The impact of road development on Mawlamyine Township, Myanmar: Multiplier and optimization analyses

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Abstract

This article has two objectives. The first, pragmatic objective is to generate recommendations as to how township and national planners can achieve higher growth through the development of transportation jobs and value added from the East-West Corridor and Asian Highways leading into and out of Mawlamyine Township, Myanmar. Although Mawlamyine is both small and labour- and capital-constrained, it is also the Western terminus of the East West Economic Corridor (EWEC) and lies close to the sea. It is thus critical to Myanmar's overall growth to maximize Mawlamyine's economic potential.

The second, methodological goal is to optimize a social accounting matrix (SAM) and to observe those results against standard matrix multiplier analysis. Original surveys and official secondary data are used to construct a pioneering 2009 social accounting matrix. SAM based multipliers are first checked to observe the sectors and institutions with the greatest income, employment, and poverty-alleviation impacts. Then, the SAM is subjected to constrained optimization problem to determine the optimal level of township income and to what extent transportation and/or other sectors should increase as a source of jobs and value added. Finally Policy and methodological recommendations are based upon all two types of results.

Key words: Social accounting matrix, optimization, multiplier analysis, Myanmar, road impact

I. Real world problem

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Myanmar is located in a strategic position as a land bridge linking ASEAN countries with India as well as China. Economists in the early 1950s predicted that Myanmar's strong colonial heritage and rich mineral and scenic resources would make it the great success story of future economic development in the region. However in 2009-2010, with a GDP per capita (PPP) income of only 1,200 USD, Myanmar was ranked among the poorest 20 economies in the world (175th out of 194 by the CIA and 161st out of 182 by the IMF). In the UNDP's Human Development Index 2007, Myanmar is also ranked 132nd out of 149, far behind its ASEAN counterparts (Table 1). Since Myanmar's social indicators, except for education, are the lowest within the region, it is hardly surprising that the nation's overall GDP index is significantly lower than those of its neighbours, and that the economy is characterized by massive un- and under-employment.

Table 1. HDI Index of ASEAN Countries, by ascending rank of human development

Country	HDI rank	HDI index	GDP (PPP) rank (IMF2010)	GDP(PPP) per capita rank (IMF2010)	GDP index	Life Expectancy Index	Education Index
Myanmar	**132**	**0.583**	**78**	**161**	**0.389**	**0.596**	**0.764**
Cambodia	131	0.596	103	145	0.552	0.55	0.691
Lao PDR	**130**	**0.601**	**129**	**138**	**0.503**	**0.637**	**0.663**
Indonesia	107	0.728	15	122	0.609	0.745	0.83
Viet Nam	**105**	**0.733**	**40**	**128**	**0.572**	**0.767**	**0.815**
Philippines	90	0.771	33	124	0.657	0.767	0.888
Thailand	**78**	**0.781**	**24**	**89**	**0.745**	**0.743**	**0.855**
Malaysia	63	0.811	29	58	0.783	0.811	0.839
Brunei Darussalam	30	0.894	118	5	0.941	0.862	0.877
Singapore	25	0.922	39	3	0.95	0.907	0.908

Source: HDI report, 2007 and International Monetary Fund (undated)

During the late 1990s, the East–West Economic Corridor (EWEC) program was initiated for the regional development of Laos, Myanmar, Thailand and Vietnam at the

Ministerial Conference of the Greater Mekong Subregion (GMS) in Manila.[5] The EWEC initiative intends to improve not only the number, grade, width, all-season nature, and interconnectivity of roads; but also other transportation infrastructures such as rail, water, and air transport linkages.[6] Accessing the whole EWEC which passes through all four countries is still fairly difficult; but the construction of key bridges, tunnels and road improvements has commenced and some are now ready to use. In addition, although construction of the major sea port in Mawlamyine had been initially planned along with EWEC; currently the deep sea port project has been projected to move to Dawei, the capital city of Tanintharyi[7] Division, after planning had shifted to two alternative sites[8].

Mawlamyine, like Danang city in Vietnam, lies at one terminal point of the EWEC (Figure 1).[9] Unfortunately, in the Myanmar case, only 18 km of the 200-km stretch from the Myawaddy border to Mawlamyine have actually been completed. Since this has been accomplished with aid granted from Thailand, and the Myanmar segment will occupy only 200 km out of 1450 km, we may presume that the impacts of the EWEC have been far less significant than those in Thailand. Even when finished, previous projections[10] indicate that the 200-km portion inside Myanmar will support more savings in time than in actual travel costs.

[5] However, the program did not actually become operational until December 12, 2006.

[6] http://www.adb.org/GMS/Projects/flagshipB.asp

[7] Tanintharyi division lies at the southern end of Myanmar. The Division has common borders with Thailand on the east and south-east, Mon state on the north, and Andaman Sea on the west. Dawei is the capital of Tanintharyi Division.

[8] Firstly it was planned in the Kalegauk island, Ye township which is very close to Tanintharyi Division and the project has not been put into action. The second planned place was in Yangon, Yangon Division. Finally, it has been decided to construct at Dawei in 2010

[9] It has been TRF (Thailand Research Fund)'s PhD scholarship Project for searching impacts of the East – West Economic Corridor which is one of regional network road that goes from Vietnam to Mawlamyine,Myanmar.

[10] Asian Industrial Foundation Development Research (Commissioned by METI Japan), Study on possibility to improve the transportation and Industrial infrastructure and Trade between Myanmar and Thailand which will develop the East –West Economic Corridor, Survey Report, February 2007.

Figure 1 Greater Mekong Subregion East _West Economic Corridor

Source: Asian Development Bank (no date)

Indeed, a survey report by the Myanmar Economic and Management Institute (MEMI) found that the delays and variable costs due to poor road quality along the Yangon – Myawaddy route wipe out any cost benefit as compared with shipping by sea.

II. Scientific problem

There are at least three major justifications for choosing Mawlamyine Township for this study. First, very few studies have been done on road impacts for either Mawlamyine or the entire Myanmar side of the EWEC. The present study aims to help fill that knowledge gap. Secondly, it seeks to establish a baseline study of level and sources of income and expenditure for the “before” phase of full development of the EWEC on the Myanmar side in

the future. Later studies can then accurately measure to what extend an eventually completed and fully functional highway will have increased and modified the patterns of production, consumption and trade in the township.

Finally, even if the deep sea port project has ultimately been lost, Mawlamyine remains the capital city of Mon State and a major transit city for domestic trade from south to north. Already targeted to become a major trade city for border trade a full decade ago, it may regain its previous condition after the EWEC and Asia Highway (leading northwest out of Mawlamyine through Yangon towards Bangladesh) are completed and connected, particularly if there are further complications with the choice of a deep-sea port. The positive effects of road development through both the Asian Highway and the EWEC are predicted to include the creation of jobs in the highway construction, maintenance, and transportation sectors; the creation and diversion of trade which had previously gone by sea; intensified flows of skilled and less-skilled migrants, and an inevitable but still unknown impact on the level and distribution of income in urban, rural and semi-urban zones.

III. Goals

As the EWEC will knit together major points in Thailand and Laos to both Danang, Vietnam and Mawlamyine, Myanmar; this paper is designed to empirically examine the potential effects of road infrastructure growth on economic development in Mawlamyine; and to triangulate the results of multiplier, constrained optimization and geographic/logistic analyses to generate practical conclusions for policy makers.

To achieve these twin goals, three specific objectives have been set, to:

(1) estimate, through employment, poverty-reduction and value-added multipliers, the potential growth impacts of the development of roads and competing/complementary sectors on Mawlamyine's overall economy.

(2) determine, through an optimized linear-program Social Accounting Matrix (SAM), those sectors that should be promoted through both investments and the removal of current hindrances to their expansion.

(3) generate policy recommendations to provincial government, and production-marketing recommendations to the private sector, in order to more fully harness the potential of Mawlamyine's strategic location and growing road access.

IV. Hypotheses

In the course of meeting these objectives, this study will test three research hypotheses:

(1) The income, employment, and poverty-alleviation multipliers of the transportation sector and the infrastructure-related construction sector are significantly higher than for other sectors.

(2) Overall income per capita and the number of jobs in the Mawlamyine area could increase by at least 20% if sector-by-sector investment patterns were adjusted according to the optimal SAM.

(3) There is no contradiction between the results gained from multiplier analysis, and SAM optimization.

V. Methods of data collection and data

The primary data used come from an unprecedented survey in May-July 2009 from 375 households and 70 firms in Mawlamyine Township. Interviews were conducted to collect income and expenditures for minutely detailed subcategories of employment category, food, clothing, transportation, housing, health, insurance, communication, education, and so on. These primary data were supplemented by official secondary data to construct a meso-economic SAM for the township. We first carefully checked the secondary data to ensure that the data cells in the matrix were as accurate as possible. Therefore, our paper is based on primary data and augmented by macro data for certain categories. For instance, in order to get production activity income from institutions (government), we came to government expenditures through simple estimation. However, we have not had the updated government budget data. Therefore, we first inflated the data by the CPI for each year and then prorated them by the ratio of population in Mawlamyine to the national population in order to obtain reasonable estimates of the 2009 government budget data for various sectors in Mawlamyine.

Although Mawlamyine is a transit and trading city not only domestically, but also with the border town of Maesot, Thailand, secondary export and import data could not be obtained.

Some might suggest that the data from Maesot, Thailand could be used as a mirror proxy of EWEC activity on the other side of the Thai-Myanmar border. The problem is that we cannot know whether the exports from Maesot flow to Mawlamyine or to other destinations. Some will go to Pha-Ann, Kayin State while others will go to Yangon, the capital of the country. As a result, we relied on the firms' survey data and estimated again by using secondary data sources to fill in the remaining gaps. For example, *Mon State Facts and Figures* reported that Mawlamyine Township itself could not fulfill its total rice demand. We then estimated the amount of imports for the agricultural sector. However, we did have complete and reliable data on the fishery sectors, as well as their exports to Yangon and China. Additional details on the meaning of each of the sectors and/or required data adjustments are presented in Table 2.

Although the data upon which our Township SAM will be based are far from complete data for business, government and other institutions; we have tried to estimate the missing data to the best extent possible. For example, government expenditures on production activities for Myanmar have not been officially published and those data have been estimated based on the national government budget year 2000, as experts have suggested.[11] Myanmar does not provide data in very much detail at a regional level either. It is well known that a SAM will be inconsistent if data from disparate years have been used to estimate it. Therefore, there are no alternative data from Myanmar for government spending although we notice that the SAM will be inconsistent since we cannot use the updated secondary data. Additionally, the SAM for Mawlamyine's transactions are recorded in *kyat* (the national currency). In the absence of reliable data, the unemployment rate is assumed to be 25%[12], much larger than the official estimate. No government expense for transfer to households is reported at all for government expenditure for households.

[11] E.g. government expenditures on production activities= (Mawlamyine population/Myanmar population)* national government expenditure on that specific sector).

[12] Firstly , we estimate the number from the marco employment estimate .

Table 2 Description and adjustments in the data by economic sector

Sectors	Data description and adjustments
Agriculture and livestock	Rice, vegetables, crops, fruits, flowers, and livestock . Although the Mawlamyine economy is principally based on agriculture, it is not self-sufficient in rice and cooking oil *(Mon State Facts and Figures 2010).* It exports some fish, fruit and flowers. Income from production activities, shops and the ROW.
Agriculture Processing	Forestry products, rubber fumigation firms. Some enterprises such as furniture and rubber plantation firms do not really have data on how much is going to capital expenditures or to nurturing rubber. Based on the official data on rubber plantations and the responses of rubber orchard firms, we estimated the breakdown for labour, capital, transportation, communication, etc.
Handicraft (blacksmith, herb digestion pill)	Harrow, blacksmithing, knifes, silversmith, natural indigestion pill . Moonseeved vine, liquorices, and citron come from not only Mawlamyine town but also from the rest of Myanmar. The same is true for the blacksmithing village. Consequently some expenses of that sector go to the ROW. Data for each entry was estimated from the survey .
Transportation (trishaw, ponycart, bus, cycle)	Trishaw, pony cart, motorcycle taxi, taxi, bus, highway express and trucks. Mawlamyine residents mostly use motorcycles. Although road quality in Mawlamyine has been upgraded, housewives use trishaws to go to market and parents feel safer to use trishaws to send their children to schools. The field survey obtained data for respective subsectors such as households, government, other institutions, communication, gasoline and shops, etc.

	According to survey responses by trishaw riders, income has declined.
Communication	Phone, internets, public phones but much less evolved than in other ASEAN countries. In 2008, 1% percent of the population had cellular phone subscriptions in Myanmar vs. 33% in Laos (*World Bank, 2010*). Cell phone rental from the Ministry of Communication costs around $ 550/year. Very few internet cafés are open to public, so many go through authorized organizations from Yangon. This means some amount of expenses goes to the ROW.
Construction	Highways and some houses. Semi-urban areas are developing recently due to Asia highway projects. Construction income comes from households, government, and ROW. The data is mostly from augmented marco data .
Shops and services	Rice, cooking oil, meat, carpenters, seamstresses, barbershops, weaving, TV games, brokers, hotels. Shops are an intermediate or buffer connecting production activities with institutions, especially households. Travelers and guests stayed at Mottama as the Thanlwin bridge closes at 8 p.m. for security reasons. As a result, the role of hotels and inns in Malamyine has declined.
Gasoline,, residence electronic shops	Gasoline shops are small and not quite legal in 2009. Residence shops like small grocery shops in the semi-urban area are sources of household income. Electronic shops are mostly in the urban.
Snack, tea, meals	Includes food, tea, snacks, water and ice shops. Tea shop culture can be found ubiquitously, but we have aggregated these shops together as one subsector because of their small size.
Business services	Advertising, seminars, warehouse costs, R and D, copyright, and law consultancy. These data are from the firm survey.
Gambling and lottery	Most people living near the border are mostly interested in playing the Thai lottery system, which opens twice per month. The amount of lottery tickets

	purchased might be understated by the households, but is still deducted from their consumption. Given the tiny probability of actually winning, the household's net income from that sector is surely negative.
Transfer, tips, interest, dividend	Gifts, interest income, dividends, investing oversea, compensations for loss, bonus, overtimes and tips, value of non-money income.
Labours	Labour income data come from the household and firm surveys again.
Capital	Capital including machines, properties purchased by firms.
15 household categories	5 rural, 5 semiurban and 5 urban household categories based on per capita income quintiles within each zone. As households do not buy directly from farmers or agriculture sectors, those items pass through the intermediary of the shop sector.
Institutions (Tax and Special gov fees) GOV	This income includes our survey data on wealth index taxes for water, lighting and house frontage paid by households, and indirect taxes paid by firms. The *Mawlamyine Township Gazetteer* provided supplemental township government income in each sector. Government expenditures on various sectors were adjusted through inflation and prorating from the official 2001-02 review book.
Transnational fee	The cost of transferring money in and out of the country or the Township. The entry was from the household survey .
Savings	Firms' and households' Saving
Lending instit'ns	Financial intermediaries lending to both firms and households.
Institutions	Education, monastery, disaster reliefs, wedding, and other social institutions. Various data sources.
Rest of world	Exports/Import to the ROW and to the rest of Myanmar. Mawlamyine is treated like a meso-economy. Firm survey and secondary data helps us to calculate and estimate the export -import data .

VI. Methods of data analysis

Social Accounting Matrix and Its Literatures

A SAM is an extension of the Leontieff Input-Output model that captures the income and expenditure linkages among firms, households and other institutions in the form of a square matrix. A SAM represents a square matrix and an extension of the Input-Output model. SAM model is based on the macro income and expenditure equations.

"A SAM is a form of single entry accounting. SAMs also embody the fundamental principle, but they record transaction between accounts in a square tableau or matrix format" (Reinert and Roland-Holst, 1997, p. 95). Therefore, a SAM normally captures of the relationship between income and expenditure linkages.

A SAM can be written algebraically as a square matrix:

T = $\{t_{ij}\}$, where t_{ij} represents the transaction value from the expenditure account "j" to the income account "i".

"Nominal flows cross the SAM from columns to rows. For transactions involving goods and services, there are corresponding real flows crossing the SAM from rows to columns, for financial transactions, there are corresponding flows of assets from rows to columns. For pure transfers, there are only the nominal flows from column accounts to rows account" (Reinert and Roland-Holst, 1997, p. 96). Rows and columns stand for income and expenditure respectively. More specifically, row totals for each account must be equal to column totals of the respective accounts. Algebraically,

$$\sum_j t_{kj} = \sum_i t_{ik} \quad ,\forall k$$

"SAMs satisfy a variant of Walras's Law. If all accounts but one balance, then the last account must also balance" (Robinson's study (1989) as cited by Reinert & Roland-Holst, 1997, p.96).

the national income for an open economy structure can be written as follows.

Y= C+I+G+ X-M (1)

Starting from that equation (1), we can write down the SAM multiplier

In equilibrium,

Investment and saving are closure, i.e I=S

Government expenditure and Taxes are closure, i.e G=T

Among right hand side variables, consumption is described endogenously as

C= a Y

or Keynes' consumption function;

where a= the marginal propensity to consume and the rest occur exogenously. Therefore, we can see this identity as the composition of endogenous variable and exogenously.

$Y= aY+I+G+X-M$

$Y-aY= I+G+X-M$

$Y(1-a) = I+G+X-M$

$Y= (1-a)^{-1} [I+G+X-M]$

$Y= (1-a)^{-1} Ex$

where [I+G+X-M]=Ex, if $(I-a)^{-1}$exists, then

OR it can be written as follows

Where y_n= endogenous total income

$A_n * y_n$ = Transaction Matrix

X= Exogenous Changes

$y_n - A_n * y_n = X$

$y_n (1- A_n) = X$

$y_n = (I- A_n)^{-1} X$

$= (I+a^2+a^3+----------) X, (I+a^2+a^3+----------)$

= recursive expenditure

$=[\sum_{k=0}^{\infty} a^k]X$

$= M_a X = M_{a3} M_{a2} M_{a1} X$ (2)

$M_a= \frac{1}{1-a}\rangle 1 = M_{a3} M_{a2} M_{a1}$= SAM multiplier matrix or accounting multipliers

Equation (2) shows the receipts of productivity activities, factors and institutions which are endogenously determined following exogenous injections. The inverse, $(1- A_n)^{-1}$, is a multiplier matrix M_a. Therefore, this multiplier matrix is related to endogenous income /receipts y_n to injections X. The "SAM based multiplier accounts not only for the direct and indirect effect

but also for the induced effects on factor and household income and activity output due to the (Keynesian) income–expenditure multipliers" (Robinson (1989) as cited in Round, 2003a, p. 7)

If we standardize the size of the exogenous change to equal a 1 million *kyat* investment in each of the activities in the SAM, we may compare the impacts on value added to isolate those activities that have the highest overall multiplier, in other words, the highest growth potential in the economy.[13] Among developing countries, Sri Lanka, Ghana, Indonesia, Thailand and Vietnam are already using the SAM-based multipliers application in decision making processes (Round, 2003).

Although a social accounting matrix is very useful for policy planning and implementation, the structure of a SAM may differ substantially from country to country based on the country's specific technological, economic, social, and institutional structure (Pradhan, Saluja, & Singh, 2006). Construction of a SAM might be started "top-down" from macro level data to form an economy wide SAM in many cases; "bottom-up" to build a micro SAM from household and firm data at the district/township/village levels; or a "hybrid" of the two. As an example of the top-down approach, Reinert and Roland-Holst (1997) have suggested that the construction of a SAM should begin by recasting the macroeconomic accounts for the economy into a simple tableau, a so-called Macro SAM. "This of course assumes that the macroeconomic account exists and that the aggregates are to be relied on without further revision or adjustment" (Round, 2003, p.174). However, extra care "should be exercised in a strict application of the 'from Macro to Micro ' rule, especially if household survey data are used to construct the SAM and if the corresponding national accounts have not relied on these data or only to a minimal extent" (Round, 2003, p.174).

To exemplify the bottom-up approach, Parikh and Thorbecke (1996) used survey data to capture and compare the socioeconomic interdependence and structure of a traditional vs. industrializing village in India. Their goal was to examine the impact of rural industrialization on village life and the economy for the two villages. The main transformations in their SAM are (1) the allocation of value added to factors (labour and capital) by production activities yielding the pattern of factor use and the consequent factorial income distribution; (2) given the amount of land owned and the amount of human capital possessed by households, the factorial income

[13] Employment multipliers are calculated through an analogous process.

distribution, mapped into the distribution of household income earned by distinct socioeconomic household groups; and (3) the corresponding expenditure patterns (consumption of different goods and services, savings, direct taxes and imports) of the various socioeconomic group so that they can estimate multiplier effects and framework for the two villages.

In a hybrid approach, Li (2002) created a 1998 social accounting matrix (SAM) for Thailand with a description of the overall economy both via a macro SAM and aggregation of a micro SAM. She also presented a mapping of the final micro SAM to the macro SAM.

Linear Programming

Linear programming is a kind of optimization problem which is a special case of above functions such as objective functions and parameters are assumed to be linear in which constraints could be inequality or equality. To solve the constrained optimization problem, some methods such as the simplex method, the pivot madly method, substitution methods and Lagrange multiplier methods are well known. Here we will present the Lagrange multiplier method.

Lagrange Multiplier Method

Lagrange multiplier method solves the problem without substituting the constraint function with the objective function. The method brings in one more variable, λ, into the problem although it is similar to the substitution method. The method of Lagrange multiplier is associated with the function after we add the λ into the problem. It is called Lagrangian (L).

L: max or min (x,y, λ) $F(x,y)+\lambda(g(x,y))$

The equations will be the following;

(x): $f_x - \lambda g_x$

(y): $f_y - \lambda g_y$

(λ) $g(x,y)$

Then, set the three equations to be zero and solve those equations simultaneously by taking partial derivatives with respect to the three control variables. Using the Lagrange multiplier

rule, we have n+1 equation and n+ 1 unknown since λ is in the problem. Therefore, the equations can generally solve for solution variable x, y and λ here.

In Lagrange multiplier method, using λ is a kind of mathematical trick to get the solution we wanted. On the other hand, it also has an key economic explanation. Based on our original equation 'n', here we have 2 equations, we can write down as

$$\frac{f_x}{-g_x} = \frac{f_y}{-g_y} = \lambda$$

In other words, the ratio of $f_x tog_x$ is the same for every x. Therefore, numerators in our problem are marginal contributions of each x to the function f . For denominators, these usually have marginal costs explanations. Therefore, λ can be seen as the ratio of marginal benefits to marginal costs.

In our case the decision variables are importantly assumed to be the total products of the transportation sector that Mawlamyine economy should focus on. This is because the transportation sector could currently offer the most positive attribution to the township by multiplier analysis. Accordingly, agriculture and the other sectors have been noted as to what level those sectors' outputs should be increased or decreased. Therefore, our objective is going to be maximization of the value of township output. Constraints are resources which are land and labour in our study.

The linear program for a SAM becomes:

Max V = v*x

s.t. I-A >= 0

r <= b

x >= 0.

where **V** = total township value added

v = value added for a given activity

x = the output level of a given activity in million kyat

r = resource (land, labour, capital)

b = maximum available level of a given resource

Secondary data sources for land utilization of Mawlamyine provided adequate data to lay calculate the cultivable land constraint in the agricultural sector at 23,445 acres (*Mon State*

*Facts and Figure*s, 2010). We further assumed that the double cropping system in Mawlamyine's agriculture sector could allow potential land utilization to be 10% greater: 25,790 acres. The labour constraint was calculated as the ratio of country wide estimation from employment (*Review of the Financial, Economic and Social Conditions* for 2001/2002). According to an official estimation on employment in various sectors, the highest employment is in the agriculture sector, representing around 60% of total employment. Labour use requirements for individual activities mostly come from the countrywide data estimation by multiplying the ratio of total people of working age, and by assuming by personal observation an unemployment rate of 25% of un- or under-employment in Mawlamyine today.[14] Since our SAM cannot fill the data for government employment for some sectors, we leave some numbers for those sectors blank. Labour enjoys a much greater slack (i.e. potential increase in use) than land. Employment can be increased up from the current level of 127,986 persons up to 209,104 persons, i.e., the total working-age population.

VII. Mawlamyine' s SAM , multipliers , optimization and hypotheses testing results

Our SAM (Table 3) is a pioneering tool for the Myanmar economy, in that we have chosen meso-level analysis and employ a hybrid approach combining elements of both micro surveys based and macro data/national income accounts. Since the Myanmar economy had no official publication and computations on I-Os or SAMs during the last 10 years, and no firm-level data which could be used directly in constructing township level SAM, we had no recourse but to perform technical estimation by assumption on our primary and secondary data for Mawlamyine. For the data that only existed at the national level, we had to approximate the data for our study area according to Mawlamyine's proportion of the national population.

A SAM may not be balanced when it has is first constructed and there are many technical methods to balance a SAM. We have chosen the technique based on the expert's judgment on balancing. Because Mawlamyine is a transit and trading town, experts have suggested that we give more weight to ROW accounts. For example, the majority of people from Mawlamyine are on migration because they are working somewhere outside Mawlamyine, especially the border area of Thailand, Malaysia and Singapore. They reported to us amounts

[14] The officially announced rate of unemployment of just 4% seems implausible.

which were much lower than their actual income from remittances. Household heads had no answer sometimes when we requested what kind of odd jobs they are working since they had claimed that they were only working odd jobs. However, many times we have seen that facilities in those houses are more than normal houses meaning there is extra income coming from the outside especially it happened when we interviewed at household with migrant workers .

Table (3) Mawlamyine's SAM (million Kyats)

	Agriculture, livestock	*Agr. Process*	*Handicraft*	*Transport*	*Commun*	*Shops and services*	*Gasoline,electronic*	*Food, ice*	*Gambling, lottery*	*Construct*	*Labour*	*Capital/machines*	*HH1*	*HH15*	*Gov.*	*Transnational money transfer*	*Savings banks*	*ROW*	Total income
Agriculture, livestock	26463	0	57	0	0	35049	0	0	0	0	0	0	0	0	1606	0	0	7457	70632
Agr. Proces	0	1036	0	0	0	486	0	0	0	119	0	0	0	0	101	0	0	2054	3796
Handicraft	0	0	0	0	0	1471	0	0	0	0	0	0	0	0	180	0	0	435	2086
Transport	54	0	5	0	0	1605	1	24	0	4533	0	0	19	130	617	0	0	7981	16311
Commun	8	2	2	9	0	4	2	2	0	0	0	0	22	636	208	0	0	95	5036
Shops and services	4270	623	4	1622	295	18641	0	1190	0	410	0	0	2807	13401	5	0	0	12878	140404
Gasoline , electronic	81	1	9	1873	0	6190	0	270	0	0	0	0	104	1467	4	0	0	825	14353
Food, ice	0	1	1	516	0	17469	23	2	0	0	0	0	168	675	0	0	0	4613	30376
Gambling, lottery	0	0	0	0	0	0	0	0	0	0	0	0	3	119	0	0	0	0	580
Construct	0	0	0	0	0	0	0	0	0	0	0	0	25	43	1355	0	0	4395	6393
Labour	16058	1845	1617	11517	70	26919	7779	24822	0	580	0	0	0	0	0	0	0	0	91207
Capital, machines	486	40	85	198	361	11	32	0	0	737	0	0	0	0	0	0	0	0	1950
HH1	0	0	0	0	0	0	0	0	0	0	675	53	0	0	0	0	0	1885	2627
HH15	0	0	0	0	0	0	0	0	0	0	29614	188	0	0	0	0	0	9306	39243
Gov.	144	2	24	241	1996	1446	200	1060	0	14	0	134	14	42	0	0	0	0	7473
Transnational money transfer	0	0	0	0	0	0	0	0	0	0	0	0	12	256	0	0	0	19092	19531
Savings banks	0	0	0	0	0	0	0	0	0	0	0	0	-973	19484	0	0	0	590	73769
ROW	20859	246	271	259	2221	26173	6285	2891	327	0	0	476	0	0	3162	19531	73670	0	173701
Total expense	70632	3796	2086	16311	5036	####	14353	30376	580	6393	91207	1950	2627	39243	7473	19531	73769	####	
Value added	**16902**	**1884**	**1702**	**11715**	**431**	**28050**	**7824**	**24867**	**253**	**1317**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
% value	23.9	49.6	81.6	71.8	8.6	20.0	54.5	81.9	43.6	20.6									
% Township VA	17.8	2.0	1.8	12.3	0.5	29.5	8.2	26.2	0.3	1.4									

Hypothesis testing results

To test hypothesis 1, we generated the $(I-A)^{-1}$ multiplier matrix, shown in Table 4 with the transportation and construction sectors . Based on the table, investing one million *kyats* in the transportation sector will have high positive indirect impacts on agriculture and shops. When we consider factors and institutions (labour and households), "the additional effect is attributed to the assumption that the factor payment passed back to institutions (wage paid to household), are assumed to stimulate additional sets of consumption (i.e. increase in final demand). This is the induced effect of the SAM output multipliers." (Hara, 2008, p. 130).

To further explore these induced effects, we may decompose the overall multiplier into value added, employment, and zone-by-zone value added multipliers (Table 5). These all reflect the various induced effects of each investible sector. The value added multipliers for the transportation and construction sectors are the highest, and the employment multipliers are the highest and third highest.

In other research, we have also determined that the greatest poverty in the Mawlamyine economy lies in the semi-urban zone. The most favourable activities for that zone are not only the transportation and construction sectors, but also agri-processing, handicrafts and the food/ snacks/ice/ water sector.

We therefore fail to reject hypothesis (1), which states that *the income and employment, and poverty-alleviation multipliers of the road infrastructure and transportation-related economic sectors are significantly higher than for other sectors*.

Table 4. Multiplier matrix for Mawlamyine	*Agriculture, livestock*	*Agr. Processing*	*Handicraft*	*Transportation*	*Construction*	*Communication*	*Shops and services*	*Gasolines , electronic*	*Food, ice*	*Business services*	*Gambling, lottery*	Tips, dividends	*Labour*	*Capital, machines*
Agriculture, livestock	1.79	0.37	0.31	0.32	0.34	0.06	0.65	0.18	0.29	0	0.18	0.42	0.32	0.28
Agr. Processing	0	1.38	0	0	0.03	0	0.01	0	0	0	0	0.01	0	0
Handicraft	0	0.01	1.01	0.01	0.01	0	0.02	0	0.01	0	0	0.01	0.01	0.01
Transportation	0.01	0.02	0.02	1.02	0.73	0	0.03	0.01	0.02	0	0.01	0.03	0.02	0.02
Construction	0	0	0	0	1	0	0	0	0	0	0	0.01	0	0
Communication	0.01	0.02	0.02	0.02	0.02	1	0.01	0.02	0.02	0	0.01	0.03	0.03	0.02
Shops and services	0.47	0.91	0.67	0.81	0.85	0.16	1.62	0.44	0.73	0	0.46	1.05	0.8	0.7
Gasolines , electronic	0.04	0.08	0.07	0.19	0.15	0.01	0.1	1.04	0.08	0	0.04	0.09	0.08	0.06
Food, ice	0.08	0.15	0.12	0.17	0.17	0.03	0.23	0.08	1.13	0	0.09	0.2	0.15	0.14
Business services	0.01	0.03	0.02	0.02	0.02	0	0.04	0.01	0.02	1	0.01	0.03	0.02	0.02
Gambling, lottery	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Tips, dividends	0.01	0.01	0.01	0.01	0.01	0	0.02	0.01	0.01	0	0.44	1.01	0.01	0.01
Labour	0.6	1.12	1.14	1.2	1.09	0.09	0.73	0.77	1.19	0	0.24	0.55	1.42	0.37
Capital, machines	0.01	0.02	0.05	0.02	0.13	0.07	0.01	0.01	0	0	0	0.01	0.01	1
HH1	0	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0	0.01	0.01	0.01	0.03
HH2	0.01	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0	0.02	0.05	0.02	0.01
HH3	0.01	0.02	0.02	0.02	0.02	0	0.01	0.01	0.02	0	0.02	0.05	0.03	0.01
HH4	0.01	0.02	0.03	0.03	0.03	0	0.02	0.02	0.03	0	0.03	0.06	0.03	0.02
HH5	0.07	0.14	0.14	0.15	0.14	0.01	0.09	0.1	0.15	0	0.06	0.13	0.18	0.08
HH6	**0.02**	**0.04**	**0.05**	**0.05**	**0.05**	**0.01**	**0.03**	**0.03**	**0.05**	**0**	**0.05**	**0.12**	**0.06**	**0.05**
HH7	**0.02**	**0.04**	**0.05**	**0.05**	**0.05**	**0.01**	**0.03**	**0.03**	**0.05**	**0**	**0.05**	**0.11**	**0.05**	**0.12**
HH8	**0.03**	**0.05**	**0.06**	**0.06**	**0.06**	**0.01**	**0.04**	**0.04**	**0.06**	**0**	**0.05**	**0.11**	**0.07**	**0.05**
HH9	**0.05**	**0.09**	**0.09**	**0.1**	**0.09**	**0.01**	**0.06**	**0.06**	**0.1**	**0**	**0.06**	**0.14**	**0.12**	**0.06**
HH10	**0.12**	**0.22**	**0.22**	**0.23**	**0.22**	**0.02**	**0.14**	**0.15**	**0.23**	**0**	**0.09**	**0.21**	**0.27**	**0.13**
HH11	0.01	0.02	0.02	0.02	0.02	0	0.01	0.01	0.02	0	0.03	0.06	0.02	0.05
HH12	0.01	0.01	0.01	0.01	0.02	0	0.01	0.01	0.01	0	0.03	0.08	0.02	0.04
HH13	0.01	0.03	0.03	0.03	0.03	0	0.02	0.02	0.03	0	0.04	0.09	0.03	0.04
HH14	0.04	0.06	0.07	0.07	0.08	0.02	0.04	0.04	0.07	0	0.04	0.08	0.08	0.16
HH15	0.2	0.37	0.37	0.39	0.37	0.04	0.24	0.25	0.39	0	0.11	0.25	0.46	0.22

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Table 5 Decomposition of total Mawlamyine's SAM-based Multiplier	Gross income multiplier	Value added multiplier	Employment multiplier	Rural income multiplier	Semi-urban income multiplier	Urban income multiplier
Transportation	5.04	**1.23**	**1.20**	**0.22**	**0.48**	**0.52**
Construction	5.76	**1.23**	**1.09**	**0.21**	**0.47**	**0.51**
Agriculture, livestock	3.67	0.62	0.6	0.11	0.25	0.26
Agr. Processing	5.26	1.15	1.12	0.21	0.45	0.48
Handicraft	4.63	1.19	1.14	0.21	0.46	0.5
Communication	1.57	0.16	0.09	0.02	0.05	0.06
Shops and services	4.23	0.76	0.73	0.14	0.3	0.32
Gasolines , electronic	3.35	0.78	0.77	0.14	0.31	0.33
Food, ice	4.73	1.21	1.19	0.22	0.48	0.51
Business services	1	0	0	0	0	0
Gambling, lottery	3.18	0.68	0.24	0.13	0.3	0.25

To test hypothesis 2, we converted the SAM of Table 3 into a linear programming model . Linear programming is a special case of optimization problem such that the objective function and parameters are assumed to be linear and in which constraints may either be weak inequalities (greater than or equal to some minimum level, less than or equal to some maximum limit) or exact equalities. In our case the decision variables are importantly assumed to be the total products of the township laid out in columns or unit budgets of 1 million *kyat*. Accordingly, agriculture and the remaining sectors have been also been determined by how much those sectors' outputs should be increased or decreased. Therefore, our objective is going to be the maximization of the value added for the township output, It is the macroeconomic equivalent of net returns at the firm level. The coefficients for value added in the linear program are identical to the third line from the bottom of Table 3. The coefficients in the model are simply the I-A matrix rows all constrained to equal 0 (i.e., expenditures may not exceed income for any sector in the economy, including households and institutions). Additional constraints allow the land, labour, capital of the township itself to be used fully or underused, but never to be over-used; and a non-negativity constraint (no activity may be produced at a level less than 0).

In order to obtain the optimal output with our resource constraints, the Solver routine in MS EXCEL 2007 is an extremely useful tool. As noted, the (I-A) matrix is a unit net income matrix very useful for linear programming matrix (Calkins, 2009). However, running the model by forcing all the I-A constraints to balance has a limit, first detected by Walras, that a meaningful solution other than zero or completely parallel changes in all activities cannot be obtained. So the essence of running our model in practice is to allow one variable to go unconstrained. Most importantly, the researcher or policy planner should decide which variable should not impose or impose with exception. As we plan to make smaller amounts of agriculture import for Mawlamyine town and we have noticed a huge level of inefficiency in using local resources, we set the ROW (rest of the world constraint) to go no higher than about 20% less than its current level, i.e. 140,000 (million *kyats*), less than the current level 173,701 (million *kyats*).

Table 6 presents the optimal solution and range analysis for Mawlamyine Township meso-economy. The results suggest a massive scope for improving the total value added of

the township if restructuring of the production/sales activities of the meso-economy were undertaken. Township value added could increase from some 95 billion kyat to almost 179 billion kyat, or an increase of 88%. However, in stark contrast to the unconstrained multiplier analysis, the two target sectors of this research, transportation and construction, should optimally be reduced in size by 3% and 1%, respectively, rather than targeted for increase. Put another way, the percent value added in the transportation sector would have to increase from 72% to 92%[15] before that sector would increase under the optimal plan.

[15] Current value added of 0.72 plus allowable increase of .20 in the Transport row of Table 7.

Table 6. Estimated optimal solution and range analysis for the Mawlamyine Economy

Name of economic activity, resource or institution	Optimal plan	Level today	% change	Shadow Price	Current value	Allowable Increase	Allowable Decrease
Township value added	178,941	94,947	88%				
Re-organization of township value added							
Agriculture, livestock	81,701	70,632	16%	0.00	0.24	infinite	4.13
Agriculture Processing	3,454	3,796	-9%	0.00	0.50	0.31	222.30
Handicraft (blacksmith pill, chops)	2,402	2,086	15%	0.00	0.82	0.18	142.00
Transport (trishaw/ponycart/bus/cycle)	15,788	16,311	-3%	0.00	0.72	0.20	38.77
Communication	6,214	5,036	23%	0.00	0.09	0.73	27.74
Shops and services	171,030	140,404	22%	0.00	0.20	8.09	1.77
Gasoline, residence electronic shops	145,106	14,353	911%	0.00	0.55	infinite	0.06
Food, tea , snacks, water and ice	35,365	30,376	16%	0.00	0.82	0.10	8.74
Business service providers	4,692	3,860	22%	0.00	0.00	0.76	64.76
Gambling and lottery	743	580	28%	0.00	0.44	0.11	304.77
Construction	6,306	6,393	-1%	0.00	0.21	0.27	44.83
Transfer , tips, interest , dividend, non money income	2,290	1,790	28%	0.00	0.00	0.25	66.70
Factor payments							
Labour	174,251	91,207	91%	0.00	0.00	20.56	0.20
Capital	2,401	1,950	23%	0.00	0.00	0.94	27.55
Agricultural capacity ("land")	25,790	23,445	10%	13.10	23,445	25,790	4869.65
Labour total	169,160	129,786	30%	0.00	129,786	209,104	infinite
Income redistribution							
HH1(Lowest rural quintile)	2,892	2,627	10%	0.00	0.00	2.21	123.24
HH2 (Second rural quintile)	4,463	4,071	10%	0.00	0.00	1.50	70.20
HH3 (Middle rural quintile)	6,506	5,681	15%	0.00	0.00	1.42	39.84
HH4 (Second-highest rural quintile)	7,336	6,337	16%	0.00	0.00	1.03	35.17
HH5 (Highest rural quintile)	22,793	12,793	78%	0.00	0.00	1.10	2.84
HH6 (Lowest semi-urban quintile)	9,375	6,699	40%	0.00	0.00	1.79	23.65
HH7 (Second semi-urban quintile)	10,159	7,808	30%	0.00	0.00	1.57	25.43
HH8 (Middle semi-urban quintile)	12,448	9,476	31%	0.00	0.00	1.72	19.44
HH9 (Second-highest semi-urban quintile)	20,207	14,859	36%	0.00	0.00	1.33	9.88
HH10 (Highest semi-urban quintile)	62,745	53,730	17%	0.00	0.00	0.69	1.87
HH11(Lowest urban quintile)	6,754	6,751	0%	0.00	0.00	1.41	74.75
HH12 (Second urban quintile)	7,772	8,146	-5%	0.00	0.00	1.53	82.21
HH13 (Middle urban quintile)	11,029	10,925	1%	0.00	0.00	1.38	46.06
HH14 (Second-highest urban quintile)	17,569	14,796	19%	0.00	0.00	1.21	15.17
HH15 (Highest urban quintile)	64,482	39,243	64%	0.00	0.00	0.91	0.75
Quintile ratio[16]	10.6:1	8.7:1	- 1.9:1				
Returns to external institutions							
Institutions (Tax and Special gov fees) GOV	10,797	7,473	44%	0.00	0.00	1.66	6.98
Transnational money transfer fee	16,033	19,531	-18%	0.00	0.00	0.00	111.21
Savings banks	98,033	73,769	33%	0.00	0.00	0.00	1.03
Lending institutions	12,874	10,334	25%	0.00	0.00	0.01	12.29
Institutions (NGO , education , monastery, disaster, wedding)	7,610	5,826	31%	0.00	0.00	0.00	23.00
Rest of Mawlamyine and the world	140,000	173,701	-19%	-1.13	0.00	1.13	infinite

[16] The quintile ratio is calculated from a linear program with 15 household types as the ratio of the average of the top three income groups to the lowest three income groups, regardless of whether those groups are urban, semi-urban, or rural.

This implies either a massive change in transportation technology or a significant improvement of efficiency in the application of current technology. In the case of pony carts and trishaws, the latter is a little difficult to imagine. The case for the construction sector is even more dramatic. The proportion of value added would have to increase more than double from 21% to 48%[17] before there would be an increase in this sector. This signals either great inefficiency or the limited usefulness of construction for those activities that have the highest value added.

Nonetheless, the results of Table 6 do show that we may accept hypothesis 2, to the effect *that overall income per capita and the number of jobs in the Mawlamyine area could increase by at least 20% if the sectoral distribution of economic size were adjusted according to the optimal SAM.* These gains are shared by virtually all household types; the sole exception being household 12 (second lowest urban quintile). Absolute poverty reduction would thus be widespread. However, relative income inequality would worsen, from a quintile ratio of 8.7:1 to 10.6:1, pointing to evidence of a Kuznets type inverted U pattern in the early stages of development.

Taken together with Table 5, the results of Table 6 force us to reject hypothesis 3, to the effect that *there is no contradiction between the results gained from multiplier analysis, and SAM optimization analysis.* Our linear programming results show that the optimal role of the transportation and construction sectors should go down, rather than up (as suggested by the multiplier analysis), once realistic Walrasian and resource constraints are taken into account. This points to the danger of relying solely on multiplier analysis by individual activity. Linear programming optimization seems a safer investment guide than multiplier analysis.

VIII. Conclusion and Policy recommendations

The result of not encouraging transportation is quite reasonable for a small town like Mawlamyine. The fact that a majority of households own at least one bicycle depresses demand and income in the transportation sector. Even though the EWEC network is not fully connected through to Thinguannyinaung, Myawaddy, a number of highways and township roads have been paved and upgraded. This has reduced the demand by households for

[17] Current value added (0.21) plus allowable increase (0.27) in Construction row of Table 7.

trishaws, motorcycles, and pony carts. Planners should probably upgrade the public transportation system instead of encouraging the private sector.

According to official statistics, the sufficiency rates of Mawlamyine Township's rice consumption in 2008-09 and 2009-2010 were only 16.8% and 21.3% respectively (*Mon State's Facts and Figure*s, 2010, p. 29-30). Our optimization plan gives a very close guide to implementing policy in reality. Currently, the optimization calls for no new investment but allows employment to increase by 18%. Facts from the sensitivity report confirm that it would be better to increase the agriculture sector including vegetables, fruits and rice production because the survey experience indicates that the majority of fruits (Thai *longan*, durian, *rambutan* and orange; Malay durian) are famous not only in Mawlamyine but also in the rest of Myanmar. As a result, orchard planters have been giving up doing business in that sector, even though Mon State was a famous fruit exporting town several years ago.

Agri& livestock and food should be encouraged 16% more . Since HH5 income increase 78% , it implies that these needs capital in rural lover quantiles to help boost production . Agriculture processing be reduced by 9% of presents also say that agriculture producers should be used for local consumption rather than processed for export from this town . This policy encourages food security and save unnecessary transportation to distant markets .

In addition, the handicraft sector such as blacksmithing and the fabrication of herbal indigestion pills and chopping hoe should be encouraged. Mostly those artisans hail from the rural zone. Encouraging those businesses will have at least two benefits. Firstly, it will give more chance for income generation for those rural families in terms of both business owners and labourers. Secondly and consequently, it will be a policy for eradication rural poverty as well. The problem of policy planner is how to encourage that sector. According to focus group interviews during the 2009 survey, people in those sectors had no motivation to carry on their home business as they thought that income from going to work on the border or in factories in Thailand offered more opportunities to do things that they want.

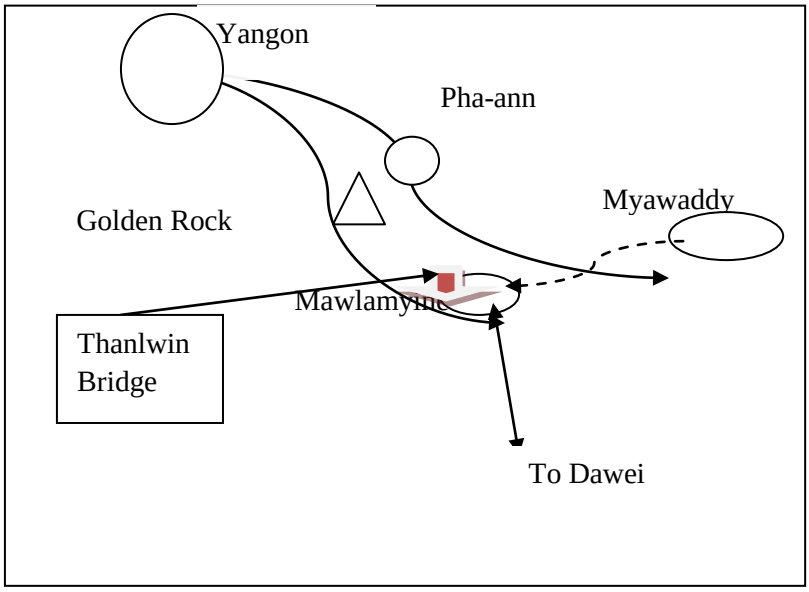
The result from gambling and lottery comes out to be considerable, as we know that income from that sector is only going to tips and the non-monetary sector and to the rest of Myanmar and the world. When we consider the problem logically, the probability of winning the lottery is infinitesimally low. However, people in that area hope that they can win that lottery,

which makes the illegal lottery a popular business among the people. Based on the survey experience, people in different classes – rich or poor - play the lottery since their hopes of winning the illegal lottery are generally quite elevated. Even if the lottery offers the chance to significantly increase the income level, this sector should not be encouraged to grow.

On the other hand, drinking water, ice, food and snack shop could be targeted for upgrading, especially since they also figure prominently in the multiplier analysis. With reference to the survey experience, people in Mawlamyine do have some burden for finding water not only for drinking but also water for general uses. Small food and snack shops should be encouraged too as those kinds of income mostly contribute to the poor people in the rural areas.

Promoting the agricultural sector, especially paddy farming and orchards, to reduce agriculture imports and increase self-sufficiency in rice consumption. We see from the multiplier matrix and sensitivity report that combining primary survey and adjusted secondary data have some valuable policy implications for the authorities. First and foremost is for the government to decide for what kind of goals they wish to apply to public policy. Our results could be checked based on Mawlamyine's geographic condition.

Figure 2 Geographic condition of Mawlamyine



For example, some might object that our optimal plan does not promote the industrial and manufacturing sector. But based on the township's current economic and geographical structure, Mawlamyine has become a totally transit-based city although handicraft was once of

the famous export many decades ago. According to the experience gleaned from our firm survey, firms must import capital goods to use in the industrial and manufacturing sectors. For example, car production requires imported engines to be installed in the chassis. Due to the nature of capital goods, the prices are much more expensive than those of agriculture goods. Encouraging car production and not encouraging agriculture and handicraft at the same time would only result in significant spending on imports and lose of the potential of exports from the agriculture and handicraft sectors.

Similarly, some may be surprised for example that the linear programming strategy grid does not mention the tourist sector. Firstly, Mawlamyine has no visible attractions such as beaches, well known historical sites or famous handcraft sites unless the government physically creates a tourist attraction. Secondly, it is not near enough to the well known Golden Rock Pagoda, *(Kyaikhteeyoe*) to take advantage of the flow of international and domestic tourists to that site. Therefore, we are hoping to foster the hotel and tourism sector in Mawlamyine only at a later phase, when the EWEC is finished and incentives for trade in the township economic sector such as handicrafts are created in Mawlamyine. Overall, then the geographic condition of Mawlamyine confirms the logic of the optimized SAM.

IX. Methodological recommendations

Generally, the multiplier matrix gives us some overall policy formulation suggestions, but it cannot be said which individual activity or which overall plan is optimal for the town. The optimal plan, on the other hand, tells us that transportation and construction, the target sectors in our study could be decreased by 3% and 1%, respectively, with corresponding declines in employment. Although the multipliers for these activities are high if we assume zero-based planning; they have clearly already surpassed the maximum efficient level with respect to current labour and capital conditions. This is undoubtedly due in large part to the very rudimentary means of transportation (trishaw, pony cart, cycle and dilapidated buses) and the feeble job creation possibilities in this sector.

The apparently contradictory results of the multiplier matrix and of linear programming should pose no dilemma for policy planners. Multipliers are calculated independently of both other activities and economic constraints; they correspond to unconstrained partial equilibria.

The linear programming, on the other hand, yields a unique optimum under constrained optimization of all activities simultaneously. It is therefore an example of complete equilibrium.

X. Limits of the research

It is necessary to recall that the data used in the SAM were mostly 2009 survey data from households and small-scale firms in the informal sector. However, data for some cells such as government expenditure on productivities activities have been estimated via the national budget from the year 2000, the last in which the national budget was shown to the public. We estimated those data by inflating them with the CPI because some experts suggested this procedure where local data are inadequate to complete the SAM. As the Mawlamyine SAM is a pioneering effort within this context, it may have some weak points due to constraints in Myanmar. For example, we cannot estimate government expenditure on households. Although there potentially should be values there, we leave those cells blank. This is because we know public utilities, health care and education in Mawlamyine are very underfinanced. Despite such data limitations, we have tried as much as possible to obtain the appropriate SAM in order to explore the real world problem by using our unprecedented 2009 survey data.

A primary sector that could promote the economic development of Mawlamyine is apparently that of gasoline, residence shops and electronic shops. Generally, participants in small gasoline shops are from medium income households. Electronic shop businessmen are from higher income classes. But the data on which the optimization results are based come from 2009, when private gasoline shops were unofficial and illegal. We therefore cannot formally recommend that a large sum of money be invested in them. Rather, our target should be to upgrade the agriculture sector and reduce agriculture imports. That is why we consider reducing the ROW account by some twenty percent. Unless there is a corresponding rise in price, such a reduction might have some favorable effects on the gas and electronic shops as Mawlamyine imports 100% gas and electronic products.

Private sector data are also hard to come by. We lack updated information of how many gas shops are operating in the private sector. Residence shops represents semi-urban areas and electronic shops are normally run by high income families. Therefore, policy formulation on those two categories should be cared as encouraging residence shops needs

some amount of money and no need to assign outside labour, and only family labour can manage those shops. In other words, encouraging small residence shops may not create employments opportunities. For electronic shops, it will encourage domestic trading as well as employment opportunities of the working population. Still to be seriously considered is how to create trading opportunities for the whole of the Mawlamyine economy.

Until now, Myanmar does not provide macro SAMs or I-O tables of each production activity. Formulating future policies based on SAM/I-O multiplier analysis and optimization is much more concrete as SAM and I-O models show, trace, and interrelate the flows of income and expenditures of endogenous and exogenous variables. If this is possible, a true national SAM should be constructed. Without such a tool to complement traditional project analysis and cost-benefit studies, we believe that Myanmar will continue to be handicapped in the appropriate development and integration of its road and transportation sectors.

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