Macro and Multi-Sector planning: a situation analysis

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Abstract:

The impact of planning to an economy cannot be overemphasized and this is because planning serves as instrument in which government policies are implemented. Also an economy or a country is a combination of different sectors and understanding sectoral inter-dependence is of important to less-developed countries and developed countries. This research paper examines “Macro and Multi-sector planning: a situation analysis”. The purpose of the research paper is to analyze “macro and multi-sector planning: a situation analysis”; explain the rational for development planning; explain multi-sector development objectives, development strategies, sector policy instrument and to explain multi-sector planning models. The researcher was of the view that there is need to indentify international sector and national sector within the different sectors of the economy and recommends the need for governments to implement policies based on sectoral inputs so as to achieve economic growth and development.

Keywords: sectoral planning and policy instrument

1.0 Introduction:

According Tinbergen J. (1967), planning is defined as ‘preparation of policy’ and any good preparation must study the structure of the system before deriving policies that will be effective. Conventional definition of development planning by Jhingan M. L. (2003) is that planning is a deliberate control and direction of the economy by a central authority for the purpose of achieving definite targets and objectives within a specified period of time.

Development planning is preceded by development modelling, which is aimed at presenting a consistent, feasible and optimal path for inter-related variables of the economy, based upon its dynamic structure. On the other hand, development modelling is the formalization of the procedure for studying the structure of an economy for the purpose of deriving consistent and optimal policies.

The important of development planning to the life of an economy cannot be over-emphasized and this is because it provides a direction for a country. National development planning is vast and multi-dimensional and naturally, the planning problems have to be broken into manageable parts or carried out in stages. This is called ‘planning in stages’ by Tinbergen Jan (1967), in the sense that national development planning is divided into the macro-economic stage, middle stage that incorporate planning at the regional level and for major economic and social sectors of the economy, and micro stage incorporating the planning for districts and project.
Various planning agencies and organizations then specialize in the respective dimensions or stages of planning, and all the planning is carried out simultaneously through continual interactions among the various planning agencies or boards, rather than by sequential stages.

The primary objective of this research paper is to analyze “macro and multi-sector planning: a situation analysis”. Also other objectives to be attain in this paper are; to explain the rational for development planning; to explain multi-sector development objectives; to explain multi-sector development strategies; to explain multi-sector policy instrument and to explain multi-sector planning models.

2.0 Overview of sector development planning:

Sector planning studies each of the sectors of an economy and explores how its potential can be harnessed in an efficient and consistent manner with respect to the objectives of national economic and social development. A sector is a collection of industries or sub-sectors of industries. A further breakdown of sector planning involves analysis and evaluation of suitable project for the development of the sector. For the purpose of sector planning, the economy has to be divided into major economic sectors with the objective of studying the factors and constraints that generally govern the performance of each of the sectors (with its constituent industries-existing and potential) and the roles each sector is capable of playing in contributing to national development. Sector planning also involves the development of planning models and methods for achieving the objectives of optimal sector development.

2.1 Rationale for development planning and formal theory of development policy:

Tinbergen (1967) postulates that for any economic system, there are four types of inter-related variables. The variables are first divided into two groups, namely, exogenous and endogenous. Each group is further divided into two types. The exogenous variables are divided into controlled and non-controlled exogenous variables. The controlled exogenous variables of a system consist of government policy instruments that are not determined by the economic system but are determined by discretion of central authorities. The non-controlled exogenous variables are the variables not determined by the economic system and beyond government control, and are also referred to as truly exogenous variables or data. Examples are rainfall, atmospheric temperature etc.

The endogenous variables, which are those determined by economic system, are divided into target endogenous and non-target endogenous variables. the form of relationship among the variables is that the non-controlled exogenous variables have some definite impact on all the variables in the economy without vice versa, that controlled exogenous variables or policy instruments have impact on all the
endogenous variables without vice verse, and that endogenous variables have mutual impact on one another, and that target endogenous variables are the main arguments of the welfare function or matter most for the development objectives.

Fig. 1 below is a diagrammatic illustration of the theory of development policy. Given the theory of development policy, the task of development modeling is to determine the nature of relationship among the variables. Without modeling and planning the system is capable of producing all kinds of outcomes on the basis of the influence of exogenous variables on the target endogenous variables.

Modeling and planning seeks therefore to manipulate the exogenous variables towards selecting the best or optimal outcome.

**Figure 1: theory of development policy:**

<table>
<thead>
<tr>
<th>EXOGENOUS VARIABLES</th>
<th>ENDOGENOUS VARIABLES</th>
<th>WELFARE FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled variables ( x ) (policy instruments)</td>
<td>Target endogenous variables ( y )</td>
<td>WELFARE FUNCTION</td>
</tr>
<tr>
<td>Non-controlled variables ( u ) (data or truly Exogenous)</td>
<td>Non-target endogenous variables ( z )</td>
<td></td>
</tr>
</tbody>
</table>

\[ Ay = Bx + Cu \]

In system (1) above, \( y \) is the vector of target endogenous variables; \( x \) is the vector of policy instruments and \( u \) is the vector of non-controlled exogenous variables, consistent with notation in Fig. 1 and \( A, B \) and \( C \) are the coefficient matrices. \( A \) has to be square matrix since the number of unknowns (vector \( y \) must be equal to the number of equations for the system to be
determined). The linear system (1) is reduced from where the non-target endogenous variables \((z)\) have been eliminated. The solution to the analytical model is given as:

\[
y = A^{-1} (Bx + Cu) = \frac{\text{-----------------------------}}{\text{-----------------------------}} (2)
\]

The solution (2) shows that our target variables that define our development target are dependent upon government policy instruments and non-controlled exogenous variables. The impact of \(x\) is measured by the matrix \(A^{-1}B\), while the impact of \(u\) is by the matrix \(A^{-1}C\).

Transforming the analytical model to policy model requires us to fix the most desirable values for our target endogenous variable \((y)\). If we do so, then the vector \(x\) become the unknowns. The question policy model posses are: what should be the values government should attach to its policy instruments in order to achieve our development targets. Mathematically, if the number (say \(m\)) of variables \(x\) is smaller than the number (say \(n\)) of the target variables \(y\), then government does not possess enough policy instruments to achieve the development targets as the system is not determinate. That is we have more equations than the unknowns in the policy model. If \(m = n\), that is, there are many policy instruments as are target variables, then the system is determinate and the government has just enough policy instruments to achieve the development targets. If \(m > n\), then there are more policy instruments than are target variables, so government needs only to use a subset of policy instruments (and not all) to achieve the development targets; in that case, government is said to have policy degree of freedom equal to \(m – n\). Government could in that case, fix the values of the excess policy instruments the way it likes, since the development targets are achievable with the other policy instruments.

2.2 multi sector development objectives:

Aggregate development objectives are reduced to and multi-sector and sectoral ones, while there are specific objectives that can be pursued at the multi-sector and sector levels. As for the aggregate objectives, the sectoral level of planning aims to maximize the target variables or minimize the cost of attaining set targets through the sectoral distribution of the tasks. As for specific sectoral objectives, a target variable is set for the relevant sector, which to be attained at least is cost by selecting the appropriate strategies and methods.

2.2.1 General sectoral objectives:

The general development objectives that are to be pursued in all sectors include:

i) Output or income growth
ii) Foreign exchange conservation for self reliance

Sector outputs are then planned such as to maximize value added and the gap between exports and imports, subject to the resource constraints (savings and foreign exchange earnings or total investment resources).
Alternatively income and balance of payment targets are to be met through sectoral investment allocation such as to minimize the total investment and foreign exchange costs. The sectors that can contribute most to national income growth and net foreign exchange earnings are given priority or designated key sectors. Sufficient investments are carried out in such key sectors to ensure the fulfillment of national targets for income growth and balance of payments.

2.2.2 Specific sectoral objectives:

The economy is first divided into the appropriate number of major sectors keeping a view the structure and prospects of the economy and national development objectives. The major sectors of an economy are:

- Agricultural, livestock, forestry and fishing
- Mining and quarrying
- Small scale manufacturing and food processing
- Large scale manufacturing
- Utilities
- Building and construction
- Transportation and communication
- Commercial services
- Community, social and personal services
- Government services and administration.

The sectors can be grouped into four major sectors in respect of specific sectoral objectives and these are:

i) **Infrastructural development objectives**: sectors such as utilities (electricity, gas, and water), transport and communication, building and construction, must be developed in such a manner that it can meet the needs of industrial activities efficiently, relatively, and adequately, so as to enhance the competitiveness of domestic manufacturing industries. Such infrastructural services cannot be imported and have to be domestically produced, otherwise the economy will not be able to cope with global competition and grow appreciably. Agricultural also has some infrastructural role to play in the supply of cheap raw materials to domestic food processing industries and other agro-allied industries.

ii) **Welfare objectives**: sectors such as housing, agriculture, small scale manufacturing can be used respectively to promote the objectives of income distribution to enhance the welfare of the poorest groups through low-cost mass housing, cheap food supplies, and employment generation in which small scale enterprises have advantage.

iii) **Industrialization and rapid development**: the large scale manufacturing sector has the objective of producing modern giant industries in which the nation posses’ immense comparative advantage and
export potentials for purpose of accelerating national economic development and technological change. However, the nation must be careful to ensure technological self-reliance, avoiding excessive technological dependence on industrially advance countries.

iv) **Strategic security objectives:** certain sub-sectors within the agriculture, manufacturing, and utilities need to be assigned strategic objectives for national self-reliance, security, and long-run survival. For example food security is required through agricultural sector to guarantee that enough food is produced locally to meet national demand in case of emergencies and at constant prices affordable by the poorest group. Also another strategic objective is the development of weapons industry for defense purposes.

### 2.3 Multi-sector development strategies:

The multi-sector development strategies are;

i) **Balance development strategy:** According to R. Nurkse’s (1953), balance development strategies deals with the process of developing all sectors of the economy in terms of ensuring equal development of all sectors. It is argued that such balance development will take account of sectoral interdependence with respect to production, intermediate demand, and demand for factor services, sectoral income generation, and sectoral household demand. This strategy implies that a developing country should develop all social and economic sectors simultaneously to avoid imbalances among various sector and units of the economy.

ii) **Lop-sided development strategy:** in the lop-sided development strategy, Hirschman A. O (1958) assert that economic development can be appreciably promoted by investing heavily in a few industrial sectors that have substantial forward and backward linkages with other sectors. Such strategy will reap immense economy of scale that characterizes modern industries and which results in relatively cheap mass production of the commodities. This will in turn vigorously encourage private sector investment in other sectors that are linked, by making available cheap intermediate inputs in large quantities to the consuming sectors and by demanding large quantities of the inputs at escalating prices from sectors that can supply the inputs.

iii) **Optimal social development strategy:** given economic principles, the optimal development strategy is straightforward. It is the principle of optimization. Optimization presents itself either as a cost minimization problem subject to the attainment of set development targets and social constraints or as a social benefit maximization problem subject to the resource and social constraints. As applied to sectoral development, optimal development strategy requires:
That the nation specializes in the industries where she has the best comparative advantages (current and potential), that is, where it can earn the maximum returns or foreign exchange for every dollar invested.

That the nation ensure balance development between “national sectors” (that is, sectors producing goods and services that are non-traded internationally) and all other sectors, since the services of national sectors cannot be imported and must be adequately produced in the country.

That all sectors producing strategic goods and services (e.g. food and ammunitions) must be developed to a certain minimum level that can ensure national security or survival in emergency periods, as well as sectors that produce welfare services which cannot be imported such as housing, primary health care, and employment generation.

Foreign exchange should be made available at accounting price or on credit to international sectors (i.e. non-traded commodity producing sectors) and at subsidized rate to essential social sectors producing public goods for which social benefit significantly exceeds private benefits, in all cases such that balance of payment equilibrium is dynamically entrenched.

### 3.4 Multi-sector policy instruments:

In order to implement the optimal development strategy, the policy instruments available to the central authorities are:

1. **Direct government investment expenditure**: the central authorities including federal, state and local governments can bring about development directly through capital expenditure in social and economic sectors, such as housing, primary health care, formal education and manpower development; agricultural land development; industrial joint ventures, transportation and communication infrastructure, civil construction, and subventions to national and strategic sectors for specific projects.

2. **Foreign exchange regulations**: in order to ensure healthy balance of payments, efficiency and growth of manufacturing sector as well as proper development of social and infrastructural sectors, and prevent illegitimate capital flight made possible through deregulated foreign exchange market, government needs to regulate foreign exchange allocation while ensuring accountability and transparency in the process.

3. **Industrial regulations and inspectorate unit**: regulations are required to check abuse of the environment, unscrupulous practices and maintenance of standards, with provision for severe penalties for violations of environmental laws and quality and safety standards.

4. **Excise (indirect) tax and subsidies**: indirect taxes and subsidies are required to adjust the divergence between social and private benefits and social and private costs,
without jeopardy to production efficiency and competitiveness of the domestic industries.

v) **Diverse monetary and fiscal incentives**: there is need for incentive to private sector such as special credit schemes, tax incentives, industrial and agricultural estates, export processing zones, with strict provisions to guard against abuse of the incentives and rent seeking.

vi) **Seminars, Workshops, Trade Fairs, and Trade Missions**: seminars, trade fairs, trade missions are essential to draw attention to domestic products in order to boost domestic and international trade for rapid economic growth and employment promotion.

vii) **International Agreements, Cooperation, and Financial and Technical Aid**: there is no doubt that the economy can benefit immensely from regional economic cooperation, beneficial bilateral and multi-lateral agreements, and technical aid for sustainable technology and technology transfer.

### 3.5 multi-sector planning models:

The multi-sector planning models for economic development are:

i) **Empirical structural change model**: This approach is based mainly on statistical or econometric study of development patterns among countries and over time, in particular that of Chenery and Taylor (1968). The study empirically investigated the changing sectoral and industrial structure of countries in response to changing income per capita, population size, investment ration of GNP, and a proxy for natural resource endowment, all of which constitute the explanatory variables for sectoral development patterns among countries and over time. Thus given the per capita income, population size, investment ration, and the proportion of primary exports to total exports, the output share of major sectors can be predicted for every country. This can then form the development targets for various sectors and industries. The handicap of this approach is that the average tendency in historical development pattern among countries is implies to be an idea or relevant for the future. But it is very simple and practical approach, and can be useful guide.

In formal terms, if $X_j$ denotes the share of GNP of sector $J$, $Y$ denote per capita GNP, $N$ denotes population size, and $I$ denotes the investment ratio of GNP, then we have the following specification:

\[
\log(X_j) = \beta_0 + \beta_1 \log(Y) + \beta_2 \log(N) + \beta_3 \log(I); \quad (5.1)
\]

Where; $J = 1, 2, 3$

Where $\beta_0$, $\beta_1$, $\beta_2$ and $\beta_3$ are the regression coefficient (or elasticities) obtained from empirical studies of many countries, including developed and less developed, large and small countries. The regression coefficient differ for large and small countries patterns, as well as for primary-commodity export oriented countries and manufactured goods export oriented countries.
Equation (5.1) may be presented in growth format as follows:

\[ G(X_j) = \beta_1 G(Y) + \beta_2 G(N) + \beta_3 G(I); \]

\[ \text{---------} \]

\[ \text{-----------------------} \]

\[ (5.2) \]

And \( G \) is denoted as growth rate.

ii) **Input-output methods:** the general Leontiev input-output system is a standard model for multi-sector and sector planning (Chenery and Clark, 1967). It expresses linearly the interdependence among sectors in the sense that every sector represents intermediate deliveries to others, apart from final (household) demand. However, the general input-output system is too unwieldy and not appropriate for sectoral planning considering the fact that optimal development is not consistent with the development of all sectors but rather with some degree of specialization in international sectors, apart from the impossible enormous statistical data required for planning with the model.

iii) **Semi-Input–output method:** Jan Tinbergen (1967) developed modified input-output methods called the “semi-input-output model”. It makes a distinction between national and international sectors. In planning for any given international sector, the semi-input-output method only looks at input requirements from national sectors as such inputs cannot be imported and must be produced at home.

In multi-sector planning there is need to identify key international sectors for the purpose of industrial specialization, the process being based on manufacturing sectors whose products can be produced at the lowest opportunity costs or in which the nation possesses the greatest comparative and international competitive advantage dynamically or potentially. Also in sector planning, only the input requirements from national sectors and key international sectors are estimated. We then evaluate the benefit of sectoral expansion by estimating the value added directly generated in that sector as well as the value added indirectly generated by the required expansion of national sectors that must supply infrastructural inputs like electricity. On the other hand, the cost of the sectoral expansion is evaluated by estimating the direct investment cost of the sector’s expansion as well as the indirect investment costs borne by the national sectors in their attempt to produce more for the input requirements of the expanding sector.

To expand a given international sector, it is necessary that some national sectors must expand to supply inputs to the international sector. This implies that investments will be carried out only in the planned sector but also in the national sectors supplying inputs for the expansion. The semi-input-output method can be employed for all these purposes, namely, deciding the optimal and consistent sectoral development, benefit and cost analysis of industrial expansion and complementary investment bunches for any planned sectoral expansion.

The semi-input-output model for optimization is shown below;
Maximize (1) \[ X - M = \xi (X_i - M_i) \]

Maximize (2) \[ Y(I,N) = \xi I v_i Q_i + \xi N v_i Q_i \]

Subject to: \[
\begin{align*}
Q_1 &= A_{1I} Q_I + A_{IN} Q_N + X_N + D_I - M_I \quad \text{equ (1)} \\
Q_N &= A_{NI} Q_I + A_{NN} Q_N + X_N + D_N - M_N \quad \text{equ (2)} \\
\Delta Q_{I,t} &= v_I \Delta K_{I,t} \quad \text{equ (3)} \\
\Delta Q_{N,t} &= v_N \Delta K_{N,t} \quad \text{equ (4)} \\
M_I &= m_I Q_I \quad \text{equ (5)} \\
M_N &= m_N Q_N \quad \text{equ (6)} \\
I(\Delta K_{I,t} + \Delta K_{N,t}) &= \Delta K_t \quad \text{equ (7)}
\end{align*}
\]

Q_i, Q_N, M_I, M_N, X_I, X_N, \Delta K_I, \Delta K_N are vectors of the unknown, respectively, of sectoral outputs (Q) for the international sectors (I) and national sectors (N). Vectors of exports (X) are similarly defined, as are vectors of imports (M) with respective vectors of imported input requirement (m), and vectors of investments or change in capital stock (K) for international (I) and national (N) sectors. X-M refers to the total net exports, while Y(I,N) refers to gross domestic product, being the sum of value added for the national sectors and the selected international sectors. AII, AIN, ANN, and ANI are partitioned matrices of input-output coefficients, respectively, for inputs of international sectors into international sectors (II), inputs of international sectors into national sectors (IN), for inputs of national sectors into national sectors (NN) and inputs of national sectors into international sectors (NI). There are six sets of equation (equ 1 to 6) to determine six sets of vectors of unknowns, leaving two sets of vectors to be determined through optimization. The variables to be determined through optimization are X_I and X_N. The remaining variables, namely D_I and D_N are final demand vectors which are given and are to be projected dynamically from the micro level of optimization. Another variable not yet accounted for is total investment \( \Delta K \) which is also given from the macroeconomic model. All sectoral investments or net capital formation sum to the total investment, \( \Delta K \) and the expression \( i(\Delta K_{I,t} + \Delta K_{N,t}) = \Delta K_t \) indicates that all the sectoral investments are to be added together and be made to the total investment (\( \Delta K_t \)).

3.0 Conclusion:

The research paper examines macro and multi-sector planning: a situation analysis. We started with a review on the need for sectoral planning and a brief overview of sector planning. This is based on the fact that an economy system is a combination of different sector units and understanding these sectors are important in achieving economic development. Based on that we recommend the need for government at all level to analyze these sectors and
implement policies that will encourage growth and development.

References


