Using System Dynamics to Analyze Social and Economic Challenges in Myanmar

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Abstract

Three years ago Myanmar 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 political and economic sanctions imposed mostly by western countries. Within this context, this study describes the results of a system dynamics model commissioned for the country´s most prominent democracy leader 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

Burma or Myanmar is the largest country in mainland South-East Asia once known as "Asia's barn" for its leading position in worldwide rice exports. Home to around 60 million people, Myanmar is a multi-ethnic resource-rich land endowed with abundant agricultural products, timber, mineral resources such as the world's most precious rubies and jade stones, and natural gas and oil. Despite its overwhelming resource characteristics, Myanmar remains the poorest country among ASEAN member states ranking low in most indicators of economic and social performance (Turnell, 2011).

The country has been governed by an authoritarian regime 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 the military dictatorship 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. Economic sanctions along with old malfunctioning institutions and decades of mismanagement left Myanmar practically disconnected from the world suffering from continued poverty and isolation for now more than fifty years.

Figure 1 Myanmar´s geographical location

Despite the country's long history of autocratic rule and widespread repression, slight changes in favor of democratization have been materializing in the past three years. In late March 2011 a new semi-civilian government led by president Thein Sein took place, and in April 2012 forty-three members of Nobel Peace prize laureate Aung San Suu Kyi's National League for Democracy party (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 non-governmental organizations (Pedersen, 2011). 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 are now a reality.

It is within this context of political and economic uncertainty that the authors of this paper 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 social and economic challenges to come. 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, the introduction of the old-car substitution program that allowed for the replacement of decade-old cars by second-hand or new ones, among others. Our contact person had close ties to Myanmar's most prominent pro-democracy leader 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.

2. Objective

This study was aimed at fostering widespread discussion about key economic and societal issues in Myanmar, improving understanding of key country dynamics, and ultimately encouraging a concerted effort among relevant decision makers in the country to thoughtfully evaluate the implications of the different development paths Myanmar could adopt in the years to come. Because the speed at which political and economic reforms are being pushed in Myanmar is extremely high and policymaking capacity of government staff is extremely limited, 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 was deemed necessary.

3. Problem definition

Economic development in Myanmar has been stagnant evidencing single-digit growth in real GDP for most of the second half of the 20th century (Myint, 2008). It is expected economic growth, as measured by macroeconomic variables such as GDP, will speed up following the political reforms introduced in the last two years (Figure 2). The question is, will economic development necessarily translate into social development?

Just as economic growth, social development as measured by economic variables like average wages, has remained stagnant over the past decade. Two possible future trends are seen as likely: (1) the feared trend involves social development remaining equal or experiencing moderate growth, while (2) the hope is for social development to grow just as much as economic development (Figure 3). Hence, the main purpose of the model is to evaluate the extent to which the so expected economic development could translate into social development given two possible investments sets: (a) investment in agriculture, and/or (b) investment in the manufacturing sector.

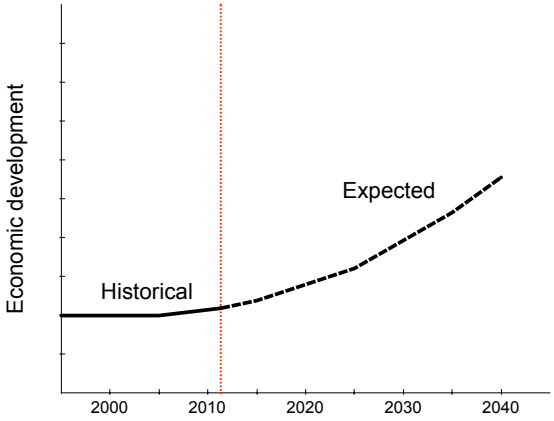


Figure 2 Reference mode for historical and expected trends of economic development

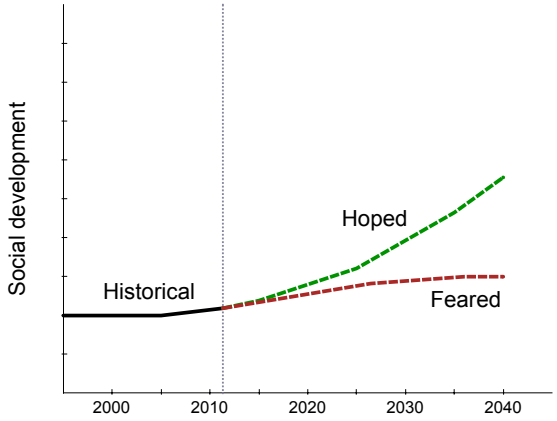


Figure 3 Reference mode for historical and expected trends of social development

4. Key assumptions

Given the short time available for the modeling effort (i.e. two weeks), several important assumptions were made during the conceptualization stage that are shown in the list below. The modeling team made these assumptions as clear and as visible as possible in the final project report.

a) Wages are taken as the only proxy for social development: given the limited information available for Myanmar´s social indicators and time constraints, wages were taken as a proxy for social development and poverty reduction assuming that the higher the wages, the higher the access people has to education, better food, healthcare, and so on.

b) In the aggregate, for the low skilled workforce, rates of increase or decrease in wages are based only on the amount of workforce available. The higher the amount of workforce available, the lower the wages. As the workforce gets scarcer, wages increase in response.

c) The main factor predicting school dropouts is income. As families need more income to sustain their living, young potential students are obligated to drop out from school and find work to help support their families. Although the literature points out many other variables influencing dropouts such as gender, race, ethnicity, parental education, place of residence, and so on (De Witte et. al, 2013), families' financial status is the primary reason for school dropout in Myanmar (ABFSU, 2003).

d) The economic model based on agricultural development was further defined into two possible sources of investment.

    a. Government investment: investment from the government targeted to farm owners and workers in order to increase productivity and output.

b. Foreign Direct Investment: investment from foreign organizations that imply the change of ownership structure from local small owners to large foreign ones. Agricultural production is mechanized under this scheme is substantially mechanized.

e) The economic model based on industrial development entails the construction of manufacturing plants hiring large quantities of low skilled labor (following the past experience of other Asian countries). Within this context, wages must be low for the country to be competitive in the world market.

5. Dynamic hypothesis

Based on a literature review of economic and social development in developing countries and a review of news articles from a decade ago onwards, a system dynamics model was developed to explain how social development may be influenced by the two previously defined types of investment in the next decades. A summarized version of the model is presented below:

a. Main causal structure for population and workforce

One of the critical factors in a country's degree of social and economic development is its stock of people (Figure 4). In the model population was divided into three cohorts, each one 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 and determine the flow of births. Finally, the groups of young and mature people add up to represent the country's workforce at any point in time.

People at young ages provide input for the education system as they enroll in school or high school. Students graduate at some point and become high-skilled workforce (i.e. upon completion of an undergraduate program) or drop out from school thus becoming part of the low-skilled workforce. Because around 70% of Myanmar's population lives in rural areas and the rural-urban migration phenomenon will be a key determinant for important economic changes in the country, the low-skilled workforce cohort was further divided into rural and urban in the model.

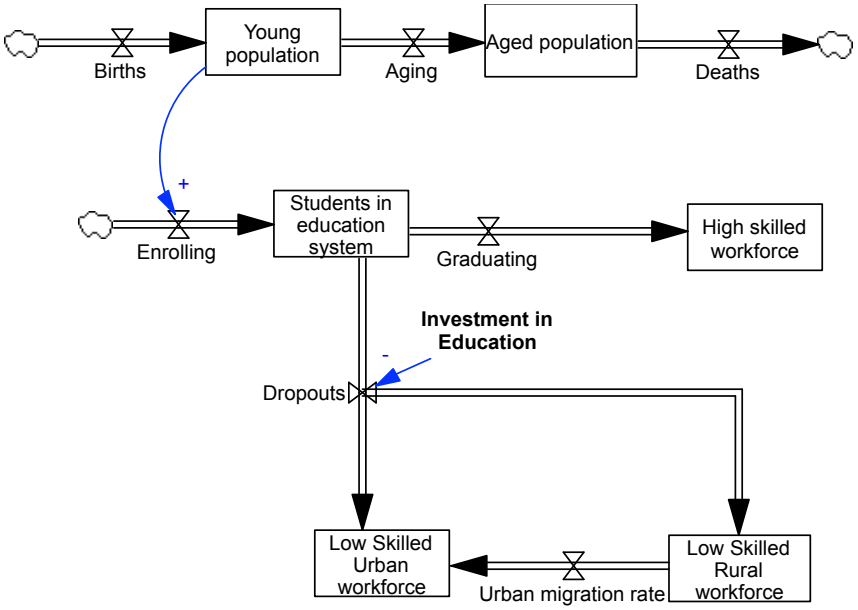


Figure 4 Flows of population through the education system and workforce

b. Main causal structure for the interaction between workforce and industrial investment: 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.

Such mechanisms result in a "stabilizing cycle" (B1), depicted in Figure 5. 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 wages at a level where investment stops growing and labor utilization does not lead to more changes in wages.

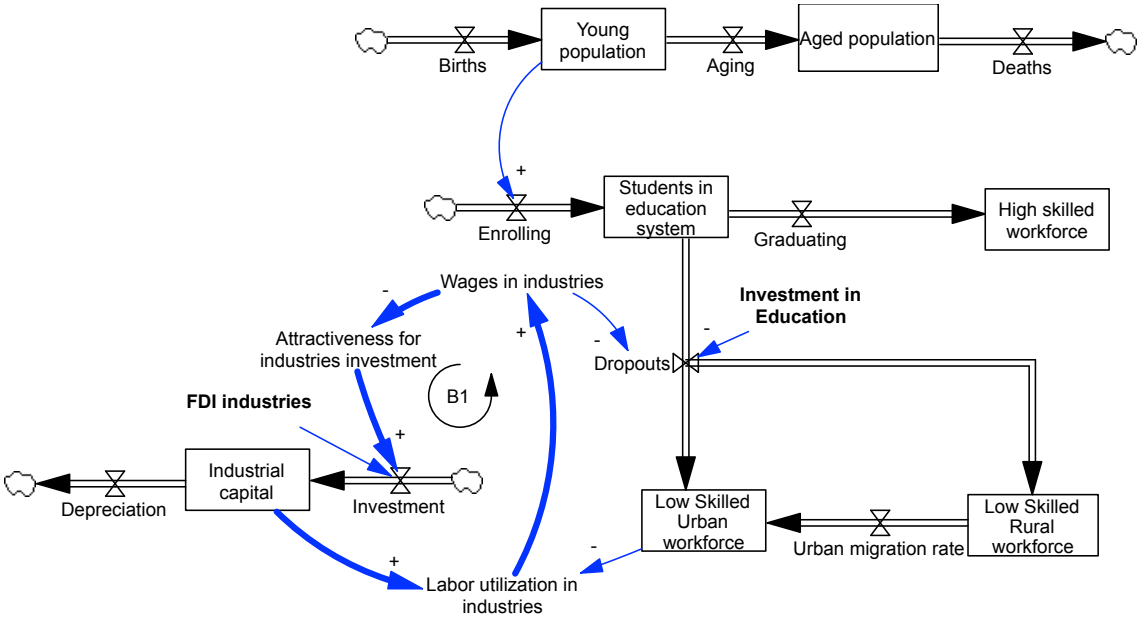


Figure 5 Relationship between industrial investment and workforce

c. Main causal structure for the interaction between workforce, students and industrial investment: 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. After some time, young people going to school become high skilled workforce 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 (R1 in Figure 6): 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.

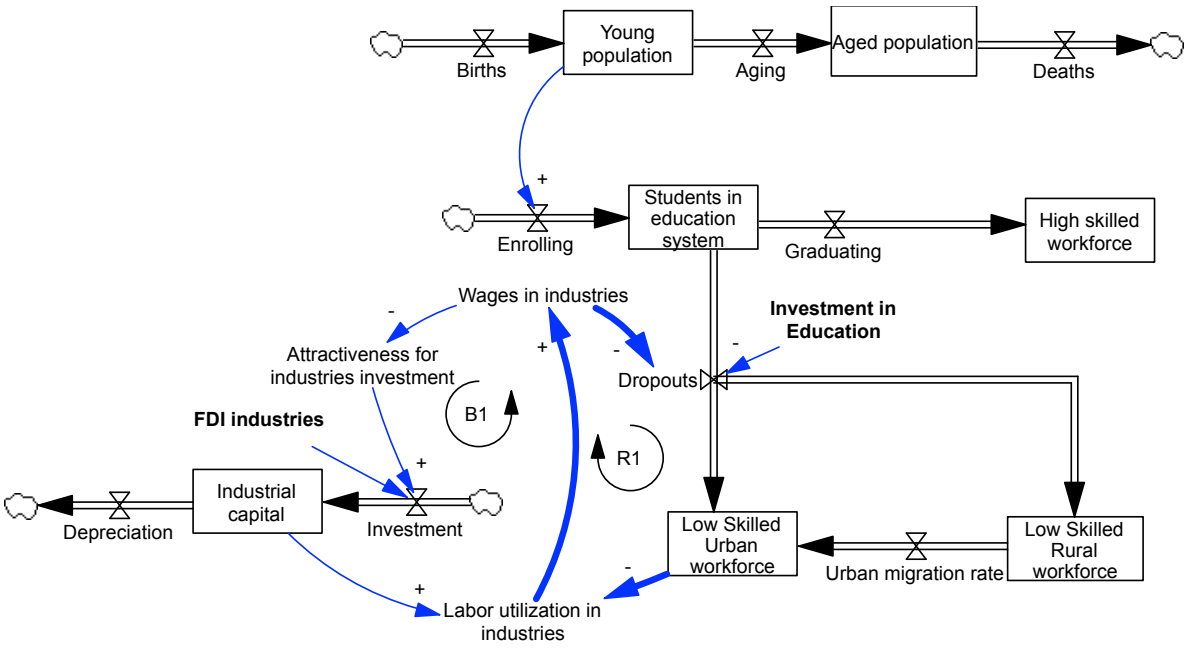


Figure 6 Relationship between wages and the education system

d. Main causal structure for the interaction between industrial investment and migration from rural to urban areas: 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. Rural-urban migration 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 (R2 in Figure 7): 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.

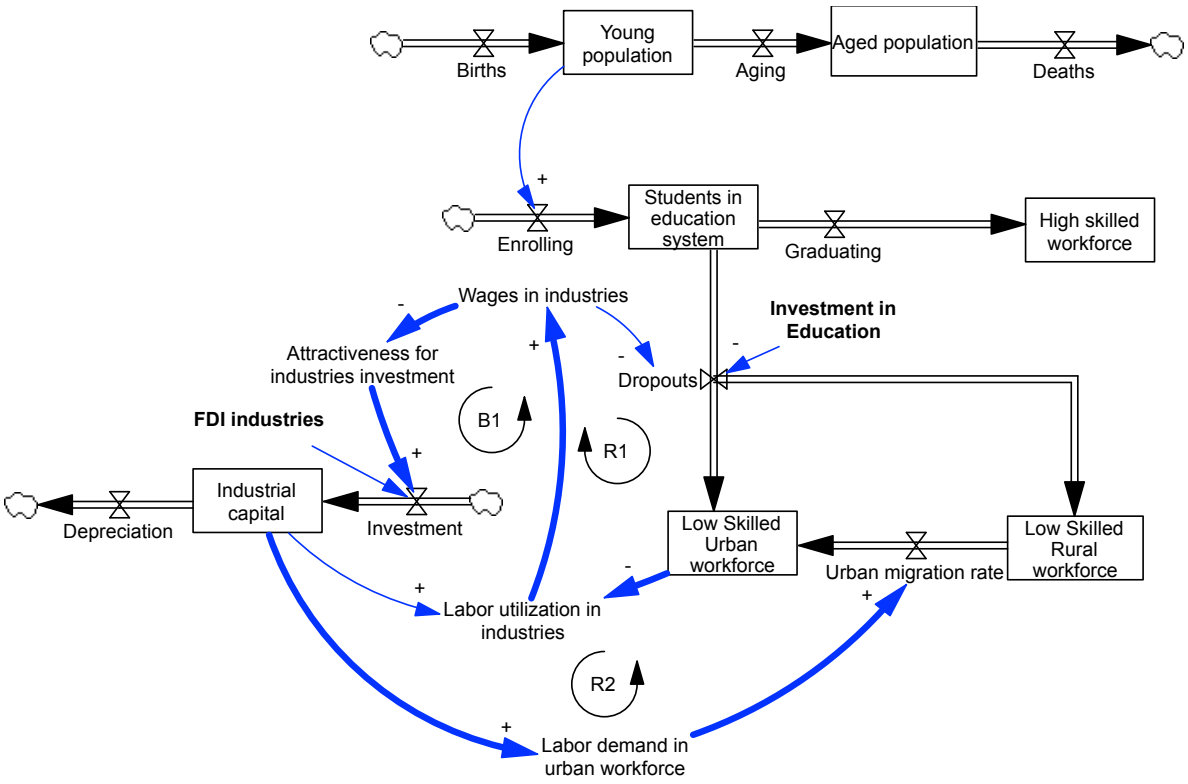


Figure 7 Relationship between investment in industrial capital and migration from rural to urban areas

e. Main causal structure for the interaction between investment in agriculture and land ownership structure in rural areas

Figure 8 shows how farms producing agricultural output were divided in two groups: small and big farms. Small farms represent the majority of the farms today, are mostly family run, occupy small areas and run mostly artisanal forms of production. Big farms are run by corporations, occupy big areas and use highly mechanized forms of production. Government investment is defined as investment that does not change the current ownership structure of farms but finances methods of increasing their output. Redistribution of wealth in small farms is higher than in big farms, hence the ratio of big farms vs. small farms determines how much of the production increases due to investment is reflected in increases in wages. Foreign Direct Investment in agriculture, unlike government investment, changes the ownership structure of the land, triggering purchases/expropriation from small owners to big farm owners, and making previous owners serve as labor for the newly purchased land.

Ownership structure has an additional effect: As previous small farm owners and their families shift towards an employee-employer relationship with the new land owners, and big farms shift to a mechanized and more efficient form of production, less workforce will be needed. Excess workforce will be forced then to migrate to urban areas.

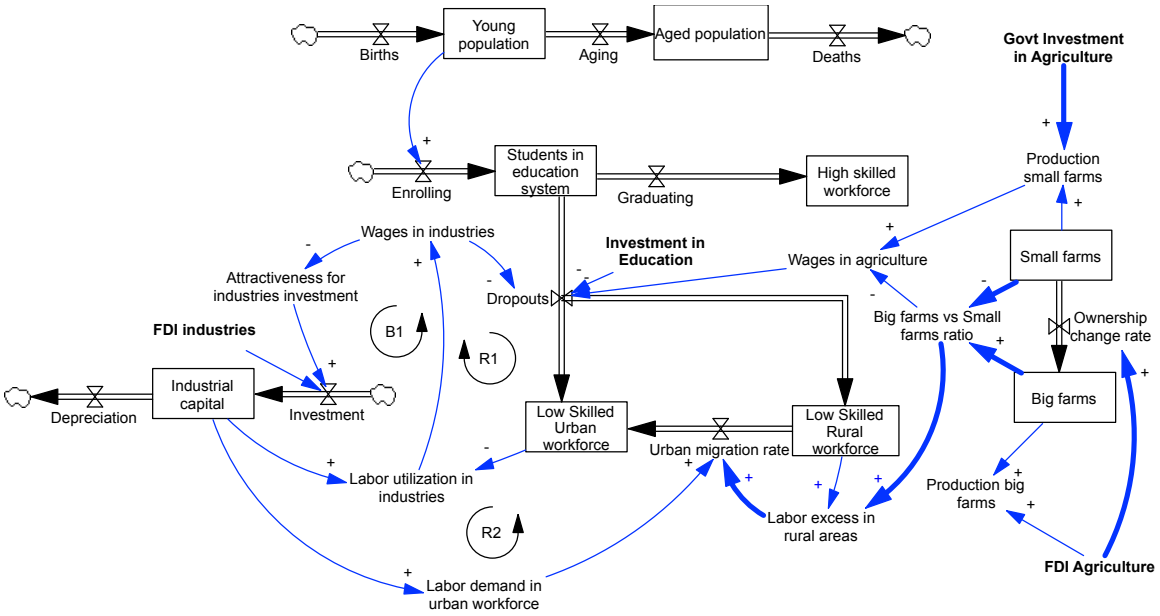


Figure 8. Relationship between investment in agriculture, wages and migration from rural to urban areas

f. Main causal structure for the interaction between investment in agriculture and wages in urban areas

The previous section discussed how FDI in agriculture would change the ownership structure towards fewer big farm owners and employees with fewer possibilities of increases in wages from an increase in production. However, FDI in agriculture is also related to wages in the urban areas. As more urban workforce is available the reinforcing cycle R1 is triggered, making wages lower than they would have otherwise been. In turn, lower wages increase the attractiveness of industrial investment and the demand for more urban workforce, triggering a new vicious cycle R2 (

Figure 9) where wages are low as a result of the supply/demand balance and this attracts even more industrial capital that encourages even more rural-urban migration (supply). Notice how lower wages keep student dropout rates high, further worsening the situation.

It is worth noticing the opposite is also feasible: Increasing employment levels in agriculture discourages migration to urban areas. Low skilled rural workforce contributes to employment in rural areas, further discouraging migration to cities.

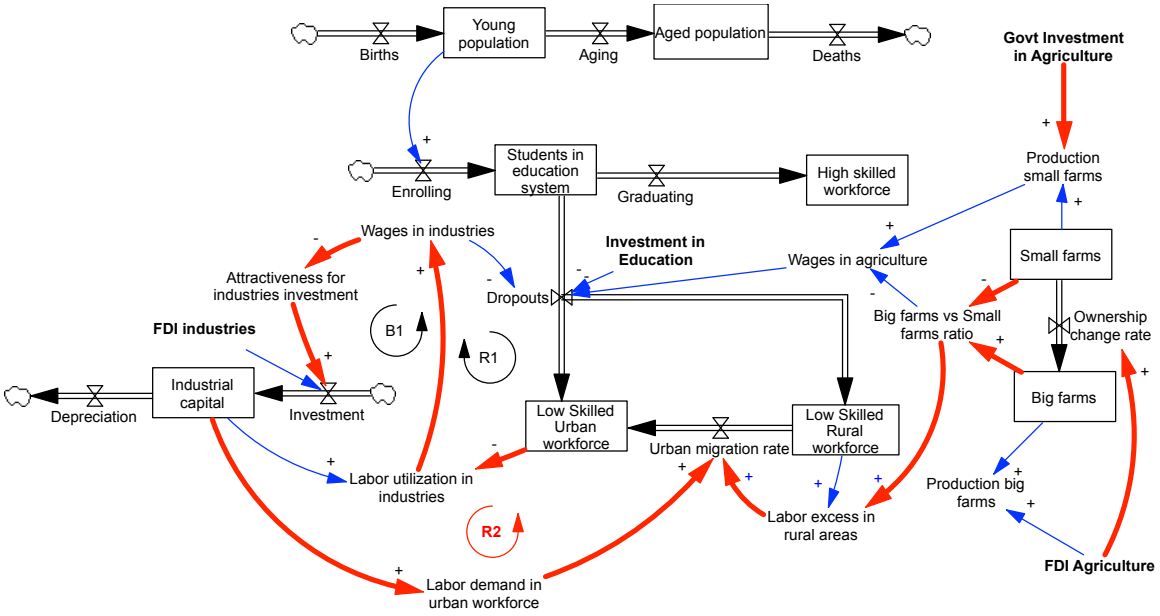


Figure 9. Vicious cycles triggered by FDI in agriculture

g. A final note on investment in education

Another powerful point of intervention rests on the network effects of the investment in education. 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 in school 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. However, when dropouts are diminished and the number of people being educated increases significantly, a transition to more knowledge-intensive industries takes place. Wages soar and dropouts diminish, further increasing the number of students in the education system as R1 shifts from a vicious cycle to a virtuous cycle (see

Figure 9).

6. Model description

This section presents a description of the stock and flow structure of the model as presented to the decision maker (see Annex 1). Numbers preceding each variable are used to ease their location in the diagram 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.

As explained in the previous section, the model explores the effects of three different sets of interventions or scenarios (2,16,31):

1. **Scenario 1: Strong emphasis 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. Government investment in agriculture is low.
    b. FDI on agriculture and industrial development is significant.
    c. Government investment in education remains at the current rates of 1% of GDP per year.

2. **Scenario 2: Strong emphasis of government investment on agriculture and education, over industrial development, as a driver of social progress** (see graphs in orange in Annex 1).
    a. Government investment in education increases from 1% to 4% of the GDP per year.
    b. Investment in agriculture comes mostly from the government in the form of support to local farmers.
    c. Foreign direct investment for industrial development is moderate.

3. **Scenario 3: Strong government investment in education and agriculture, and high rates of FDI on industrial development** (see graphs in magenta in Annex 1).
    a. Investment in education raise from 1% to 4% of the GDP per year.
    b. Investment in agriculture comes mostly from the government in the form of support to local farmers.
    c. Foreign direct investment for industrial development is high.

7. Scenario testing results

Because the model does not include feedback effects of the economy or education on fertility rates, the fertility rate remains constant and the population sector behaves identically under the three different scenarios. However, aging cohorts of the population display quite an interesting result: while cohorts from 0 to 44 years old remain approximately constant, the population group over 45 years old and particularly over 65

years old increases dramatically. In other words, while the economically active working cohort remains constant, the amount of individuals in the older cohorts increase, creating a strong pressure on the economy. The rest of the test results a presented for each scenario below:

a. Scenario 1: Strong emphasis of FDI on industries and agriculture, as a driver of social progress (see graphs in blue in Annex 1)

High foreign investment in industrial development increases industrial production significantly. However, when compared to scenario 3 for instance, wages per capita are not increased as much because labor utilization does not reach a point where labor force scarcity drives up wages. Therefore, even though high industrial output is achieved in this scenario, wages do not increase as much as desired.

Additionally, labor utilization in agriculture does not increase significantly because FDI outweighs government investment and leaves a fraction of the previously employed farm workers unemployed. Unemployment in rural areas drives migration to urban areas, increasing the urban workforce available, lowering urban labor utilization and keeping wages lower than if migration had not occurred. After a delay, lower wages and low investment in education negatively impact the dropout rate, creating a large pool of low-skilled labor for the industrial sector, keeping labor utilization low and reducing the pressure to increase wages.

Finally, investment in agriculture driven by FDI causes the ownership structure of rural land to switch towards big farms with fewer owners. Paradoxically, even if big farms produce in a bigger scale, gross agricultural production decreases overall due to effects of farm size on crop rotation and land productivity. Bigger farms also employ less labor, reducing labor utilization and the pressure on owners to increase wages. The result is lower wages and more unemployed rural workforce migrating to rural areas. In other words, rural workforce decreases significantly. The end result of this scenario in terms of social progress is lower wages for the rural and urban workforce, and less high skilled workforce in the economy.

b. Scenario 2: Strong emphasis of government investment on agriculture and education, over industrial development, as a driver of social progress

Moderate investment in industrial development leads to considerably lower wages (about one third) when compared to the investment made in scenarios 1 and 3. Wages per capita are the lowest because of the low labor utilization and the low level of capital production. High government investment in agriculture, on the other hand, is directed towards increasing the land productivity of small owners who experience no changes in their land ownership structure. 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 the agricultural sector, the vast majority of Myanmar's population, leads to a lower dropout rate, increasing the quantity of skilled workforce in the economy and reducing the low skilled workforce. Fewer low skilled

workforce leads to more labor utilization and more pressure to increase wages. The end result of scenario 2 in terms of social progress is lower wages for the urban workforce, higher wages for the rural workforce, less migration from rural to urban areas and a higher skilled workforce.

c. Scenario 3: Strong government investment in education and agriculture, and high rates of FDI on industrial development (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, the model shows a higher increase in wages 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 government investment in agriculture inhibits migration from rural to urban areas. In urban areas there is high industrial investment and a workforce shortage causing wages to boost. Such rise in wages lowers the investment attractiveness of the industrial sector thus balancing or counteracting the initial push in industrial investment.

Also, 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 for the industrial sector and pushing wages even higher through higher labor utilization. The end result of scenario 3 in terms of social progress is higher wages for the rural and urban workforce, less migration from rural to urban areas and high levels of industrial and agricultural production.

8. Insights from model results

a. Population: Demographic dividend and the elderly issue

Myanmar's working age population (i.e. those between 14 and 60) as a percentage of the total population reaches around 63% nowadays 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.

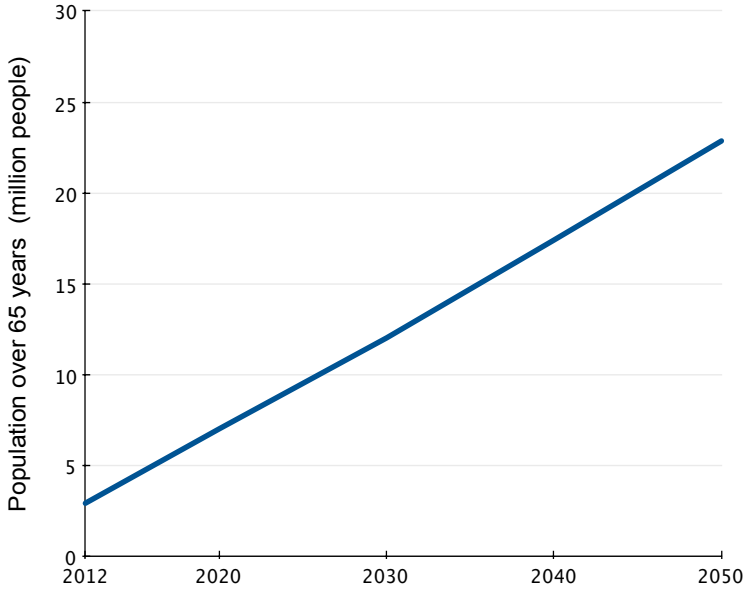


Figure 10 Evolution of Myanmar´s population over 65 within the next 40 years

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).

b. 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. However, historically high rates of dropouts have resulted in a predominantly unskilled 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 simulation 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. Forecasted reductions in fertility rates for Myanmar, however, will result in new generations coming slower than ever before, thus reducing the rate of renewal of the workforce that can get education.

How will Myanmar deal with the unavoidable scenario of a predominantly low-skilled workforce?

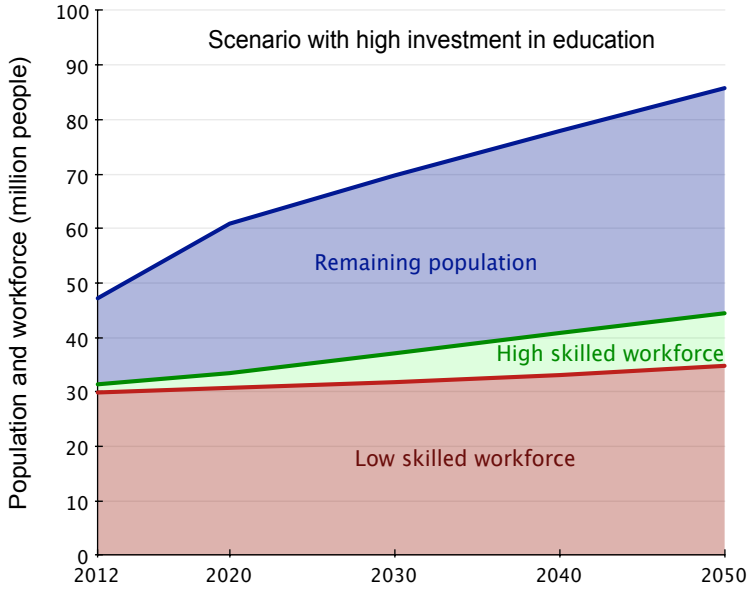


Figure 11 Evolution of Myanmar´s low and high skilled workforce

c. Dropouts and capacity planning

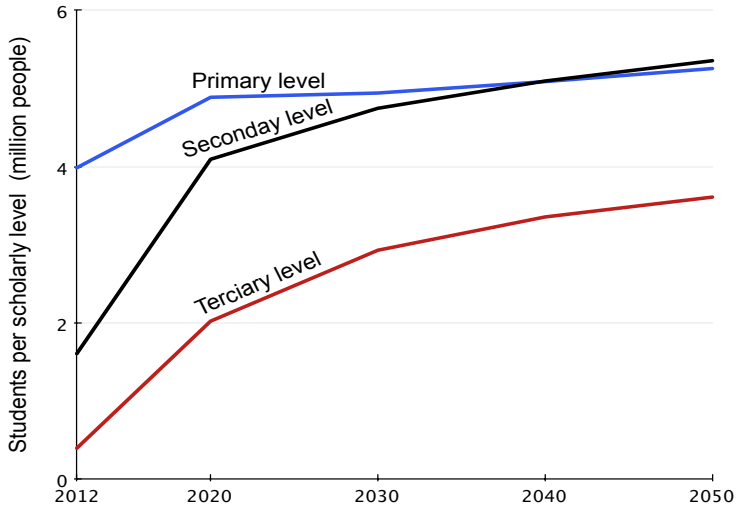


Figure 12 Students per scholarly level in Myanmar

When investments in education are materialized, dropout rates diminish. As more students are foreseen to be part of the education system, the 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 key aspects of the education sector should be left unattended such as an outdated curriculum, limited teaching methods or regional inequalities in access to education (Metro, 2014), but simply to raise awareness on the capacity implications of such a policy.

d. 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 grating 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 low wages.

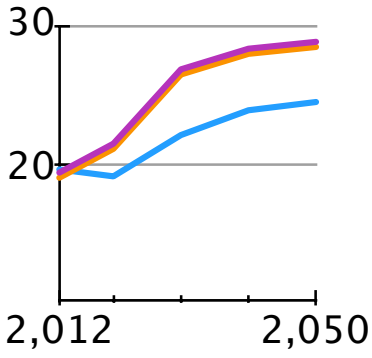


Figure 13. Increases in agricultural production (million USD/yr. Purple and orange represent government investment in agriculture. Blue represents Foreign Direct Investment in agriculture)

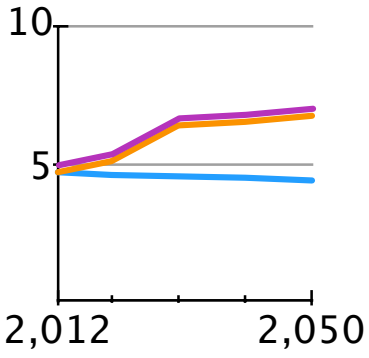


Figure 14. Increases in wages in rural areas (USD/person*mo. Purple and orange represent government investment in agriculture. Blue represents Foreign Direct Investment in agriculture)

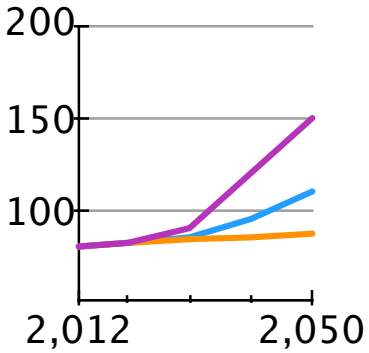


Figure 15. Wages in urban areas (USD/person*mo)

4% of GDP to education
100% government investment in agriculture
Moderate FDI in manufacturing

1% of GDP to education
100% FDI in agriculture
High FDI in manufacturing

4% of GDP in education
100% government investment in agriculture
High FDI in manufacturing

Why higher production in small farms?

Research has demonstrated the economic output per Ha is higher for small farms (Rosset, 1999) than for big ones. 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.

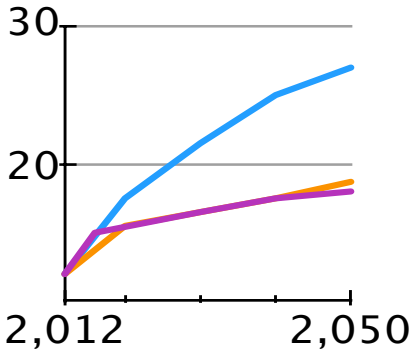


Figure 16. Simulation results for Low skilled urban workforce (mill. People)

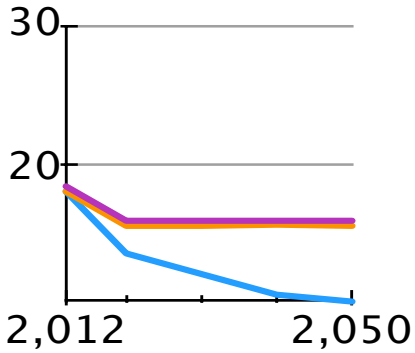


Figure 17. Simulation results for Low skilled rural workforce (mill. People)

4% of GDP to education
100% government investment in agriculture
Moderate FDI in manufacturing

1% of GDP to education
100% FDI in agriculture
High FDI in manufacturing

4% of GDP in education
100% government investment in agriculture
High FDI in manufacturing

9. Conclusions

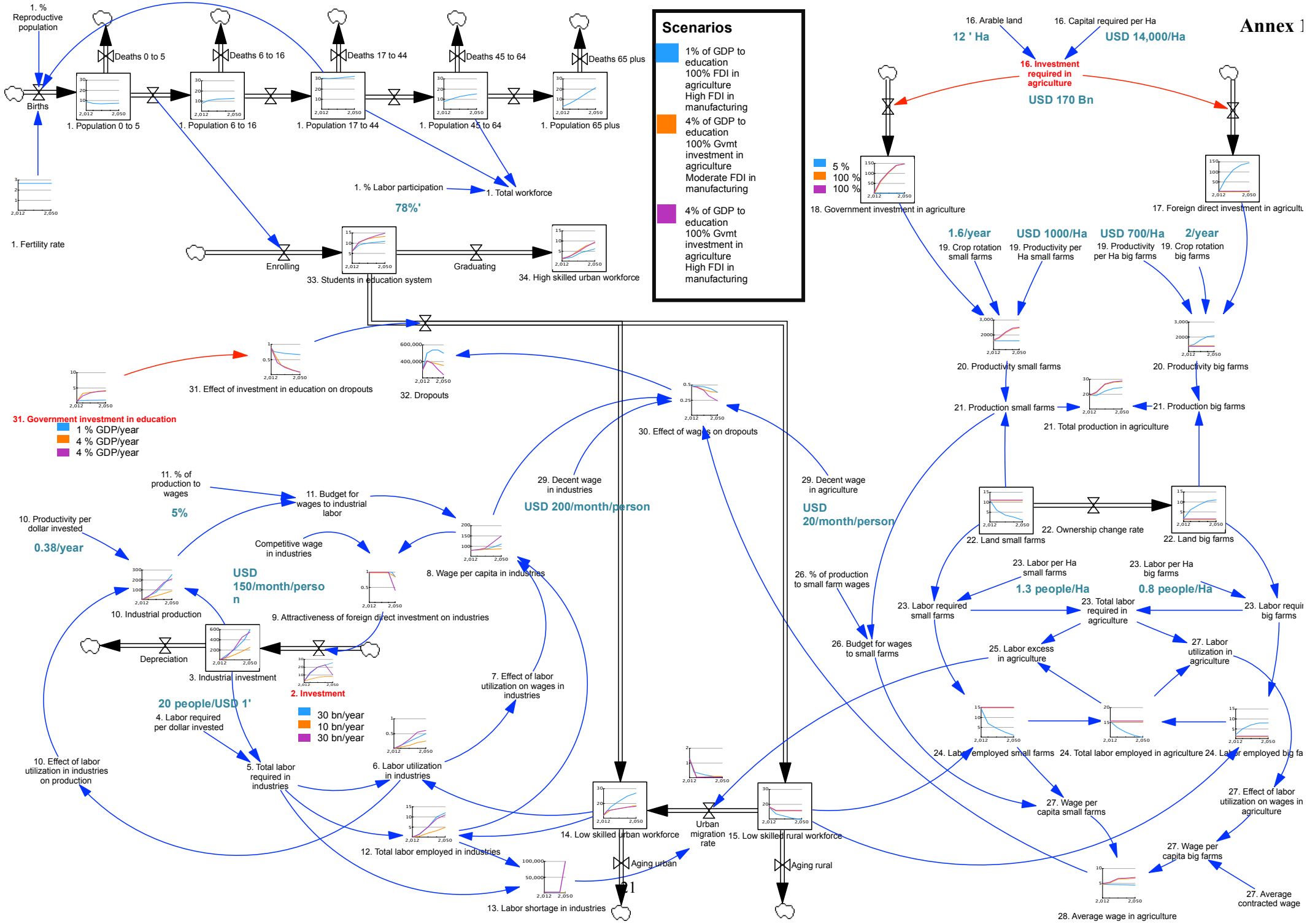
Myanmar carries on its shoulders almost six decades of self-enforced isolation that have left it with lack of institutional capability, obsolete infrastructure, and widespread poverty. This quick, though rigorous modeling exercise using System Dynamics, proved fundamental to understand some of the main 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 though 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.

10. 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 the sectors receiving most attention. Social development is measured only by increases in wages.


Annex 1
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
1. % Reproductive population
Births
Deaths 0 to 5
Deaths 6 to 16
Deaths 17 to 44
Deaths 45 to 64
Deaths 65 plus
1. Population 0 to 5
1. Population 6 to 16
1. Population 17 to 44
1. Population 45 to 64
1. Population 65 plus
1. Fertility rate
1. % Labor participation
78%'
1. Total workforce
Enrolling
33. Students in education system
Graduating
34. High skilled urban workforce
31. Government investment in education
1 % GDP/year
4 % GDP/year
4 % GDP/year
31. Effect of investment in education on dropouts
32. Dropouts
30. Effect of wages on dropouts
29. Decent wage in industries
USD 200/month/person
29. Decent wage in agriculture
USD 20/month/person
11. % of production to wages
5%
11. Budget for wages to industrial labor
10. Productivity per dollar invested
0.38/year
Competitive wage in industries
USD 150/month/person
8. Wage per capita in industries
10. Industrial production
9. Attractiveness of foreign direct investment on industries
Depreciation
3. Industrial investment
2. Investment
30 bn/year
10 bn/year
30 bn/year
20 people/USD 1'
4. Labor required per dollar invested
7. Effect of labor utilization on wages in industries
6. Labor utilization in industries
5. Total labor required in industries
10. Effect of labor utilization in industries on production
12. Total labor employed in industries
13. Labor shortage in industries
14. Low skilled urban workforce
Urban migration rate
15. Low skilled rural workforce
Aging urban
Aging rural
16. Arable land
12 ' Ha
16. Capital required per Ha
USD 14,000/Ha
16. Investment required in agriculture
USD 170 Bn
5 %
100 %
100 %
18. Government investment in agriculture
17. Foreign direct investment in agricult
1.6/year
19. Crop rotation small farms
USD 1000/Ha
19. Productivity per Ha small farms
USD 700/Ha
19. Productivity per Ha big farms
2/year
19. Crop rotation big farms
20. Productivity small farms
20. Productivity big farms
21. Production small farms
21. Production big farms
21. Total production in agriculture
22. Land small farms
22. Ownership change rate
22. Land big farms
23. Labor per Ha small farms
1.3 people/Ha
23. Labor per Ha big farms
0.8 people/Ha
23. Labor required small farms
23. Total labor required in agriculture
23. Labor requir big farms
26. % of production to small farm wages
26. Budget for wages to small farms
25. Labor excess in agriculture
27. Labor utilization in agriculture
24. Labor employed small farms
24. Total labor employed in agriculture
24. Labor employed big fa
27. Wage per capita small farms
27. Effect of labor utilization on wages in agriculture
27. Wage per capita big farms
27. Average contracted wage
28. Average wage in agriculture

Annex 2

OPINION

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EDITORIAL

Warning signs flash as Myanmar gears up

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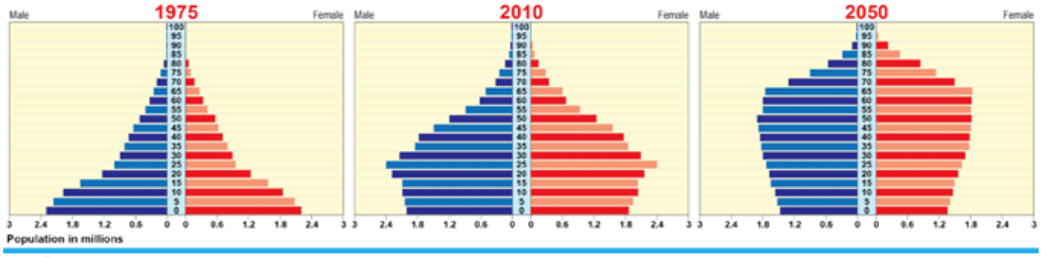
From pyramid to skyscraper: Myanmar's ageing dilemma



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