



# **A Precise Guidance for Fair Local Communities' Development Investments Allocation, Case Study: Damietta Governorate, Egypt**

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## **Abstract**

Integrated statistical-theoretical based approaches in decision support promise to support effective investment decision making. From this view, this paper proposes an innovative methodology to digitally indicate the true developmental level of villages (the smallest Egyptian local units), which would accordingly provide a precise guidance for fair investments' allocation according to their needs' priorities. This would be achieved through testing 158 variables; taking Farscour district in Damietta Governorate in Egypt as a case study. Accordingly, this paper comes out with a statistical methodology that enables decision makers' map out the most deteriorated local communities and to set up investment priorities.

**Keywords:** Socio-cultural Aspects; Urbanization; Local Communities' Needs; Development Challenges; Investment Priorities

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## **1.0 Introduction**

Decision-making is a very complex activity because of the interdependencies which exist between reasoning and making decisions (Johnson-Laird and Shafir, 1993).

## **2.0 Overview on Decision Theories**

When the feasible set of alternatives of a decision consists of a finite number of elements that are explicitly known in the beginning of the solution process, we have an important class of problems called multi criteria evaluation problems. When the number of alternatives of a decision is uncountable infinite, the alternatives are not specified directly, but are defined in terms of decision variables as is usually done in single optimization problems like linear programming. This type of problem is called a continuous decision problem in which the alternatives are only implicitly known. It is referred to as a multi criteria design problem. Here is a listing of many decision techniques found in the literature; Multi criteria evaluation methods, the outranking approach (Software Electra) by Roy (B. Roy, 1981) and Roy and Vincke (B. Roy and P. Vincke, 1981), other methods developed by some French-Belgian school researchers are: Oreste by Roubens (M. Roubens, 1982) and Pastijn and Leysen (H. Pastijn and J. Leysen, 1989). Others by Newman J.W., 1971), Steuer R. and Choo E.U., 1983; Wierzbicki A., 1980; Zadeh L.A., 1965; Zimmermann H.J., 1991; Zionts S. and Wallenius J., 1976.

## **3.0 Proposal and Classification of Variables Used in the Statistical Analysis**

The variables used in this research were proposed and filtered according to the data available in the Central Agency for Public Mobilization and Statistics (CAPMAS) to 158 variables. These were classified into urban, economic, and social (demographic, educational, health care, cultural, and social services) variables and are shown in table (2). They were collected for the 22 villages and the two cities in Farscour district due to the continuous change in the administrative borders between cities and villages and would thus be all included within the coming statistical analyses.

## **4.0 Defining Steps for the Proposed Decision Making Process**

Since all the above listed variables, which all contribute in defining the developmental level of any planning unit and in defining their requirements were so many and confusing, the statistical analysis was the best method selected to reach the most precise results using the SPSS (Statistical Package for Social Sciences) program by the factor analysis (the principal component method). It is one of the methods that are used for the exploration and the detection of patterning of variables with a view to the discovery of the new concepts, together with confirmatory uses for the testing of hypothesis about the structuring of variables in terms of the expected number of significant factors and factor scores. It classifies all the tested variables into components, each having a percentage for representing the strength of its

correlated variables in affecting the results, called the total variance explained which validates the test when it is above 30 %. The component loadings on the other hand is an absolute number describing the strength of each variable inside these components and is considered effective when its absolute values is 0.5 or above. (Nie et al, 1975). Finally, the factor scores represent the strength of each of the case studies tested in this analysis (with numbers relative to each other). Four main analyses were undertaken according to the following steps.

The following points explain these tests and their results briefly as all the resulting tables cannot be shown in the paper. The author has thus highlighted the main results as follows, with indication of all the factor scores in Table 1 and an example of the component matrix results in Table 2:

Table 1: Results for the factor scores of the different statistical steps carried out

Planning Units' Names	Factor scores	Factor scores	Factor scores	Factor scores
	Step 1	Step 2	Step 3	Step 4
Farscour city	4.09	4.19		
Al Roda city	1.75	1.62		
Sherbas	0.49	0.41	3.00	3.07
Al Rahmna	0.17	0.08	1.41	1.32
Abo Greida	-0.50	-0.45	-0.85	-0.73
El Azazma	-0.62	-0.56	-1.09	-1.05
El Obeidia	-0.33	-0.33	-0.36	-0.39
El Tarha	-0.56	-0.54	-0.84	-0.84
El Barashia	-0.38	-0.36	-0.32	-0.29
El Ghwabein	-0.28	-0.27	-0.04	0.01
Awlad Khalaf	-0.35	-0.36	-0.34	-0.25
El Ghoneimia	0.02	0.00	0.89	0.91
El Dhara	-0.32	-0.31	-0.33	-0.34
El Salemia	-0.61	-0.57	-1.26	-1.24
El Nagareen	-0.44	-0.43	-0.72	-0.72
Kafr El Arab	0.00	-0.05	1.02	0.84
Kafr El Shenawy	-0.50	0.47	-0.77	0.89
El Nasria	0.17	0.16	1.35	1.48
Karam wa Razook	-0.21	-0.17	-0.17	-0.17
El Arbein	-0.40	-0.38	-0.52	-0.55
El Hawarni	-0.24	0.26	0.09	0.06
Meit El Shoyokh	-0.45	0.45	-0.47	-0.44-
El Atwi	0.27	-0.27	0.13	0.10
Hagaga	-0.22	-0.26	0.18	0.10

- In the first test, all the variables for the 22 villages and the two cities were tested. The first component has shown that the total variance explained reached 50% and this is a relatively high score. The factor scores revealed that the highest scores were occupied by the cities followed by sherbas, whereas the less developed villages is clearly the one with the lowest factor score, which is El Azazma. From the component matrix, the highest component loadings were for the social variables (educational services) followed by the economic and demographic variables, as shown in table (2).
- In the second test, another run was performed after excluding all the weak variables whose component loadings were less than 0.5 to ensure the accuracy of these results.

The variables entered were 90 variables. The results have yielded the same findings explained in the first test.

- In the third test, all the variables were tested but without the two cities, to ensure that their data do not affect the rest of the results. The total variance explained here was 30.45%, and the highest factor score was for sherbas and the lowest one was for El Azazma. From the component matrix, the highest component loadings were for the social variables (educational services) followed by the economic and demographic variables.
- In the fourth test, only strong variables including 61 variables, whose component loadings were more than 0.5, were tested to ensure the accuracy of these results. The results have yielded the same findings explained in the third test.

Table 2: Resulting component matrix from the first test

	Urban variables		Social variables		Economic variables
0.450	Length of paved road		Social (Demographic variables)	0.596	Number of commercial buildings
-0.089	Length of smoothed road	0.968	Number of population 1986	0.911	Number of industrial buildings(factories/workshops)
0.713	Length of unsmoothed road	0.944	Number of population 1996	-0.076	Value of exported products
		-0.338	Annual Growth rate	-0.092	Value of local products
		-0.163	Percentage from district population	0.229	Local income
		-0.265	Average family size	0.179	Number of touristic rooms
		0.774	Number of families 1996	0.271	Number of touristic beds
		0.944	Number of population 2002	0.876	Number of annual touristic visitors
		0.944	Number of population 2007	0.005	Number of owners-females
		0.944	Estimated Number of population 2012	0.072	Number of owners-males
		0.944	Estimated Number of population 2017	0.576	Number of owners-males and females
		0.944	Estimated Number of population 2022	-0.075	Cultivated land area-(feddan-thousands)
			Social (Educational services)	0.138	Cultivated land area-kirates

0.639	Number of primary schools	-0.033	Cultivated land area-sahm
0.501	Number of Islamic Azhari primary schools	0.171	Crop composition (cultivated area-feddans)
0.791	Total number of primary schools	0.086	Crop composition (cultivated area-kirates)
0.699	Number of preparatory schools	-0.050	Crop composition (cultivated area-sahm)
0.825	Number of Islamic Azhari preparatory schools	0.576	Number of chicken labs
0.835	Total number of preparatory schools	-0.075	Number of eggs from chicken labs
0.746	Number of secondary schools	0.138	Number of produced honey cells
0.825	Number of Islamic Azhari secondary schools	-0.033	Average honey cells production
0.882	Total number of secondary schools	0.171	Number of livestock-milk
0.838	Number of technical secondary school	0.086	Number of livestock-meat- female
0.986	Number of classes (primary-preparatory-secondary)	-0.050	Number of livestock-meat- male
0.988	Number of high institutes	0.430	Total number of livestock-meat
0.979	Number of faculties	-0.109	Coffee production-tons
0.993	Number of female teachers (primary-preparatory-secondary)	0.606	Commercial electricity consumption(Kw/year)
0.911	Number of male teachers (primary-preparatory-secondary)	0.589	Number of commercial members in electric network
0.912	Total number of teachers	0.212	Number of connected families in electric

			network
0.911	Number of male students in first primary	0.451	Residential electricity consumption(Kw/year)
0.912	Number of female students in first primary	0.980	Industrial electricity consumption(Kw/year)
0.913	Total number of students in first primary	0.565	Number of residential members connected to sewage system
0.992	Total number of male students in all stages	0.817	Number of industrial members connected to sewage system
0.990	Total number of female students in all stages	0.512	Number of houses connected to sewage pipes
0.992	Number of enrolled students (primary-preparatory-secondary)		Total number of houses connected to sewage pipes or systems
0.992	Number of enrolled students	0.971	Average water consumption
0.965	Number of illiterates	0.973	Number of families connected to water network
-0.060	Number of literacy target groups	0.735	Number of residential units connected to water network
-0.025	Number of enrolled in literacy classes - females	0.843	Number of members in water network
0.146	Number of enrolled in literacy classes - males	0.535	Number of residents connected to telephone network
0.078	Number of pass in literacy classes - females	0.713	Number of non-residents connected to telephone network
-0.237	Number of fail in literacy classes - males	0.935	Number of residents connected to communication network
-0.059	Number of un-enrolled in literacy	0.813	Number of non-residents connected to

	classes - females		communication network
0.075	Number of un-enrolled in literacy classes - males	0.871	Number of post offices- agencies
	Social (Healthcare services)	0.500	Number of governmental post offices
-0.012	Number of children under 5 suffering from malnutrition	0.373	Number of private post offices
0.694	Death rate in children under 5	0.895	Number of computers-residents
0.819	Death rate in children under 1	0.867	Number of computers-governmental
0.726	Death rate in pregnant women		
0.047	Number of nurses for pregnant women		
0.874	Monthly birth rate		
0.847	Number of enrolled in family planning methods-Bills		
0.910	Number of enrolled in family planning methods-loop		
0.859	Number of enrolled in family planning methods-other		
0.904	Total number of enrolled in family planning methods		
0.460	Number of residents who benefits from free vaccination services-females		
0.947	Number of beds in hospitals		
0.886	Number of residents benefitting from		

	maternity and childhood services
0.867	Number of mothers taking vaccinations
	Number of residents going to clinics
0.021	Number of residents benefitting from pregnancy services
0.708	Number of pregnant women suffering from
0.885	Anaemia
0.029	Number of doctors
	Number of nurseries
0.137	
0.938	Number of nurses
	Number of medical helpers
0.871	Number of permanent workers
0.332	
0.941	No, of labs' workers
	Number of employees in medical administrations
0.886	Number of socialists
0.269	Number of technicians in hospitals
0.793	Number of temporary workers
-0.068	Total number of workers and helpers in hospitals
0.863	Number of health units
0.882	Social (Entertainment services)

0.871	Number of clubs
0.092	Number of youth centres
0.387	Number of playing courts
0.310	Number of sports' centres
0.312	Number of local gathering nodes
	Social (cultural services)
0.814	Number of public libraries
0.899	Number of cultural centres
0.104	Number of children libraries
0.961	Number of theatres
0.886	Number of cinemas
	Number of distributed daily journals
-0.022	Social (social services)
	Number of civil societies' organizations
0.397	Number of members in these- female
0.694	Number of members in these- male
0.899	Number of members in these- kids female
0.863	Number of members in these- kids male
0.911	Number of families benefiting from their services
0.353	
0.408	Number of citizens

	benefiting from their services
	Number of families benefiting from productive family project
-0.159	Number of governmental social units
0.632	Number benefiting from exceptional pensions
-0.176	Number benefiting from permanent pensions
0.930	Daily consumed flour(tons)
0.963	Daily consumed gas
0.943	Number of commercial markets
0.574	Number of basic food supply cards
0.971	Number of partial financed food supply cards
0.724	Number of totally financed food supply cards
0.723	

It is clear from the previous statistical analyses that the two main cities in Farscour district are dominant and represent a separate developmental entity isolated from the rest of the villages existing within its administrative border, and which are much deteriorated. This represents a clear proof for the extreme centralization that Farscour and Al Rowda cities have full control of. This was obviously clear from the results of the four tests which yielded the same findings with or without the cities, as most of the factor scores of the villages were negative, and have slightly increased after excluding the cities and the weak variables.

## 6.0 Conclusion

Multi-sectorial systems, such as cities and local communities' entities (villages), face strategic challenges of optimal development due to the complexity of interacting perspectives, and preferences of decision-makers and stakeholders. From this view, this paper has presented an integrated statistical-theoretical based approach in decision support to generate effective results and to guarantee fair investment allocation plans. This has been achieved through testing 158 variables classified into urban, social and economic variables by the factor analysis (principal component) using the SPSS program on the local units and cities comprising Farscour district in Damietta Governorate to end up with a precise numerical value for each planning unit describing its developmental level as compared to each other.

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