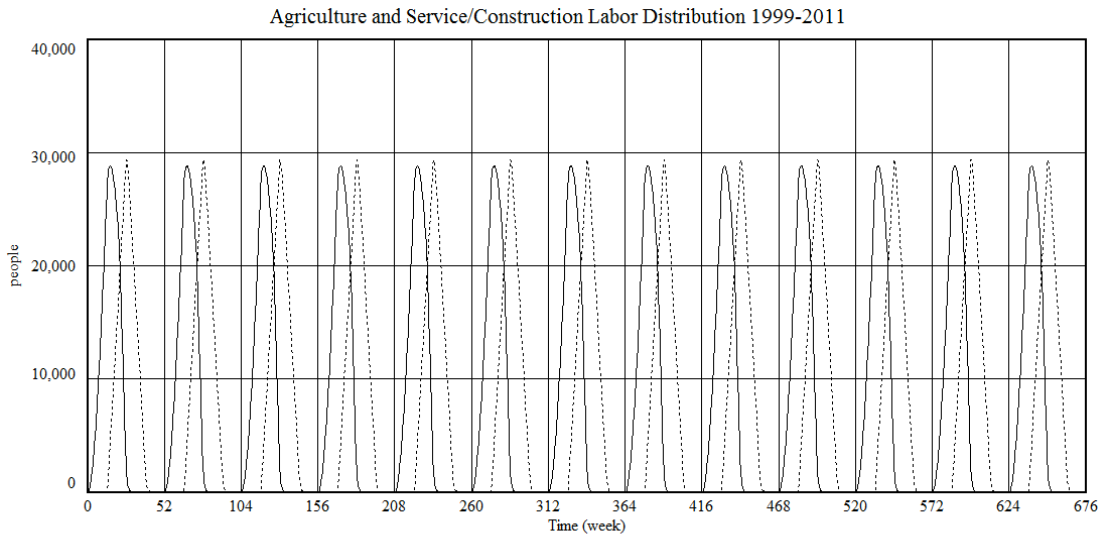
Figure 4.6: Scenario B simulation for a period of 13 years: 1999 – 2011 (a): and year 2008 (b). Relative attractiveness=1.9 and GDP=1. Guest Worker Factor=1

In scenario C simulation results (Figure 4.7) we include the effect of the financial crisis GDP=0.5. We can see how service and construction jobs decrease. In this simulation we suspend the circular

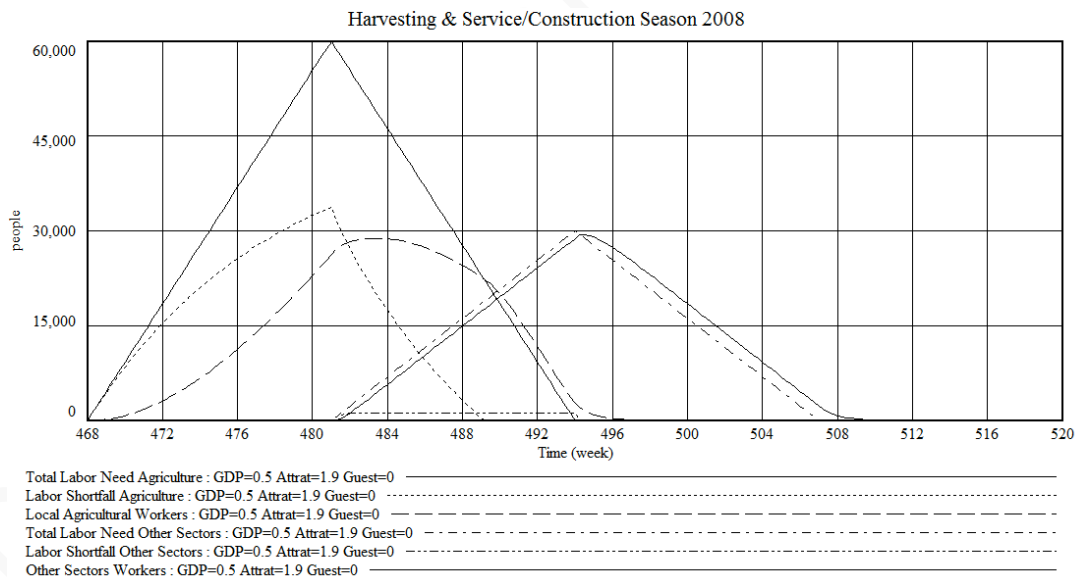
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migration program (guest worker=0). However we can see the side effect of the policy. Stopping guest workers from the agriculture industry does not decrease the number of local unemployment. What happens is that a labor shortfall emerges in the agriculture industry introducing uncertainty in this sector and motivating farmers to decide to plant less the next year.



(a)



(b)

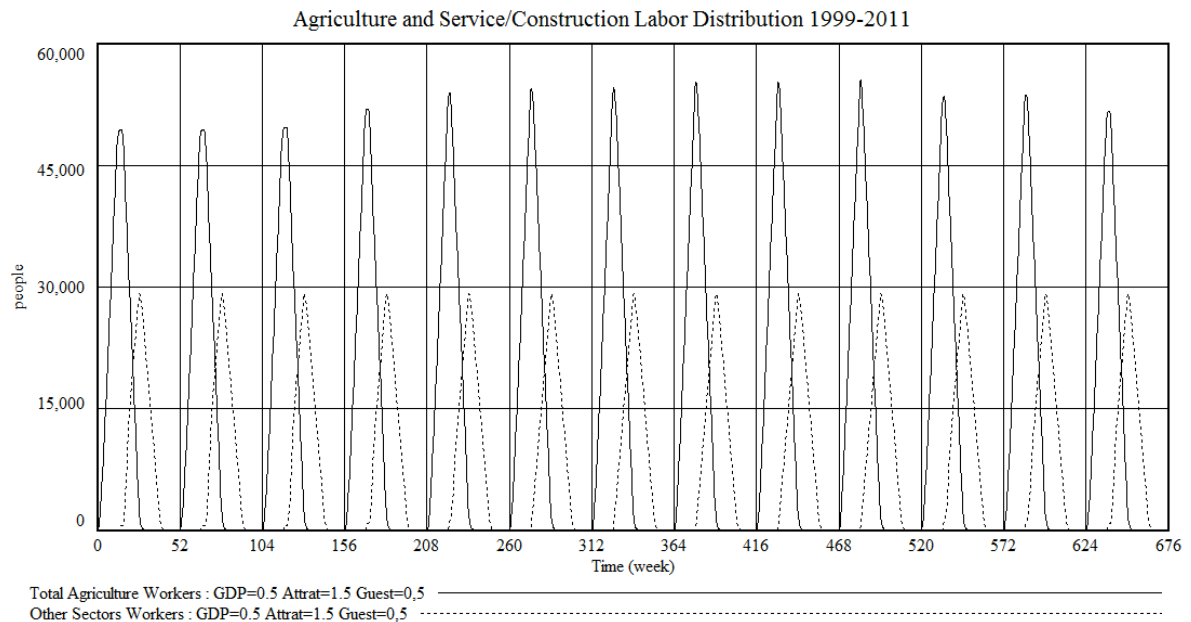
Figure 4.7: Scenario C simulation for a period of 13 years: 1999 – 2011 (a): and year 2008 (b). Relative attractiveness=1.9 and GDP=0.5. Guest Worker Factor=0

In Figure 4.8 we see scenario D where we simulate the policies applied by managers in the circular migration program in Huelva (maintain guest worker program to 50% and increase the

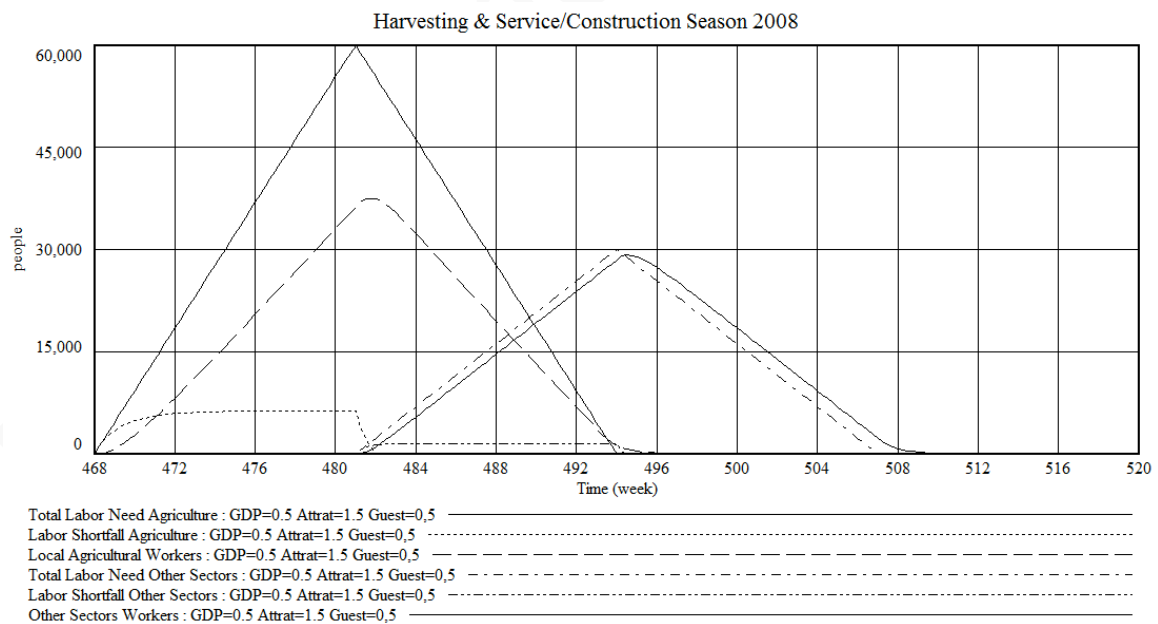
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attractiveness of agriculture jobs while encouraging farmers to hire locals). The result is that the agriculture labor shortfall decreases by having guest workers. This represents a compromise that allows guest workers and locals to work in the fields, providing a more robust employment structure to support the agriculture industry.



(a)



(b)

Figure 4.8: Scenario D simulation for a period of 13 years: 1999 – 2011 (a): and year 2008 (b). Relative attractiveness=1.5 and GDP=0.5. Guest Worker Factor=0.5

5. Analysis/Discussion

The economic system has been stressed during a recent recession leading to unpredictable behaviors. At the time when the number of unemployed increased, local administration experimented for the very first time the benefits of having a circular migration program. Because every year immigrants return home after the harvesting, there is not risk of them staying illegally. That made possible the reduction of the number of contracts in origin prioritizing the job in farms for local workers. In Figure 4.5 we observed that decreasing the number of temporary visa to foreigners the number of farm jobs filled by local increased, thus reducing the number of local unemployed workers. However, this policy needs to be applied in combination with others since agriculture hiring rate of locals depend on the attraction of agriculture jobs (see Figure 4.4).

In Huelva we observe that even during a period of financial crisis, local unemployed workers that have unemployment benefits or at least family economic support prefers not to work in farms and wait for later employment offer in the construction and service sector. The tourism industry in the province of Huelva hires a large number of locals from mid April until September. That creates an important problem for farmers that need to balance labor supply that is influenced by restrictions on visas for guest workers and a lack of commitment of local workers that abandon agriculture jobs in the middle of the harvesting for better paid jobs in other industries. In order to avoid this situation where farmers cannot hire legal immigrants nor committed local workers to finish the harvesting until June, local administration decide to guarantee a minimum number of visas to guest workers, and foster commitment from local workers. For the season of 2010-2011, 5,500 visas have been authorized according to an interview with Millán, Chairman of the Committee of Municipalities with circular migration in the province of Huelva. That creates a controversy among society that thinks that employment should only be given to the locals who are unemployed. The complexity of the behavior in agriculture labor supply, together with policy makers' ability to negotiate with farmers, should motivate the need for a stable forecast of future guest worker visas.

Other implications of a collapse in the number of guest workers are the decrease in health care assistance on those towns who during high population period enjoy extra service hours (those services were over dimension in order to increase the acceptance of high population and avoid social conflict in the local population) [60,61]. Another negative effect on the decrease of foreign population is the decrease in sales of local business (by the effect of reduction of consumption with less people residing during several months in these municipalities). A key factor to consider during a drastic reduction of the immigrant populations is the delicate international relations with the sending country [58, 59]. Voluntary return is being developed successfully since the receiving country commit to hire them next year. However this decreased in the number of visa created in 2008 distrust. Other possible consequence is the development of the agriculture in sending countries.

Many efforts and policies are made in order to calm down society and stakeholders during that strong change in behavior, and be ready to reactivate the migration flow after the economy recovery. There is a strong social awareness of the necessity of migrant workers, and the conviction that local workers will again abandon the fields is crisis decreases.

There are three important policies that make circular migration program a success: Strong collaboration among stakeholders, a well designed housing network for guest workers provided by farmers, and guaranties of return to home countries [39]. Nevertheless, it is necessary not to forget social implications of this recruitment and prevent the effects of possible accumulative future negative loops. Though we have focused on social innovation at the management of circular migration, and we have considered this case as a success one from the perspective of the supply of workers –JIT-, and by the induced effects on economy, consumption and etc., in future developments of this work we must assess the importance of other social consequences of implementing circular migration. This is a completely different issue.

Some social actors of rural municipalities specialized in strawberries, through social discourses; express negative ideas about the way in which the recruitment is organized: Why the season has shifted only to hire women? Is there some kind of discrimination here? What about the effects of hiring only women for the societies at origin? Are they hired only for the strawberry recollection or for other hidden works? Not forget that European markets are very sensitive to racism, xenophobia, discrimination, and so on, and a bad press (as it was in the case of the El Ejido in Almeria, several years before, in the same Andalusian region) [63] could produce accumulative negative effects, having effects on the economy of this area, and questioning the model for the future. Other point is the necessity of reinforcing the focus on integration, but adapting integration policies to the time of the harvesting season.

In this paper we have built a model based on the dynamics of a particular implementation of circular migration program in Southern Spain. The model illustrates how a financial crisis can stress a well design system and put in risk its sustainability. Also we have included in the model mitigation policies implemented by stakeholders in order to correct behavior during difficult economical periods. Those policies are better understood using the model and provide insight about additional adjustments than can be make in the future as changes occur.

The model also provides implementation guidelines for to other agriculture regions throughout for the implementation of similar labor supply management. Based on the case of Huelva and the different dynamics experienced during previous years, other governments could. The model would provide an easier understanding of the factors and iterations to stakeholders that seek for this solution to labor supply while avoiding illegal migration. Even though circular migration is fostered by the European Pact on Immigration and Asylum [64] in order to help managing legal migration and controlling irregular migration, many regions in Southern and Easter Europe countries have not developed it yet due to its complexity. Because good practices in circular migration require accumulating experience¹¹ [65], playing with the model can help not only to countries in Europe that face agriculture labor shortfall, but also countries in Africa that would benefit from having remittances without risk in drain brain. In words of the Chairman of the Committee of Municipalities with circular migration in the province of Huelva Millán ‘without a methodology, they [circular migration stakeholders in other setting] would most probably need to go through the entire process that Huelva experienced during the last 20 years in order to benefit for a well implemented circular migration program’.

Our model highlights the importance of international cooperation between source and host countries. Past experiences in circular migration in Southern and Easter Europe countries [66] show the circular migration is not a tool that serves only host countries. As we can see in the model, the collaboration between EU and employment offices in source countries is what makes the program success visas,

¹¹ Learning by doing is also a dynamic process [65]

governmental, employers, NGOs. In the case of Huelva, previous experience with Senegal demonstrated this. Due to the corruption from the employment office in this country that benefits certain citizens made this implementation fail. However the case of Morocco is an example of how the receiving country can help origin administrations improve their systems. Morocco's National Agency for the Promotion of Employment and Skills (ANAPEC) [67] as a result of the partnership with Huelva has experienced fast growth and professionalism. The result is the creation of four regional agencies focuses on opportunities for guests in Europe (job offers from European employers received and processed and the pre-selection of potential candidates). This comprehensive partnership must be created with non-EU countries of origin and transit in order to encourage synergy between migration and development, and in the long run avoid brain drain.

Another important factor to consider when implementing a circular migration program is the availability of housing during the harvesting season. In previous years some immigrants decided to invest in the purchase of a house and that create settlements. Now the managing office of the program requires farmers to provide good housing conditions to Guest workers when applying for this type of labor.

Finally, the voluntary return of migrants is fundamental for the success of the program. During the season of 2010 in Huelva, 87% returned to their home country after the harvesting season [39]. To these three main factors we have included in our model the important coordination between FUTEH and the Andalusian Employment Service (SAE). A circular migration program could not be successful if a management association such as FUTEH coordinated all activities among the stakeholders. This configures a mobility management service that focuses on the logistic of the labor population mobility. Transportation and visa processing play an important role that require coordination with the Spanish consulate in Tanger and police authorities in Algeciras in order to be able to proceed with the entry of a large number of people. One of the issues that concern the countries of origin governments is brain drain. However during the pre-selection of the workers, ANAPEC and FUTEH work together in order to avoid the loss of skilled workers.

As we stated before, immigration is intimately linked to economic trends between regions of the world. At the same time there are global economics factors able to shape different regions and industries [68]. For that reason another consideration that we can see in our model in the character of co-development, where in the case of Huelva many of the workers gained enough skills to have the opportunity, at least in some cases, to start their own business once they return to their country of origin. The remittance together with the opportunity to get exposure to innovative agriculture and additional educational programs provided to guest workers an opportunity to personal development.

Even though the model has some limitations in terms of factors and policies implemented, and also the assumptions considered in order to calibrate it, it can provide a better understanding of circular migrations processes. The use of the model can help to overcome the limitations in decision makers' intuition about the complexity in seasonal labor management and their often incorrect mental models. The resulting insights are intended to help policymakers and other stakeholders in circular migration better understand complex multicause and multieffect relationships.

6. Conclusions

This paper explored how a seasonal labor management program responds in a period of economic crisis. The circular migration program implemented in Huelva served as a fruitful example of social innovation that was driven by multi-stakeholder collaboration to match the labor demand to the labor supply in the agriculture sector. Different policies applied during the last 20 years show the experience of this pioneering program in Europe that continues improving and extending to other countries. There were three important policies that made the circular migration program a success: Strong collaboration among stakeholders, a well designed housing network for guest workers provided by farmers, and guarantees of return to home countries.

However, during the financial crisis this program was almost canceled due to the perception that it could slow down economic recovery. With a system dynamic approach this research provided a mechanism to analyze different strategies considered during the crisis to make the program sustainable. The models also identified key factors to implement a robust program, and can serve as a guide for further implementation in other regions in Europe. The model also would be very valuable to stakeholders in other countries in Africa and East Europe interested in implementing circular migration. Local administration policies and initiatives to foster local hiring among farmers together with strategic international collaboration make this program success even under economic stress and social pressure. It effectively evolved from labor supply from Easter Europe, African, men and women and back to local labor supply. We also simulated the importance of relative attractiveness of agriculture jobs and showed how this affects labor shortfalls even in financial crisis periods.

ACKNOWLEDGEMENTS

This work has been enriched through the discussion with several colleagues and experts in the areas of Systems Dynamics, Sociology, Economics and Geography. Special mention goes to David Keith, John Lyneis and Stefan Grösser (MIT Sloan System Dynamics Group); José Andrés Domínguez Gómez (University of Huelva, Spain, Sociology), Iván Rodríguez Pascual (University of Huelva, Spain), Verónica de Miguel Luken (University of Málaga, Spain). Special thanks to Juan Luis Pérez Molins (FUTEH) for his valuable feedback during the modeling process, and Manuel García (FUTEH) and Juan Millán (Chairman of the Committee of Municipalities with circular migration in the province of Huelva) for facilitating data to this research.

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8. Vitae

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