

Using System Dynamics to Analyze Social and Economic Challenges in Myanmar

Abstract

Three years ago Myanmar, also known as Burma, experienced a historical transition from a dictatorial military-led government to a civilian one. The newly established government has repeatedly expressed its intentions of opening up to the world after decades of seclusion resulting from long-term economic sanctions imposed mostly by western countries. Within this context, this study describes the results of a system dynamics model commissioned for democracy leader Aung San Suu Kyi by the CEO of one of Myanmar's biggest importers of heavy machinery to investigate the implications of an agricultural vs. an industrialized economic model for the country. Overall, model results suggest (1) demographic dividends from the working-age population segment should be sized immediately before this population segment gets old, (2) even aggressive investments in education will not be enough to build the large stock of high-skilled labor the country demands, (3) investments favoring big mechanized farms will result in low wages both in the agricultural and industrial sector, and (4) investment in manufacturing does not by default connect to high wages as expected. Although this study was conducted throughout a 2-week period, it produced insights that raise questions about the way Myanmar is laying out its new economic model for the future.

1. Introduction

“Myanmar is now in a transition period—what development direction are we going to take?”

Myint Zaw, Environmentalist
Bloomberg Businessweek, 2014

Rich in a variety of natural resources, among them the world's most precious rubies and jade stones, Burma or Myanmar remains by far the poorest country among ASEAN member states suffering from continued isolation and poverty since the military junta led by General Ne Win took power in 1962. In the late 1990s, the United States, Europe, and Japan imposed economic sanctions against this country based on evidence of the government's recurrent human rights violations that included land confiscations, arbitrary arrests of political opposition members, attacks to unarmed civilian of ethnic minorities, and the use of torture in places of detention.

Despite a long history of autocratic rule and widespread repression, slight changes in favor of democratization have sprouted throughout the last three years. In late March 2011 a new

civilian government led by president Thein Sein took place, and in April 2012 forty-three members of Nobel Peace Prize winner Aung San Suu Kyi’s National League for Democracy (NLD), including her, took parliamentary oath at office, marking a pivotal milestone in the history of the country. Although the military junta ceded power two years ago, serving and retired military officers still dominate government as well as civil service seats at all levels and run an extensive network of state economic enterprises and government-organized nongovernmental organizations (Pedersen, 2011). However, in spite of the widespread concern that the country is rather transitioning to a “military-run capitalism,” moves favoring change such as more open foreign investment laws and the establishment of a special economic zone have already materialized.

It is within this context of political and economic uncertainty that we were asked by the CEO of one of Myanmar’s biggest importers and sellers of heavy machinery to build a system dynamics model that could help decision makers in the country have a broader perspective on the challenges they would probably had to face in the upcoming years. Back in 2012, we were working in the country and were witnessing first hand all the changes that were taking place including the first ever ATM machine to accept international payment cards, the dramatic reduction in SIM card prices, among others. Our contact person had close ties to Myanmar’s democracy leader Aung San Suu Kyi and this is why model results were particularly commissioned for her. The project was rather urgent and so we were given only 2 weeks to complete it.



Figure 1 Myanmar’s geographical location

2. Objective

This study was aimed at fostering widespread discussion about key economic and societal issues in Myanmar, improving understanding of key dynamics, and ultimately encouraging a concerted effort among key decision makers in the country to thoughtfully evaluate the

implications of the different development paths Myanmar could adopt in the years to come as it transitioned to a new historical era. Because the speed at which political and economic reforms are being pushed is extremely high, coupled with the limited policymaking capacity of government staff and its poor and old inherited infrastructure and institutions, critical decisions tend to be ad-hoc and not thoughtfully designed (Crisis Group, 2012). Therefore, a study of the implications of possible roadmaps for reform is deemed necessary.

3. Report

The final report for this study was assembled in the form an A3 format pamphlet comprising a small project introduction, a causal loop diagram, insights by subsector, and a stock and flow diagram with simulation results from 3 investment scenarios. Though we were notified Ms. Suu Kyi had received and analyzed the material, we will never know for sure which her reactions were and the extent to which the project insights proved informative and/or valuable for her.

4. Model subsectors and causal loop diagram

The model explores 5 different subsectors including demographics, rural-urban migration, education, agricultural, and industrial development. Below a short description of the model's main dynamics.

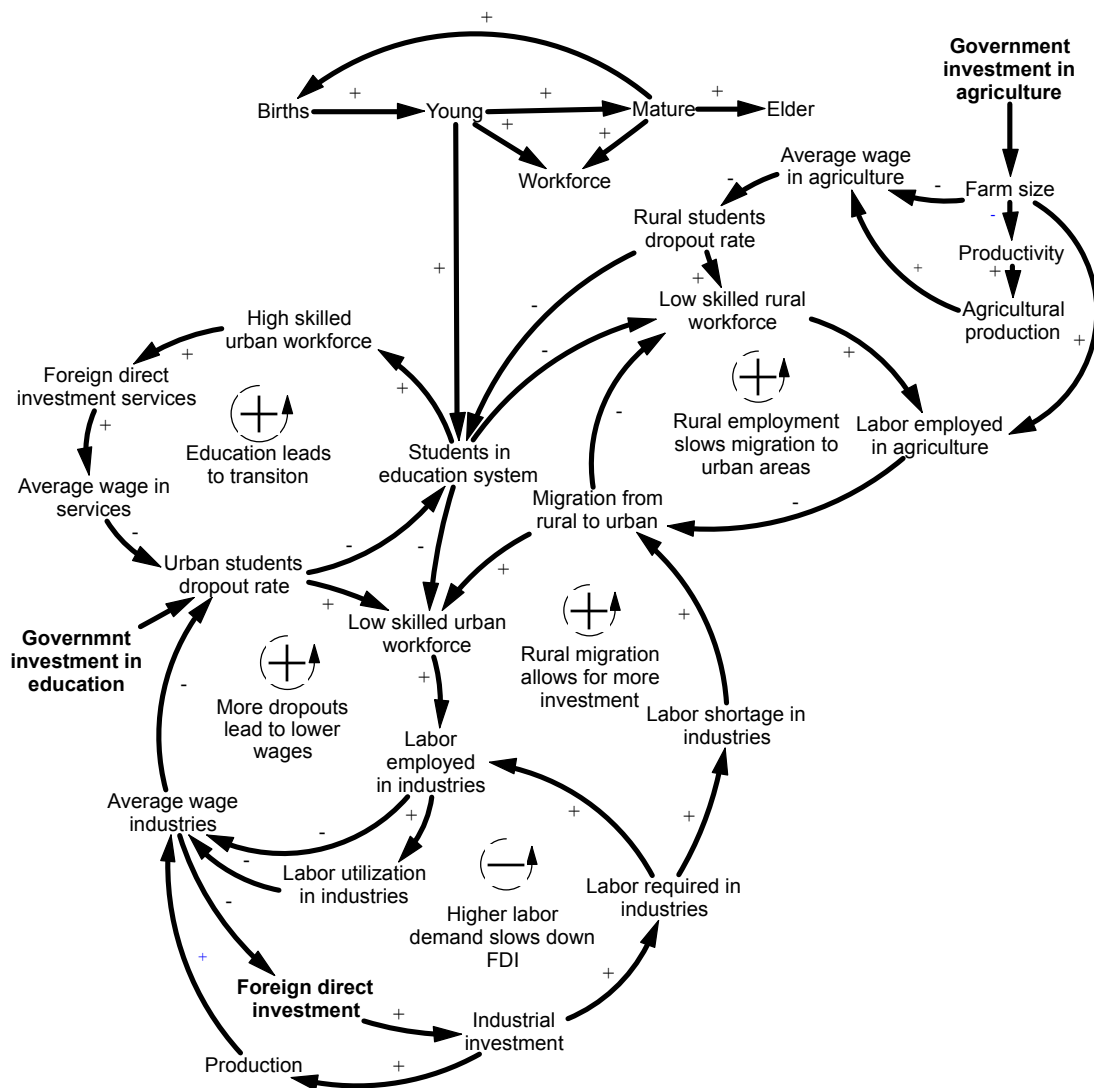


Figure 2 Causal loop diagram of Myanmar's key subsectors

✓ **Population**

One of the critical factors in a country's degree of social and economic development is its stock of people. In the model, population was divided into three cohorts, each representing different age ranges (i.e. "young," "mature," "elder"). Births increase the cohort of young people, young people eventually mature, and mature people eventually get old. Mature women in childbearing age reproduce consequently determining the number of births. Finally, the groups of young and mature people add up to represent the country's workforce at any point in time.

✓ **More dropouts lead to lower wages**

As more low skilled labor is required from different industries, the degree of labor utilization increases. It is known from economic theory that when labor supply saturates, wages tend to increase as demand reaches supply. The contrary holds also true: as less labor is utilized, wages tend to decrease because there is more labor available, and hence more supply than demand. When wages increase, families can afford to send their children to school, so the urban student dropout rate diminishes. Young people going to school become high skilled workforce after some time and will not likely join the low skilled workforce. When this happens, low skilled wages increase as low skilled labor gets scarcer than the labor required by industries.

The previous mechanism results in a virtuous cycle (+): the less the low skilled workforce, the more the labor utilization and the higher the wages. Higher wages lead to fewer dropouts, which further reduces the low skilled workforce. The opposite also holds true: the more the low skilled workforce, the lower the wages, the higher the dropout rate, and finally the bigger the pool of low skilled labor leading to further wage reductions.

✓ **Higher labor demand slows down FDI**

Higher labor utilization (i.e. labor supply reaching labor demand) increases average wages in the manufacturing industry. Because wages are one of the factors attracting labor-intensive foreign direct investment, when wages increase, the attractiveness for further investment diminishes. Less growth in investment leads to less growth in the labor required by industries, which decreases the labor utilization and stabilizes average wages.

These mechanisms result in a "stabilizing cycle" (-). As more labor is required more labor is utilized and wages tend to increase. As wages increase, foreign investment slows down and growth in labor required diminishes, stabilizing the wages at a level where investment stops growing and labor utilization does not lead to more changes in wages.

✓ **Rural migration allows for more industrial investment**

When foreign investment in manufacturing industries increases, more low skilled labor is required. If labor requirements rise as high as to surpass the quantity of labor in the workforce, a labor shortage takes place. Migration from rural to urban areas then follows as prospects for better-paid employment consolidate. High levels of labor supply allow average wages to stay low, thus attracting further foreign investment and encouraging further migration from rural to urban areas.

The previous mechanisms result in a vicious cycle (+): shortages of low skilled labor in urban areas increase and encourage migration to the cities. As more people migrate and the pool of

low skilled urban workforce is plentiful, wages remain low. As wages remain low, foreign investment keeps growing requiring even more labor.

✓ **Rural employment slows migration to urban areas**

Increasing employment levels in agriculture discourage migration to urban areas. Low skilled rural workforce contributes to employment in rural areas, further discouraging migration to cities.

✓ **Education leads to transition**

In an ideal situation, the “young” cohort will join the country’s education system starting at a certain age. In Myanmar, however, high dropout rates (especially in high and tertiary education) prevent the stock of students who are being educated to rise further. Young dropouts progressively enter the group of low skilled workforce, getting employed in low skilled jobs when labor in industries (i.e. manufacturing sector) is required. When dropouts are diminished and the number of people being educated rises significantly, a transition to more knowledge intensive industries take place. Wages soar and dropouts diminish, further increasing the number of students in the education system.

5. Model description

This section presents a description of the core stock and flow structure of the model as presented in Annex 1. Numbers preceding each variable are used to ease its location and provide a guide on the order that must be followed to read the model. The diagram includes a population sector representing the aging structure of Myanmar’s population (1). The aging chain drives the enrollment inflow to the education system (33,34). Students from the education system either graduate from university and become high skilled labor (34), or drop out at some point during their education. Dropouts (32) are the main supply of low skilled labor either in urban or rural areas (14,15). The availability of workforce in rural or urban areas has effects on labor utilization and wages on each area. Such availability will depend mostly on migration levels from rural areas to urban areas. Migration is driven by investment in the industrial sector (3) and investment in agriculture (16,17,18). In particular, investment in agriculture can be executed through government investment or Foreign Direct Investment (FDI). This decision has an impact on the ownership structure of the land, potentially changing the current situation of many small owners (22) to few big owners (23). Finally, the ownership structure has also a direct impact on wages perceived by workers and on land productivity.

From these basic assumptions, the model includes, as explained in the previous section, a set of interacting feedback loops in order to explore the possible effects of three different sets of interventions or scenarios (2,16,31):

1. A strong focus of FDI on industries and agriculture as a driver of social progress. This scenario is based on the following assumptions (see graphs in blue in Annex 1):
 - a. There will be low government investment in agriculture. Most of the investment will come from FDI.
 - b. Investment in both the industrial and agriculture sector is injected to the economy, but it takes some to realize such investment into a significant increase in production.
 - c. Education is not a priority, keeping investment in education at the current rates of 1% of the GDP per year.

2. A strong focus of investment on agriculture and education over industrial development as a driver of social progress (see graphs in orange in Annex 1).
 - a. Investment in education amounts raise from 1% to 4% of the GDP.
 - b. Investment in agriculture comes mostly from the government in the form of support to local farmers.
 - c. Foreign direct investment in industrial development is moderate.
3. A strong focus of investment in agriculture and education from the government and high rates of FDI on industrial development (see graphs in magenta in Annex 1).
 - a. Investment in education amounts raise from 1% to 4% of the GDP.
 - b. Investment in agriculture comes mostly from the government in the form of support to local farmers.
 - c. Foreign direct investment in industrial development is high.

6. Scenario testing results

For the three scenarios, the population sector behaves identically (model does not include effects of the economy or education in fertility rates). The fertility rate remains constant (1). However, aging cohorts of the population behave quite differently: while cohorts from 0 to 44 years old remain approximately constant, population over 45 years old and particularly over 65 years old increases dramatically. In other words, while working population will remain constant, aged cohorts will increase, creating a strong pressure on the economy in order to provide them with social security. The rest of the test results a presented for each scenario below:

✓ Scenario 1 (see graphs in blue in Annex 1)

High investment in industrial development increases significantly industrial production. However, wages per capita for workers are not increased so significantly (as compared to scenario 3) because labor utilization does not increase to a point where labor force scarcity drives up wages. Hence, it can be said that as for the industrial sector, it presents a growth scenario, but if labor wages are taken into account, as a proxy for social development, it does not offer such positive result.

Labor utilization does not increase significantly because in this scenario, since FDI in agricultural sector is predominant over government investment, it actually leaves a fraction of previously employed labor in agricultural areas unemployed. Unemployment in rural areas drives migration to urban areas, augmenting the urban workforce available, lowering labor utilization in urban areas and keeping wages lower than if migration had not occurred.

Lower wages and low investment in education do not reduce quickly the dropout rate from the education system, allowing for a big loss of the demographic dividend available in the upcoming years, as shown in a lower quantity of high skilled urban workforce. At the same time, more low skilled labor resulting from the dropouts feed the demand of industrial development, keeping labor utilization low and reducing the pressure to increase wages.

Investment in agriculture driven by FDI causes ownership structure of rural land to change toward big farms with less owners. Paradoxically, even if big farms produce in a bigger scale, due to effects of farm size on crop rotation and land productivity, at the end agricultural production decreases. Bigger farms also employ less labor, reducing labor utilization and the pressure on owners to increase wages. The result is lower wages and more rural workforce unemployed migrating to rural areas, to feed directly the demand of the industrial sector. Rural workforce decreases significantly.

End result in terms of social progress is lower wages for rural and urban workforce, and less high skilled workforce in the economy.

✓ **Scenario 2 (see graphs in orange in Annex 1)**

Moderate investment in industrial development leads to considerably lower (about one third) of the industrial capital compared to investment made in scenarios 1 and 3. Wages per capita are the lowest, given the low labor utilization and the lower level of capital production. High government investment in agriculture leads to a conservation of the current land ownership structure of many small owners. Hence investment is directed towards increases in their productivity. Increased production in farms leads to higher wages (since wages in small farms are approximately proportional to production and not a fixed rate), and less migration to urban areas.

High investment and higher wages in agricultural sector (which represents most of the country's population) leads to a lower dropout rate, increasing the quantity of skilled workforce in the economy and reducing the low skilled workforce. Less low skilled workforce leads to more labor utilization and more pressure to increase wages.

End result in terms of social progress is lower wages for urban workforce, higher wages for rural workforce, less migration from rural to urban areas and higher skilled workforce.

✓ **Scenario 3 (see graphs in magenta in Annex 1)**

High investment in industrial investment leads to higher industrial capital, and higher production. Even if investment is equal to that of scenario 1, wages see a higher increase because labor utilization goes up to a point where workforce scarcity drives wages higher than they would have been otherwise. From the three scenarios, this is the one with higher growth for both, industries and workers.

Labor utilization is driven up because high investment in agriculture from the government has the effects already mentioned in scenario 2, including a decrease in the migration from rural to urban areas. Less workforce in urban areas facing high industrial investment leads to a shortage of workforce in urban areas (13), which in turn ends up making wages for labor higher, and industrial investment in the country less attractive, balancing the initial push in industrial investment (9).

High investment in education combined with higher wages in the agricultural and industrial sector leads to a lower dropout rate, keeping more students in the education system, further reducing the low skilled labor available to the industrial sector, thus pushing wages even higher through higher labor utilization.

The end result in terms of social progress is higher wages for rural and urban workforce, less migration from rural to urban areas and high levels of industrial and agricultural production.

7. Insights from model results

✓ **Population**

- **Demographic dividend and the elderly issue**

Today, Myanmar's working age population (i.e. those between 14 and 60) as a percentage of the total population reaches around 63% and is expected to drop to 40% within the next 40 years. This scenario is known as a "demographic dividend" and refers to the changes in the age structure of a country's population as it transitions from high to low birth and death rates. Whereas Myanmar's population composition resembles a pyramid today, with the working-age group as the base of the pyramid, it will look more like a skyscraper in the future with the population over 60 years on top of it and less of the younger population at the bottom. Model results revealed that within the next 40 years the share of population over 65 years old will rise significantly from around 2.5 million to 23 million in 2050.

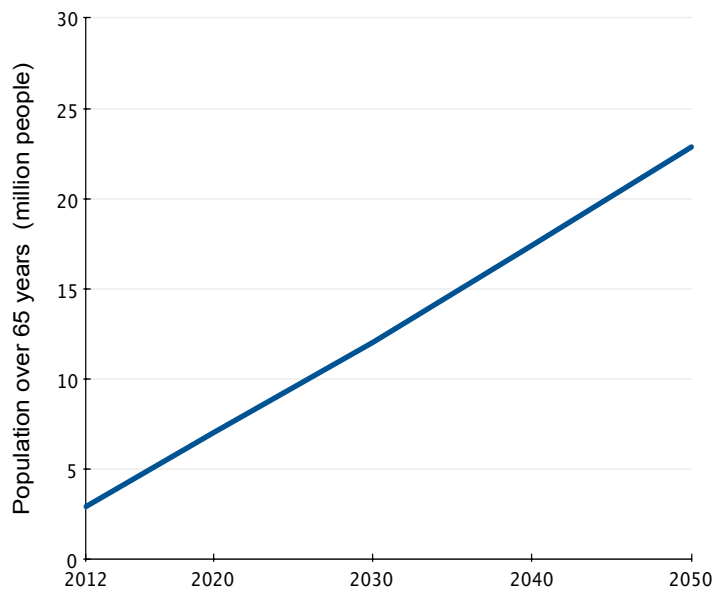


Figure 3 Evolution of Myanmar's population over 65 within the next 40 years

How will Myanmar use this dividend and how will Myanmar support its elders?

The transition to a different population structure poses questions to Myanmar's government. As today's young population will start to age in the upcoming two decades, it becomes critical to seize the benefits of the country's opening before its population grows old. Other areas for immediate planning and intervention include not only pension funds, but also heavy investments in the health sector, which will likely support higher prevalence rates of chronic diseases such as diabetes and hypertension. With fewer younger family members and increased economic migration to neighboring countries such as Thailand, the elderly will find increasingly difficult to go through their old age with family support, as it has traditionally been the case. Finally, it is important to highlight that unlike Thailand, which began the process of introducing pensions about 30 years ago, Myanmar was a closed country for so long that social protection is completely new to the government and related laws are just beginning to be drafted this year (Mudditt, 2014).

✓ **Education**

• **The lost generation**

Because it is the second largest population in Asia, Myanmar has been tagged by many sources as a country abundant in labor resources. Historically high rates of dropouts, however,

have resulted in a predominantly unskilled or low skilled demographic dividend today. High dropout rates, going up to 42% in secondary school, stem from widespread poverty levels that push children to leave school early and find a job that can help supporting their families financially.

The model evidenced how even if hypothetically high investments in the economy today would result in a dramatic dropout reduction in the near future, the low skilled labor force will continue to predominate for most part of the upcoming 40 years. Why? Because the skilled workforce increases only as new generations come. However, forecasted reductions in fertility rates for Myanmar will result in new generations coming slower than ever before, thus reducing the rate of renewal of the workforce that can be educated.

How will Myanmar deal with the unavoidable escenario of a predominant portion of low skilled workforce?

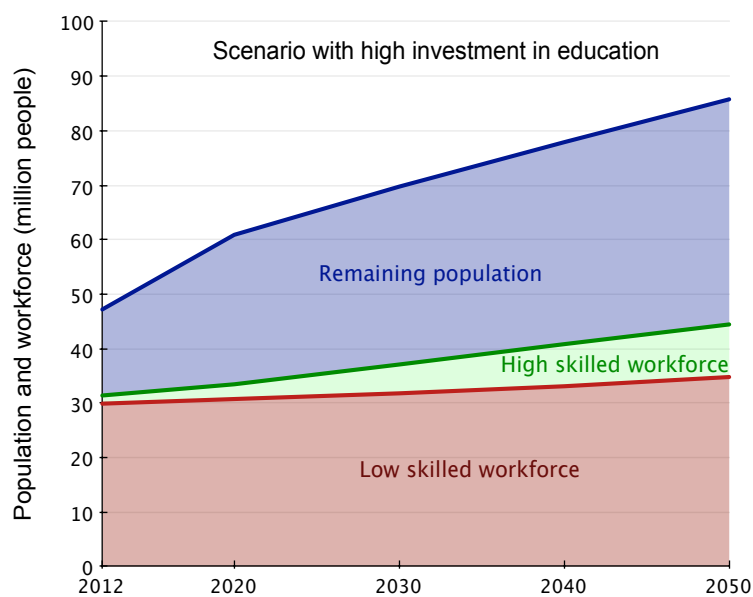


Figure 4 Evolution of Myanmar's low and high skilled workforce

- **Dropouts and capacity planning**

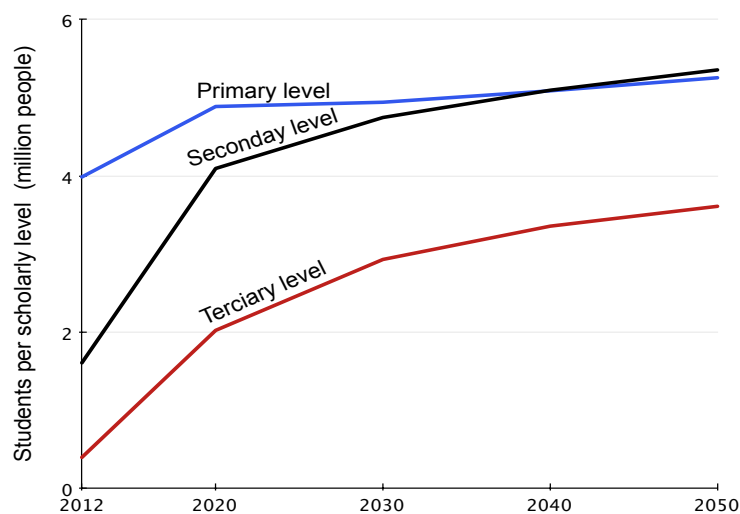


Figure 5 Students per scholarly level in Myanmar

When investments in education are materialized, dropout rates diminish. As more students are

foreseen to be part of the education system, a need for planning infrastructure and staff requirements also arises. Just in the case of secondary level for example, capacity would need to be duplicated within the next ten years to catch up with demand. This is not to say other primary aspects of the education sector should be left unattended such as an outdated curriculum, limited teaching methods, and regional inequalities in access to education (Metro, 2014), but simply to raise awareness on the resource requirements of such a policy.

✓ **Investment in agriculture and/or industries**

Today

Once the world's largest rice exporter, Myanmar is a country endowed with vast amounts of nearly unexploited natural resources. About 50% of Myanmar's GDP comes from agriculture, with paddy rice being its main crop, and around 70% of the country's population is directly or indirectly related to this sector. Different studies point out broad-based agricultural growth offers a singularly powerful instrument for raising rural incomes and reducing poverty, food prices and hunger (Haggblade, 2013). Depending on the nature of the investment in the agricultural sector, its impact on big and small farms is different.

• **Wages**

The model assumes that when the agricultural sector is opened for foreign direct investment, big investors owning big farms will predominate, assumption supported by the enormous land concessions the government has been granting since 2010. Conversely, government investment in agriculture will preserve the small-owner status of many farmers in rural areas. Differences in wages for agricultural workers are thus greatly connected to the ownership status of the farm. Whereas for small farmers a higher production will result in higher and more equally distributed wages, for big farms the monopolistic power of the owner over the means of production coupled with the poor bargaining power of its workforce will result in stagnant wages.

Why higher production in small farms?

Research has demonstrated the economic output per Ha is higher for small farms (Rosset, 1999). As counterintuitive as it sounds, processes in big farms are highly mechanized and therefore require mostly monocrops to ensure harvesting effectiveness. On the other hand, labor-intensive processes in small farms allow for multiple crops to coexist in the same piece of land thus achieving higher total output per unit area. Note the higher productivity in small farms is only ensured when the proper legal, technical, and economic support is provided to the agricultural sector in the form of secure land tenure, farmer credits, storage facilities and so on.

• **Migration**

In a scenario where foreign direct investment favors big farms, mechanization prevails, and less labor is required in general. As a result, a significant amount of the rural population ends up unemployed or landless and the incentives to migrate to urban areas increase. The aftermath involves low wages both in the industrial and the agricultural sector: in the former because of the excess supply and in the latter because of the ownership nature of the farm.

8. Limitations

This study does not investigate the effects of different policies on the environment or the

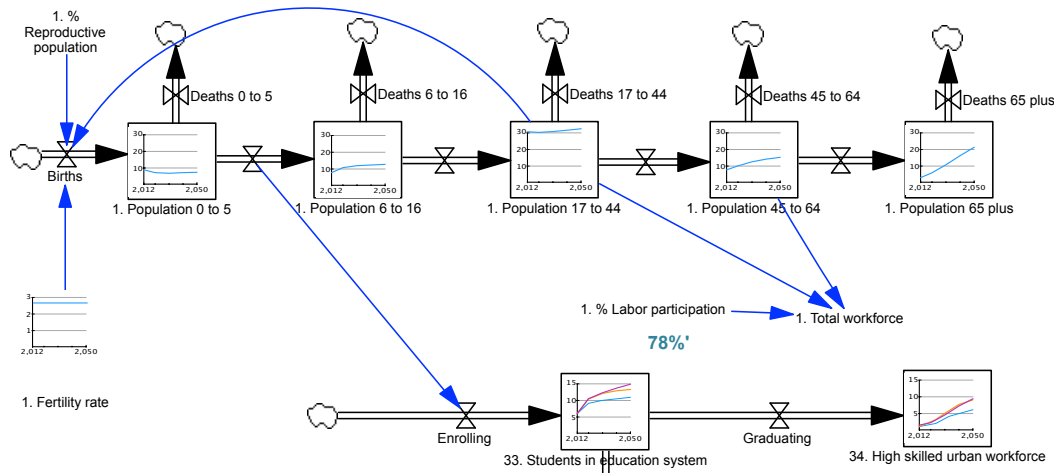
struggles they could create at the community level. For simplicity, it also ignores key sectors such as health and government debt. Additionally, foreign direct investment is only targeted to agriculture and manufacturing ignoring Myanmar's power sector, considered to be one of the sectors receiving most attention.

9. Conclusions

Myanmar carries on its shoulders almost six decades of self-enforced isolation that have left it with lack of institutional capability, obsolete infrastructure, and widespread poverty. This quick, though rigorous modeling exercise using System Dynamics, proved fundamental to understand some of the main dynamics behind two economic models and its effects on education, migration, and wages. Furthermore, linked to the concept of understanding is the idea of anticipating the outcomes of different reform packages rather than just reacting to these outcomes with ad-hoc policies once they have occurred. Such concerns are now evidenced by media coverage on the early warning signs of Myanmar's wide-ranging reforms targeting fast development, 2 years after this project was completed (see Annex 2)

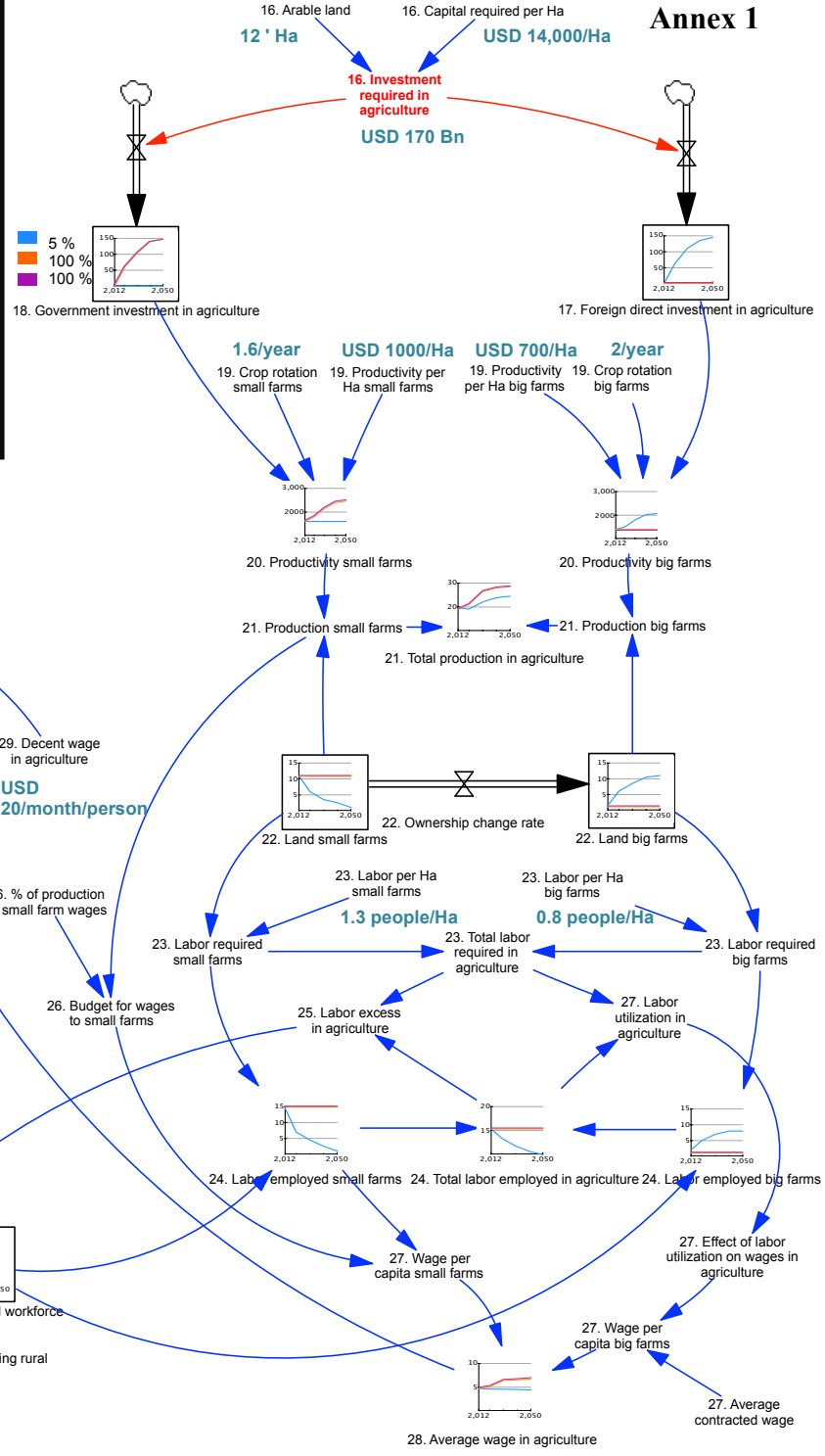
Myanmar is a rather special case nowadays as it has the possibility of witnessing how similar growth policies in other countries have affected their social and economic development through time. It is in a stage where carefully planned high-level strategies can ensure a more sustainable and healthy course of development allowing for peoples' civil liberties and freedoms to be respected as well. The scenario right now involves economic reform proceeding political and structural reform and millions of development aid loans and foreign investment being injected in a country with the same antiquated infrastructure, and inefficient and decaying governmental and industrial organization.

Considering the perverse reinforcing mechanisms described in previous sections, the relevance of the model should then lie in redefining economic development to move away from maximizing output growth, since growth in both is constrained by physical and institutional limits (Saeed, 2000), to clearing the obsolete infrastructure and institutions and rethinking unsuitable political mental models that will after all hinder the so much desired growth.



Scenarios

- 1% of GDP to education
100% FDI in agriculture
High FDI in manufacturing
- 4% of GDP to education
100% Gvmt investment in agriculture
Moderate FDI in manufacturing
- 4% of GDP to education
100% Gvmt investment in agriculture
High FDI in manufacturing



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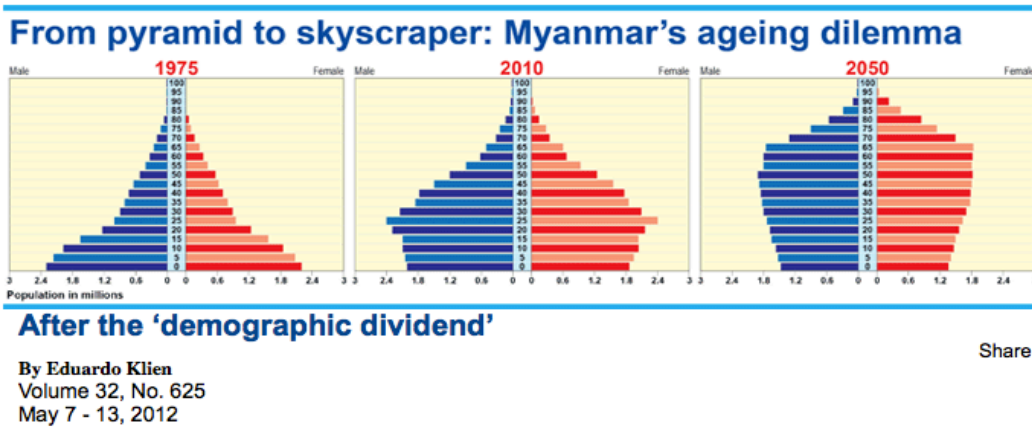
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The Nation March 19, 2014 1:00 am

The dizzying speed of economic development has led to rapid urbanisation; millions of citizens urgently need proper urban planning and infrastructure



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"I CAME TO RESET MYSELF FOR BROADER RESPONSIBILITIES. AND REFLECT ON WHAT'S MEANINGFUL."
— Archana Singh, Advanced Management Program 2012

Asia

Myanmar Struggles to Keep Children in School

By Christina Larson | March 18, 2014

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