
Analysis of Factors of Trade Balance in Sudan for the period (2000-2014) using Interpretive Structural Modeling (ISM)

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ABSTRACT

The aim of this paper is to analyze the interaction of various factors in trade balance which prevent or hinder management of export and import for sustainable economic development in Sudan. After literature survey on trade balance elements in Sudan, major elements of trade balance have been identified. The literature review, together with the experts' views is obtained during various field of visit have been used in the relationship matrix, which used in the development of an interpretive structural modeling (ISM) model. This has been to analyze the driving power and dependence power of factors. By analyzing the factors using (ISM) analysis we obtained essential factors, which have both high driving power and dependency, thus wanting more attention while doing on a comprehensive plan for sustainable economic development

Key words -Trade Balance, interpretive structural modeling (ISM), factors

I. INTRODUCTION

The balance of payments accounts of a country record the payments and receipts of the residents of the country in their transactions with residents of other countries. If all transactions are included, the payments and receipts of each country are, and must be, equal. Any apparent inequality simply leaves one country acquiring assets in the others. For example, if Americans buy automobiles from Japan, and have no other transactions with Japan, the Japanese must end up holding dollars, which they may hold in the form of bank deposits in the United States or in some other U.S. investment. The payments of Americans to Japan for automobiles are balanced by the payments of Japanese to U.S. individuals and institutions, including banks, for the acquisition of dollar assets. Put another way, Japan sold the United States automobiles, and the United States sold Japan dollars or dollar-denominated assets such as Treasury bills and New York office buildings. Although the totals of payments and receipts are necessarily equal, there will be inequalities—excesses of payments or receipts, called deficits or surpluses—in particular kinds of transactions. Thus, there can be a deficit or surplus in any of the following: merchandise trade (goods), services trade, foreign investment income, unilateral transfers (foreign aid), private investment, the flow of gold and money between central banks and treasuries, or any combination of these or other international transactions.

IMPORTS: Goods and services produced by the foreign sector and purchased by the domestic economy. In other words, imports are goods purchased from other countries. The United States, for example, buys a lot of the stuff produced within the boundaries of other countries, including bananas, coffee, cars, chocolate, computers, and, well, a lot of other

products. Imports, together with exports, are the essence of foreign trade--goods and services that are traded among the citizens of different nations. Imports and exports are frequently combined into a single term, net exports (exports minus imports).

EXPORTS: The sale of goods to a foreign country. The United States, for example, sells a lot of the stuff produced within our boundaries to other countries, including wheat, beef, cars, furniture, and, well, almost every variety of product you care to name. In general, domestic producers (and their workers) are elated with the prospect of selling their goods to foreign countries--leading to more buyers, a higher price, and more profit. The higher price, however, is bad for domestic consumers. In that domestic consumers tend to have far less political clout than producers, very few criticisms of exports can be heard.

BALANCE OF TRADE: The difference between the value of goods and services exported out of a country and the value of goods and services imported into the country. The balance of trade is the official term for net exports that makes up the balance of payments. The balance of trade can be a "favorable" surplus (exports exceed imports) or an "unfavorable" deficit (imports exceed exports). The official balance of trade is separated into the balance of merchandise trade for tangible goods and the balance of services. A balance of trade surplus is most favorable to domestic producers responsible for the exports. However, this is also likely to be unfavorable to domestic consumers of the exports who pay higher prices. Alternatively, a balance of trade deficit is most unfavorable to domestic producers in competition with the imports, but it can also be favorable to domestic consumers of the exports who pay lower prices.

Literature Review: Definition of Balance of Trade

Trade refers to buying and selling of goods, but when it comes to buying and selling of goods globally, and then it is known as import and export. The Balance of Trade is the balance of the imports and exports of commodities made to/by a country during a particular year. It is the most important part of the current account of the country's Balance of Payment. It keeps records of tangible items only. The Balance of Trade shows the variability in the imports and exports of merchandise made by a country with the rest of the world over a period. If the imports and exports made to/by the country tallies, then this situation is known as Trade Equilibrium, but if imports exceed exports, then the condition is unfavorable as it states that the economic status of the country is not good, and so this situation is termed as Trade Deficit. Now, if the value of exports is greater than the value of imports, this is a favorable situation because it indicates the good economic position of the country, thus known as trade surplus

Definition of Balance of Payments: The Balance of Payments is a set of accounts that recognizes all the commercial transactions performed by the country in a particular period with the remaining countries of the world. It keeps the record of all the monetary transactions done globally by the country on commodities, services and income during the year. It combines all the public-private investments to know the inflow and outflow of money in the economy over a period. If the BOP is equal to zero, then it means that both the debits and credits are equal, but if the debit is more than credit, then it is a sign of deficit while if the credit exceeds debit, then it shows a surplus. The Balance of Payment has been divided into the following sets of accounts:

Current Account: The account that keeps the record of both tangible and intangible items. Tangible items include goods while the intangible items are services and income.

Capital Account: The account keeps a record of all the capital

expenditure made and income generated collectively by the public and private sector. Foreign Direct Investment, External Commercial Borrowing, Government loan to Foreign Government, etc. are included in Capital Account. Errors and Omissions: If in case the receipts and payments do not match with each other than balance amount will be shown as errors and omissions.

Key Differences between Balance of Trade and Balance of Payments

The following are the major differences between the balance of trade and balance of payments: A statement recording the imports and exports done in goods by/from the country with the other countries, during a particular period is known as the Balance of Trade. The Balance of Payment captures all the monetary transaction performed internationally by the country during a course of time. The Balance of Trade accounts for, only physical items, whereas Balance of Payment keeps track of physical as well as non-physical items. The Balance of Payments records capital receipts or payments, but Balance of Trade does not include it. The Balance of Trade can show a surplus, deficit or it can be balanced too. On the other hand, Balance of Payments is always balanced. The Balance of Trade is a major segment of Balance of Payment. The Balance of Trade provides the only half picture of the country's economic position. Conversely, Balance of Payment gives a complete view of the country's economic position. The trade balance is affected by a number of factors; including exchange rate changes, monetary and fiscal policies, domestic growth, production process, marketing techniques, exports/imports, production costs, comparative price, unexpected supply shock, economy's international competitiveness, taxes, customs,. There are many empirical studies that examined the determinants of trade balance especially the effect of exchange rate depreciation on a country's trade balance which extensively examined in the empirical literature in the context of the Marshall Lerner condition and the J-curve theory. According to the former, currency devaluation improves the trade balance only if the sum of the absolute values of import and export demand price elasticity exceeds unity. Most studies relating the exchange rate to the trade balance have found weak statistical evidence of such a relationship. Imam Sugema (2005) investigated the determinants of trade balance and adjustment to the crisis in Indonesia. His results suggested that trade balance will improve due to the devaluation through an increase in exports and a collapse in imports. Since the elasticity of import with respect to real exchange rate was higher than that of export then according to him that phenomenon implied that trade balance improvement would come from the import compression. Harwai-mum, Ng yuen-ling, Tan Geoi-Mei (2008) investigated real exchange rate and trade balance relationship in Malaysia for a period between 1955 to 2006, their empirical study showed that there is an existence of long run relationship between trade balance and exchange rate, other major variables that were significant includes the domestic income and foreign income. Their results also indicated the no j-curve effect in Malaysia.

SUDAN'S TRADE BALANCES:

The trade balance, commercial balance, or net exports (sometimes symbolized as NX), is the difference between the monetary value of a nation's exports and imports over a certain period, O'Sullivan, Arthur; Sheffrin, Steven M. (2003). Sometimes a distinction is made between trade balances for goods versus one for services. If a country exports a greater value than it imports, it is called a trade surplus, positive balance, or a "favorable balance", and

conversely, if a country imports a greater value than it exports, it is called a trade deficit, negative balance, "unfavorable balance", or informally a "trade gap" (see Table 1). The trade balance forms part of the current account, which includes other transactions such as income from the net international investment position as well as international aid. If the current account is in surplus, the country's net international asset position increases correspondingly. Equally, a deficit decreases the net international asset position. The trade balance is identical to the difference between a country's output and its domestic demand - the difference between what goods a country produces and how many goods it buy from abroad; this does not include money re-spent on foreign stock, nor does it factor in the concept of importing goods to produce for the domestic market. Exports grew by 29.8% to US\$ 4.8 billion in 2005, boosted by oil exports, while imports progressed by a slightly higher 30.9% to US\$ 5.9 billion. Subsequently, a trade deficit was recorded in 2005, standing at US\$ 1.9 billion, breaking from a trend of more modest deficits or very small surpluses over the previous five years to 2005 (see Table 1). The significant widening of the deficit in 2005 and 2006 could be attributed to several reasons resulting from economic policies or sector-related structural obstacles. The important appreciation of the local currency and increased trade openness, part of the market liberalization reforms currently under implementation, have cheapened imports and made exports more expensive.

Factors that can affect the trade balance include:

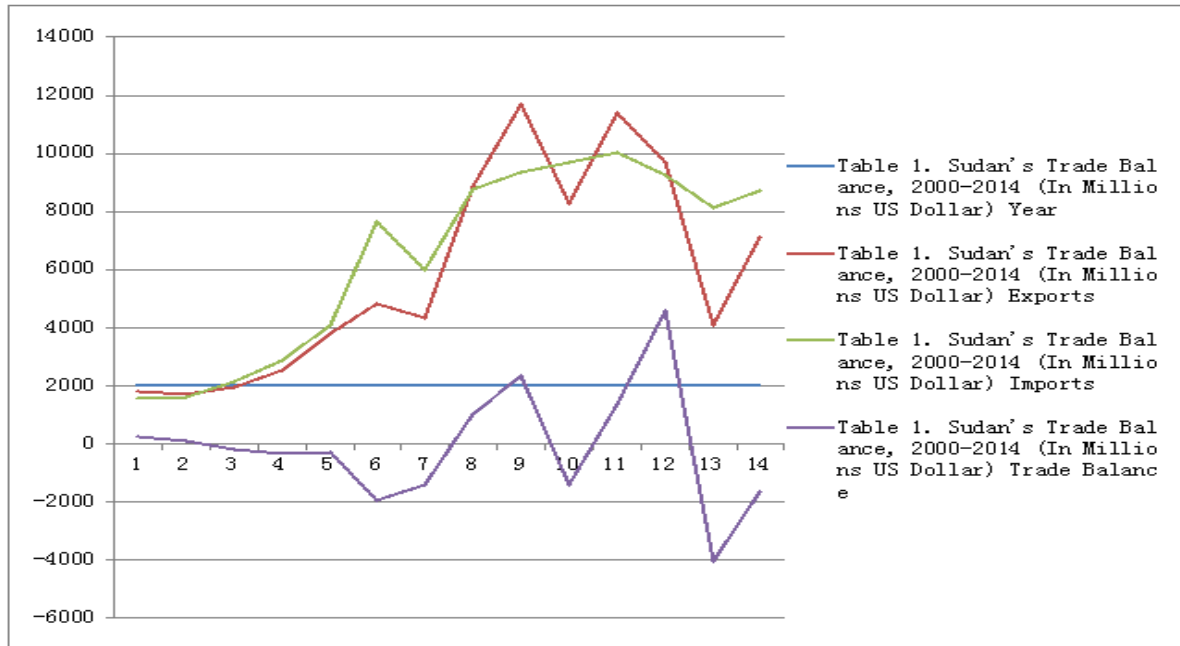
The cost of production (land, labor, capital, taxes, incentives, etc.) in exporting economy vis-a-vis those in the importing economy; the cost and availability of raw materials, intermediate goods and other inputs, Exchange rate movements(see table 2); multilateral, bilateral and unilateral taxes or restrictions on trade; Non-tariff barriers such as environmental, health or safety standards; the availability of adequate foreign exchange with which to pay for imports; and prices of goods manufactured at home- influence by the responsiveness of supply.

Table 1. Sudan's Trade Balance, 2000-2014 (In Millions US Dollar)

Year	Exports	Imports	Trade Balance
2000	1808	1553	255
2001	1698	1585	113
2002	1949.1	2152.8	-203.7
2003	2542.1	2881.9	- 339.7
2004	3777.8	4075.2	- 297.5
2005	4824.3	7656.8	- 1932.5
2006	4350.6	5969.5	- 1397.7
2007	8879.3	8775.5	1032
2008	11670.5	9351.5	2319
2009	8257.1	9690.9	-1433.8
2010	11404.3	10044.8	1359.5
2011	9688.8	9231.0	4579
2012	4,066.5	8,122.7	-4,056.2
2013	7,086.2	8,727.9	-1,641.7
2014	4,350.2	8,105.9	-3,755.7

Source: Bank of Sudan Annual Reports (various issues) and Ministry of Finance and National Economy

Graph 1 Sudan's Trade Balance, 2000-2014 (In Millions US Dollar)



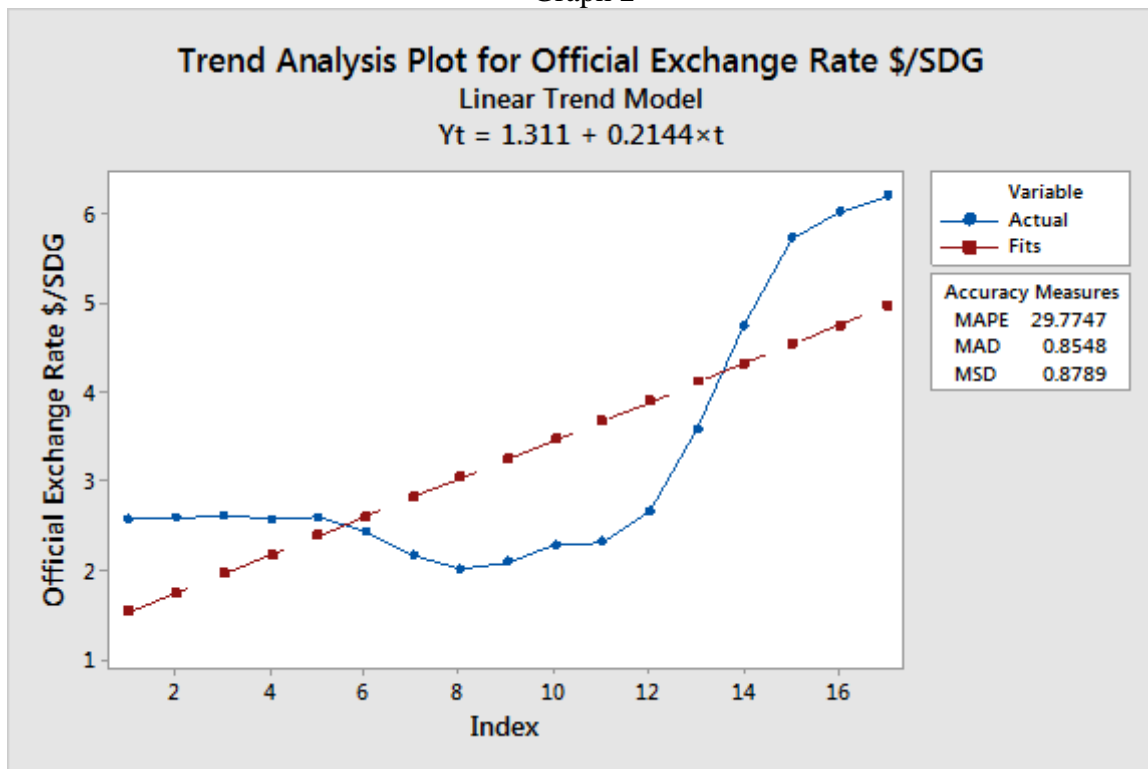
Graph: 1

Table 2. Sudanese Pound Exchange Rate Versus \$US during the Period 2000-2016

Official Exchange Rate \$/SDG	Years
2.57	2000
2.58	2001
2.62	2002
2.57	2003
2.59	2004
2.43	2005
2.17	2006
2.0107	2007
2.0861	2008
2.2804	2009
2.3170	2010
2.6600	2011
3.5637	2012
4.7422	2013
5.7115	2014
6.0107	2015
6.1815	2016

Source: Sudan Central Bank (Various Issues)

Graph 2



Method

Model type Linear Trend Model

Data Official Exchange Rate \$/SDG

Length 17

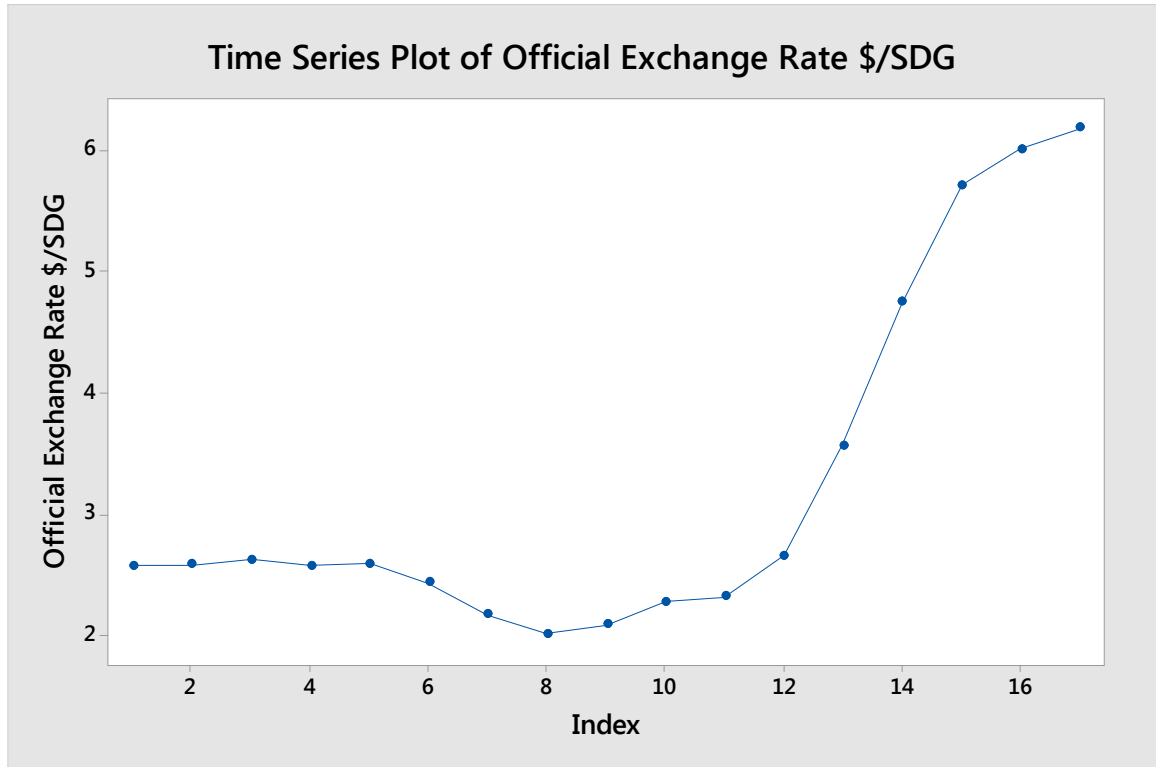
NMissing 0

Fitted Trend Equation

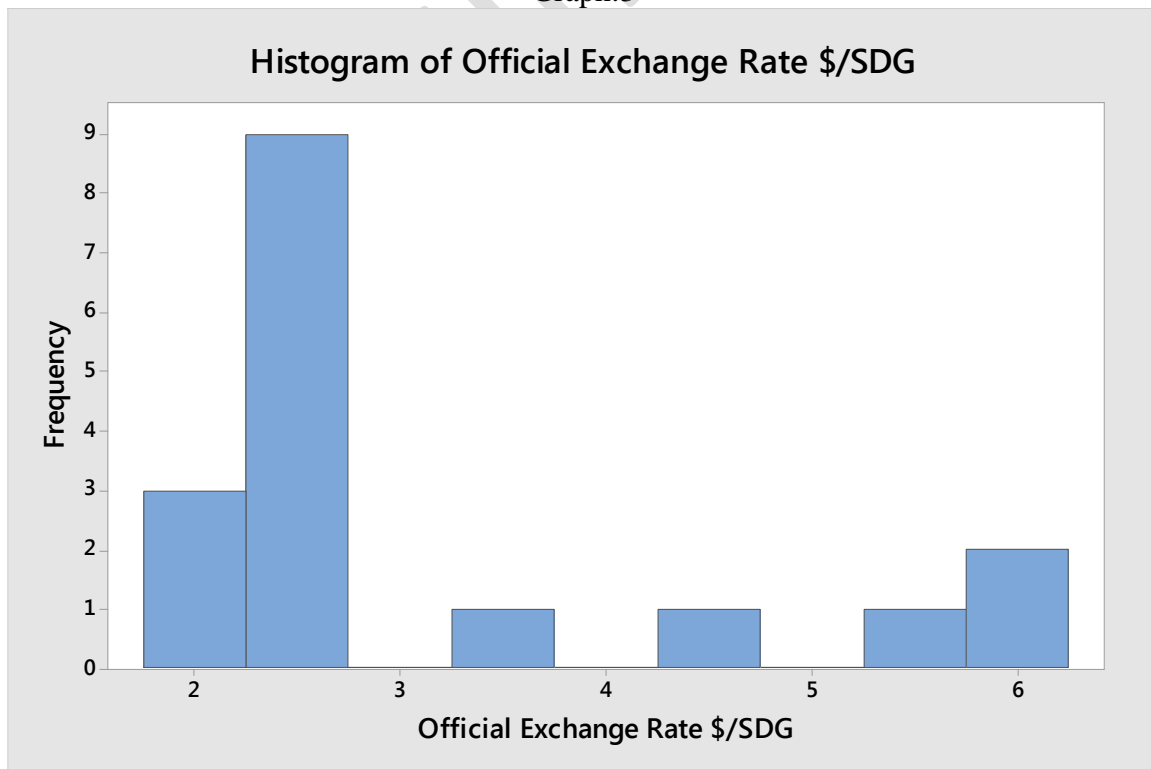
$$Y_t = 1.311 + 0.2144 \times t$$

Accuracy Measures

MA	29.7747
PE	
MA	0.8548
D	
MS	0.8789
D	



Graph:3



II. METHODOLOGY

THE METHOD

ISM falls into the soft operation research (OR) family of approaches. It is computer-assisted learning process that enables individuals or groups to prepare a map of the complex relationships between the many elements involved in a complex situation. Its basic idea is to use experts' practical experience and knowledge to decompose a complicated system into several sub-systems and construct a multilevel structural model. ISM is frequently used to present fundamental understanding of complex situations, as well as to set together a course of action for solving a problem. ISM can be used for finding and analyzing the relationships among specific factors/variables which define a problem or an issue (Rajesh Attri and Nikhil Dev, 2013).

INTERPRETIVE STRUCTURAL MODELING

Interpretive structural modeling (ISM) enables the individual or group to manage the interrelations between two or more elements at a time without compromising and deviating from the actual properties of the original elements/issues (Morgado, 1999). ISM provides a framework for delineation of a hierarchy amongst variables, influences or elements of any project under consideration (Warfield, 1974; Sage, 1977). This kind of modeling is seen as a useful tool that helps logical thinking and carefully approaching complex issues, and then communicating the results of that thinking to others. The term 'interpretive structural modeling' (ISM) connotes systematic application of elementary notions of graph theory in such a way that theoretical, conceptual, and computation leverage is exploited to efficiently construct a directed graph, or network representation, of the complex pattern of contextual relationship among a set of elements (Malone, 1975). ISM is much more flexible than many conventional quantitative modeling approaches that require variables to be measured on ratio scales. It offers a qualitative modeling language for structuring complexity and thinking on issue by building an agreed structural model (Morgado, 1999). ISM as a tool is interpretive because it is based on interpretation and judgments of group members on whether and how elements are related, and it is structural as it extracts the overall hierarchy from complex set of variables. It has a mathematical foundation, philosophical basis, and a conceptual analytical.

METHODOLOGY

Details of various steps involved in ISM are as follows:

1. Identify and list elements/variables relevant to the trade balance under consideration, through a literature review.
2. Develop a structural self-interaction matrix (SSIM) for variables, indicating pair-wise relationships being studied.
3. Convert the SSIM developed into reachability matrix.
4. Test the reachability matrix for transitivity (if A depends on B and B depends on C, then by principle of transitivity, A depends on C), make modifications to satisfy the transitivity requirements, and derive the final reachability matrix.
5. Delineate levels by iterative partitioning of the final reachability matrix.
6. Translate the relationships of reachability matrix into a digraph and convert it into an ISM.

7. Review the model for conceptual inconsistencies and make modifications in SSIM, if necessary.

IDENTIFICATION OF ELEMENTS

In view of the concept model and the light of results available in the literature and having discussions with expert from business and academics, twelve factors responsible for trade balance in Sudan have been selected and are summarize as twelve factors Trade Balance (TBF) in the following table 3:

Number	Factor
1	Unexpected Supply Shock (USS)
2	Exports & Imports (E/I)
3	Customs (C)
4	Marketing Techniques (MT)
5	Quality Control (QC)
6	Production Costs (PC)
7	Monetary/ Fiscal Policies (M/FP)
8	Taxes (T)
9	Comparative Price (CP)
10	Exchange Rate Changes (EXRC)
11	Production Process (PP)
12	Domestic Growth (DG)

Table (3): Trade Balance Factors

STRUCTURAL SELF INTERACTION MATRIX (SSIM)

It is developed for factors, which shows pair wise relationships among factors of the system under consideration. This matrix represents the respondent's perception of element to element directed relationship. By considering the contextual relationship for each factor symbols are used to represent the type of relationship that can exist between two elements under consideration. These are:

- V: Factor i will help to achieve factor j
- A: Factor i will be achieved by factor j
- X: Factor i and j will help achieve each other
- O: Factor i and j are unrelated

Table 4: Structural Self-Interaction Matrix (SSIM)

TBF	US S	E/I	C	M T	QC	PC	M/ FP	T	CP	EX RC	PP	DG
USS	1	X	V	V	A	A	V	X	V	O	A	V
E/I		1	A	A	A	X	V	A	X	X	O	V
C			1	A	A	V	A	V	V	A	V	A
MT				1	V	V	O	O	V	V	A	V

QC					1	V	O	A	V	V	O	V
PC						1	X	V	A	V	O	X
M/F P							1	V	A	A	V	X
T								1	V	V	A	X
CP									1	V	A	V
EXR C										1	V	V
PP											1	O
DG												1

REACHABILITY MATRIX

Based on the SSIM, a binary matrix that reflects the directed relationships between the variables is created. SSIM is transform into binary matrix, called the initial reachability matrix by substituting of V, A, X, O relationship by 1 and 0 as per the case. The rules for the substitution of 1 and 0 are as the Table (4). Following these rules, initial reachability matrix is obtained. The final reachability matrix for the trade balance in Sudan is obtained by incorporating transitivity's in initial reachability matrix is shown in Table 6.

INITIAL REACHABILITY MATRIX:

Now the SSIM has been converted into a metrics of binary elements named as Initial Reachability Metrics. This is developed by appropriately assigning V, A, X and O by 1 and 0. The following rules have been applied to complete this step.

Table 5: rules for Transformation

The (i,j) entry in the SSIM	Entry in the initial reachability matrix	
	(i,j)	(j,i)
V	1	0
A	0	1
X	1	1
O	0	0

Following these rules, the initial reachability matrix has been developed. It is shown in Table 5.

Table 6: Initial Reachability Matrix

TBF	USS	E/I	C	M T	QC	PC	M/ FP	T	CP	EX RC	PP	DG
USS	1	1	1	1	0	0	1	1	1	0	0	1
E/I	1	1	0	0	0	1	1	0	1	1	0	1
C	0	1	1	0	0	1	0	1	1	0	1	0
MT	0	1	1	1	1	1	0	0	1	1	0	1
QC	1	1	1	0	1	1	0	0	1	1	0	1
PC	1	1	0	0	0	1	1	1	0	1	0	1
M/FP	0	0	1	0	0	1	1	1	0	0	1	1
T	1	1	0	0	1	0	0	1	1	1	0	1

CP	0	1	0	0	0	1	1	0	1	1	0	1
EXRC	0	1	1	0	0	0	1	0	0	1	1	1
PP	1	0	0	1	0	0	0	1	1	0	1	0
DG	0	0	1	0	0	1	1	1	0	0	0	1

Table 6: below shows the interrelationship between given 12 factors of Trade balance.

In Table 6, the completed initial reachability matrix is given by completely changing the element's relationship in binary numbers of 1s and 0s. Since it is found that some more relationship among the elements are relevant for the final reachability matrix, the Table 6 is prepared by considering the transitivity as the conditions stated below. In order to get a final form, in Table 6 the 0s for transitivity is given in bold numbers. The final reachability matrix is received by given in Table 7. Here, the step for the transitivity were also taken into account and established the relationship between various factors. If a variable A leads to another variable B and if the variable B leads to a third variable C, as per the rule of transitivity A leads to C. In other words, if A leads to B and B lead to C, then A lags to C. Through this step the final reachability matrix is formed.

Table 7: Initial Reachability Matrix with Transitivity

TBF	USS	E/I	C	M T	Q C	PC	M/ FP	T	C P	EX RC	P P	D G
USS	1	1	1	1	0	0	1	1	1	0	0	1
E/I	1	1	0	0	0	1	1	0	1	1	0	1
C	0	1	1	0	0	1	0	1	1	0	1	0
MT	0	1	1	1	1	1	0	0	1	1	0	1
QC	1	1	1	0	1	1	0	0	1	1	0	1
PC	1	1	0	0	0	1	1	1	0	1	0	1
M/FP	0	0	1	0	0	1	1	1	0	0	1	1
T	1	1	0	0	1	0	0	1	1	1	0	1
CP	0	1	0	0	0	1	1	0	1	1	0	1
EXRC	0	1	1	0	0	0	1	0	0	1	1	1
PP	1	0	0	1	0	0	0	1	1	0	1	0
DG	0	0	1	0	0	1	1	1	0	0	0	1

Table 8: Final Reachability Matrix of trade balance

TBF	USS	E/I	C	M T	Q C	PC	M/ FP	T	C P	EX RC	P P	D G	DRIV ING POW ER
USS	1	1	1	1	0	0	1	1	1	0	1	1	9
E/I	1	1	1	0	0	1	1	0	1	1	1	1	9
C	0	1	1	0	1	1	0	1	1	0	1	0	7
MT	0	1	1	1	1	1	0	0	1	1	0	1	8
QC	1	1	1	0	1	1	0	0	1	1	0	1	8

PC	1	1	0	0	0	1	1	1	0	1	0	1	7
M/FP	0	0	1	0	0	1	1	1	0	0	1	1	6
T	1	1	0	0	1	0	1	1	1	1	0	1	8
CP	0	1	1	1	0	1	1	0	1	1	0	1	8
EXRC	0	1	1	1	0	1	1	0	1	1	1	1	9
PP	1	0	0	1	0	0	0	1	1	0	1	0	5
DG	0	0	1	0	0	1	1	1	0	0	1	1	6
DEPENDEN CE POWER	6	9	9	5	4	9	8	7	9	7	7	10	90

Table 7 is the final form of the inter relations of all the twelve elements. Thus we call Table 7 as the Final Reachable matrix. Then count each rows 1s to get the driving power and each columns 1s to get the dependence power. Table 7 shows the total of driving power is 90 and the number of the dependence is also 90. These driving power and dependence helps to classify the factors into four clusters namely autonomous, dependent, linkage and independent. These four clusters position is determined by the separation of antecedent set and reachability set. From these two sets determine the intersection set. Table is prepared for each one (Table 8, Table 9, Table 10, Table 11 and Table 12) the common factor is identified in each level. Level I to Level V is evaluated. Table 8, Table 9, Table 10, Table 11 & Table 12 (Relationship of reachability set with antecedent set to get intersection set and level I to level V).

Table 9

Trade Balance Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1. Unexpected Supply Shock	1,2,3,4,7,8,9,11,12	1,2,5,6,8,11	1,2,8,11	
2. Exports And Imports	1,2,3,6,7,9,10,11,12	1,2,3,4,5,6,8,9,10	1,2,6,9,10	I
3. Customs	2,3,5,6,8,9,11	1,2,3,4,5,7,9,10,12	2,3,5,9	
4. Marketing Techniques	2,3,4,5,6,9,10,12	1,4,9,10,11	4,	
5. Quality Control	1,2,3,5,6,9,10,12	3,4,5,8	5,	
6. Production Costs	1,2,6,7,8,10,12	2,3,4,5,6,7,9,10,12	2,6,9,12	
7. Monetary And Fiscal Policies	3,6,7,8,11,12	1,2,6,7,8,9,10,12	6,7,8,12	
8. Taxes	1,2,5,7,8,9,10,12	1,3,6,7,8,11,12	1,8,12	
9. Comparative Price	2,3,4,6,7,9,10,12	1,2,3,4,5,8,9,10,11	2,3,4,9,10	
10. Exchange Rate Changes	2,3,4,6,7,9,10,11,12	2,4,5,6,8,9,10	2,4,6,9,10	I
11. Production Process	1,4,8,9,11	1,2,3,7,10,11,12	1,11	
12. Domestic Growth	3,6,7,8,11,12	1,2,4,5,6,7,8,9,10,12	3,6,7,8,12	

Table 10

Variable	Reachability Set	Antecedent Set	Intersection Set	Level I
1. unexpected supply shock	1,3,4,7,8,11,12	1,3,4,5,8,11	1,3,4,8,11	
3. customs	3,5,8,11	1,3,4,5,7,12	3,5	
4. Marketing techniques	3,4,5,12	1,4,11	4,	
5. quality control	1,3,5,12	3,4,5,8	3,5	
6. production costs	1,7,8,12	3,4,5,7,12	7,12	II
7. monetary and fiscal policies	3,7,8,11,12	1,7,8,12	7,8,12	II
8. taxes	1,5,7,8,12	1,3,7,8,11,12	1,7,8,12	II
9. Comparative price	3,4,7,12	1,3,4,5,8,11	3,4	
11. Production process	1,4,8,11	1,3,7,11,12	1,11	
12. domestic growth	3,7,8,11,12	1,4,5,7,8,12	7,8,12	II

Table 11

Variable	Reachability Set	Antecedent Set	Intersection Set	Level I
1. unexpected supply shock	1,3,4,11	1,3,4,5,11	1,3,4,11	III
3. customs	3,5,11	1,3,4,5	3,5	
4. Marketing techniques	3,4,5	1,4,11	4,	III
5. quality control	1,3,5	3,4,5	3,5	
9. Comparative price	3,4,11	1,3,4,5,11	3,4,11	III
11. Production process	1,4,11	1,3,11	1,11	

Table 11

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
3. customs	5,	1,5	5,	IV
5. quality control	1,5	3,5	5,	IV
11. Production process	1,	1,	1,	

Table 12

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
11. Production process	1,	1,	1,	V

ISM BASED MODEL

Based on the relationship given in the final reachability matrix and the determined level for each variable, a directed graph is drawn and transitive links are removed. The resultant diagraph is converted into an ISM by replacing variable nodes with statements. The ISM therefore, gives a very clear picture of the system of elements and their flow of relationships. The ISM developed based model of Trade Balance is reviewed to check for conceptual

inconsistency and to make necessary modifications. Figure 1, shows the final ISM model of Trade Balance in Sudan.

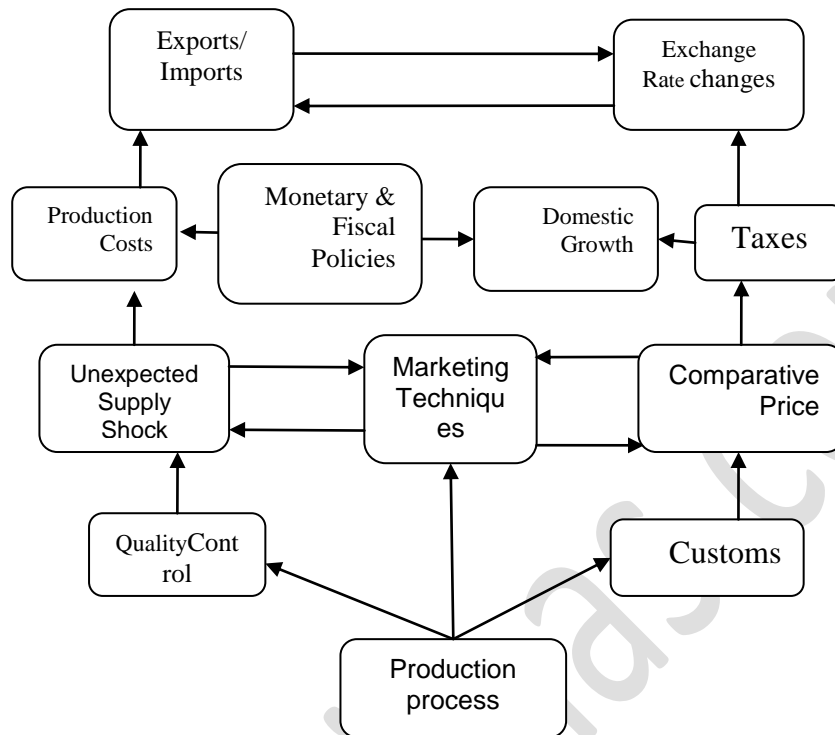


Fig. 1: (ISM) Based Model for Factor Effecting Trade Balance in Sudan

III. ANALYSIS AND CONCLUSION

ANALYSIS:

It is done to identify the key factors that drive the system in various categories. Based on their drive power and dependence power, the factors have been classified into four categories i.e. Autonomous, factors, linkage factors, dependent and independent factors. Figure (2) shows driving and dependence graph of all the factors which is for their comprehensive analysis.

A. Autonomous Factors: these factors have weak drive power and weak dependence power. They are relatively disconnected from the system, with which they have few links, which may be very strong. In the present case of study factor 11(Production process) falls in this category.

B. Dependent Factors: these factors have weak drive but strong dependence power. Factors 7 and 12 (monetary and fiscal policies and domestic growth) fall in this category.

C. Linkage Factors: these factors have strong driving power as well as strong dependence power. These factors are unstable in the fact that any action on these factors will have an effect on others and also a feedback effect on themselves. These factors are 2, 3, 6, and 10 (2.

Exports and Imports, Customs, production costs and Exchange Rate Changes) fall in this category are unstable.

D. Independent Factors: these factors have strong drive power but weak dependence power. A factor with a very strong drive power, called “key factor” falls into the category of independent or linkage factors. Factors 1, 4, 5, and 8 (Unexpected Supply Shock, Marketing techniques, quality control and Taxes) come under this category. A high priority in tackling the factors should be given which are shown at upper level of the ISM

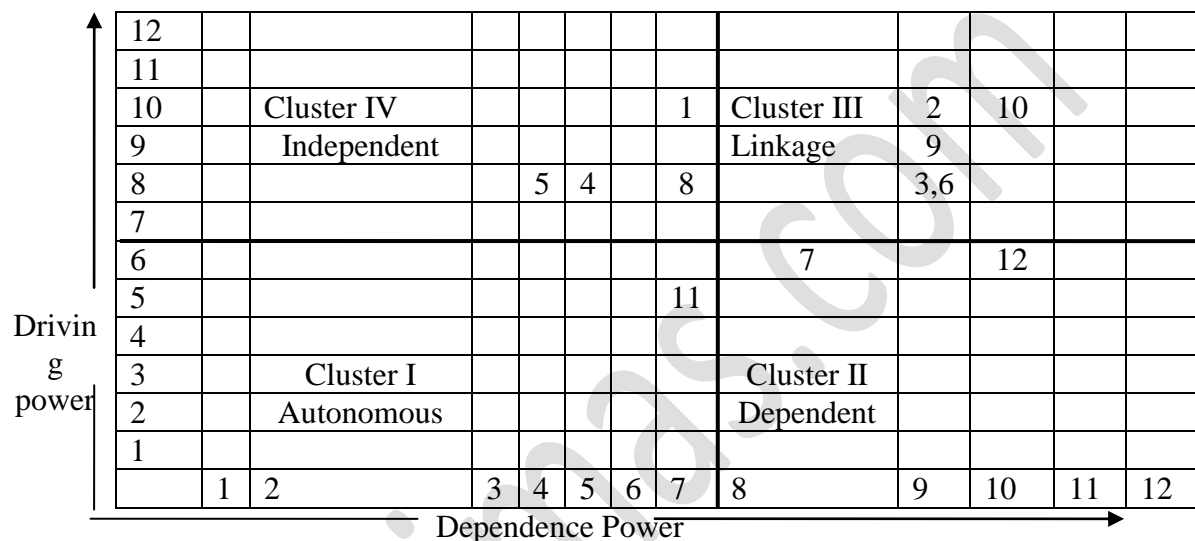


Figure 2: MICMAC Analysis

CONCLUSIONS:

A high priori should be given, to those factors which have a high driving power and thus possessing the capability to influence other factors. Factor 1 (Unexpected Supply Shock), 4 (Marketing techniques), 5 (quality control) and 8 (Taxes) are independent factors, which are shown at the upper levels of the ISM and are the most important ones. It can be inferred that these are strong drivers and may be treated as the root cause of remaining factors. There is only one factor in autonomous category, factor 11(Production process) and this has the last influence. The linkage factor s category possessing strong driving power and strong dependence power. Therefore, most of selected factors are unstable. Factors 2, 3, 6, 9, and 10 are dependent factors. They are identified by their weak driving power and therefore, are placed at the initial levels of ISM model. They are influence by all other factors except factor 11. A comprehensive strategic plan for trade balance in Sudan (2000-“014) should be prepared keeping factors 1, 4, 5, and 8 in highest importance level. The utility of the proposed ISM methodology in imposing order and direction in the complexity of relationships among factors of a system assumes a high value to the decision makers.

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