ASSESSMENT OF INDUSTRIAL INVESTMENT PROJECTS USING DATA ENVELOPMENT ANALYSIS (DEA): CASE STUDY IRAN

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Abstract

In the framework of the evaluation of investment projects of the United Nations Industrial Development Organization, a lack of comprehensive approach in financial and economic indicators can be observed. In this study, the application of data envelopment analysis to determine the efficiency of an investment project is investigated. Statistical sample includes 60 projects out of 155 investment project investigated by Member companies of Fars Province Association of Credit Counseling Services. Fourteen input data and two output data selected to calculate the investment indicators based on UNIDO models. Then these data used in different patterns of data envelopment analysis. Comparison of statistical correlation results showed that the performance of the Non-Radial input-oriented model in addition has a higher spearman correlation with UNIDO method results (Sig<0.05). Among the investigated industry groups, the highest average efficiency was related to electricity and electronics group followed by food and pharmaceutical industries. The lowest average efficiency was also related to textile and cellulose industries. The important point in this model is accessible reliable data in an appropriate number of existing projects. This limitation for the investor can be considered a risk as a strong point for investment advisors, banks and investors that are using this model by having actual data on a large number of projects and plans.

Keywords: Data envelopment analysis (DEA), investment, efficiency, industrial projects.

1 Introduction

Basically, the result of investments in various financial and economic indicators appears in the evaluation of industrial projects. These indicators typically include rate of return on investment, return period of investment, net present value of investment, internal rate of return, investment structure analysis and immediate and ongoing financial ratios. Since the objectives of industrial investment are defined in several dimensions, it is difficult to make a comprehensive conclusion about an industrial projects based on defined indicators. Because in a series of investment projects, variation range of the indicators may be in such a way that comparing and selecting the right project to be difficult. Therefore, it seems that the use of a scientific appropriate model along with various aspects of investment can create a logical relationship between inputs and outputs of a Feasibility Project. With regard to the objective nature of the feasibility studies and variety of inputs and outputs of a Feasibility Project, it is hypothesized that whether data envelopment analysis can be used in a comprehensive and proper decision making of a series of investment projects. Data envelopment analysis is a mathematical programming approach for evaluating the efficiency of decision-making units (DMU's) with several input and output. With development of the models different methods and in DEA and combining these models with other techniques, the widespread use of this model in many areas was considered by researchers [1].

Therefore, a new application of data envelopment analysis in the field of investment decision-making is investigated in this study. In this study, a brief review of studies in the field of quantitative methods applications in investment decision-makings is provided. Next, the mathematical model of data envelopment analysis is designed based on introducing the model inputs and outputs while methodology of investment feasibility studies is provided based on the pattern of the UNIDO (United Nations Industrial Development Organization). In the fourth part of the study, four DEA models were investigated based on experimental data of investigated samples in investment projects in radial pattern of constant returns to scale, variable returns to scale and non-radial patterns of constant and variable returns. Moreover, input oriented and output oriented models investigated for each of them. Finally, after solving each of the models using available data, the optimal pattern for evaluating investment projects was determined. At the end, another question was answered in this study that which of the industrial sectors in the province is more justified for investment.

2 Literature Review

Farrell (1957) measured the efficiency of production units using by using the same method of efficiency measurement in engineering discussions. The related case considered by Farrel for efficiency measurement included one input and one output. Charnes, Cooper, and Rhodes (1978) developed the Farrell's view and provided a model with the ability to measure the efficiency of multiple inputs and outputs. This model called data envelopment analysis. This model called CCR since it was suggested by Charnes, Cooper, and Rhodes. This model is used to evaluate units with constant returns to scale. In order to overcome this deficiency, Banker, Cooper and Charnes with small changes in the CCR model provided the model of variable returns to scale called BCC. In these models, changes in the input or output are optimized with considering another constant model in a mathematical programming model to lead in to unit efficiency optimality. Charnes, Cooper, Golani, Stifford and Status presented a model in which the possibility of simultaneous changes of input and output is achieved and the optimality of efficiency of decision-making occurs under such conditions. This model that is called additive model is among other important models of DEA [2].

One of the applications related to the topic of this study is the use of DEA in evaluating projects, though DEA has not yet significantly applied in the evaluation and selection of projects and plans. This is due to the poor ability of the model in the separation of outputs. Although the choices can be classified in several ranking groups, but usually it is difficult to rank the alternatives in a group. To solve this problem, Conka and Ercan defined a set of complementary criteria to complete ranking based on outputs of data envelopment analysis [3]. The combination of balance scorecard approach and data envelopment analysis is used for better selection of data envelopment analysis projects [4,5].

Another problem of the DEA is that this method does not consider resource constraints in evaluating alternatives. Since this model considers the same limitations, it is used extensively in the business issues. In this model a poor combination of projects with limited resources may achieve a higher rank of a good project with high resources. To solve this problem, Mavrotas et al. proposed a law of strengthened ranking [6]. Cook and Green combined DEA and Knapsack problem to propose a model to rank projects for the selection of R&D projects. This model selects a package of projects that have had the best efficiency by considering the limitations. Though the assumption of accurate input and output data may raises questions about operational application of this model [7].

In another study, different methods for selecting technology for wastewater treatment investigated and suggested using DEA Meta Frontier Model. Although in this research project the evaluation of economic and technical efficiency is a useful tool in selecting the appropriate technology for wastewater treatment, traditional models have the limitation of evaluation in units with the same technology. Meanwhile, the suggested model of Meta Frontier for convex functions using data envelopment analysis determines and investigates technical-economic efficiency and technological gap in wastewater treatment of 99 units [8].

In another study the efficiency of China's regional investment in research and development area was investigated using data envelopment analysis. In this study, 30 provincial investments in China in the area of research and development investigated using the country's National official data in DEA to compare efficiency of investment in these regions. Another aspect of this study was to investigate the effect of regional conditions on investment efficiency. In their study, technical and scale efficiency of three regions of western, eastern and central states were compared. In this study, costs, full-time staff of research and development as inputs and applied innovations and inventions, new product sales revenue and profit by leading businesses as outputs of research and development units entered the model. The Kruskal-Wallis test was used to investigate significant differences between the studied areas. Finally, with regard to technical and scale efficiency obtained from the model, some suggestions provided to improve the efficiency of research and development investment [9].

In a similar study, this approach was used to rank social and economic role of the Chinese national oil companies. In this study, four variables of return of investment (ROI), operational funds, saving rate and oil and gas extraction rate as inputs and variables of tax rate, financial performance to number of personnel, storage of oil and gas for the country energy security and employment rates as outputs were used [10]. In another study that is very close to the nature of technical and economic evaluation of projects, Juan Chiang & Cheh (2010) used a combination of hierarchy process and fuzzy data envelopment analysis to evaluate the product development project. In this study, market research and marketing costs, costs of experimental production of the product, project workforce cost, costs of production equipment and facilities as inputs and expected revenue, the business value of technology as outputs of the project were considered. Fuzzy Analytical Hierarchy Process was used to determine the project efficiency scope considered in limitations of DEA model [11].

Predicted financial statement analysis is an appropriate tool for assessing the justification of the project performance. The use of DEA in evaluating the financial statements of pharmaceutical companies was applied in the research conducted in 2007 by Mohamadi. In this study, it is noted that the separate use of one or more financial ratio cannot provide a global assessment of the status of the company. Therefore, the DEA model is used to calculate the performance of the studied companies based on financial data and outcomes [12]. These evaluations will be used in the evaluation of investment projects.

3 Methodology

Investment decision-making is considered as one of the important stages in the process of the development of a society. The more accuracy and compliance of investment decision-making with the conditions of society leads to more successful development of a country. One of the important tools in proper investment decisions is to prepare a proper justification project and accurate conclusions based on the conducted studies. According to the proposed framework of the United Nations Industrial Development Organization, Feasibility Study of Industrial Projects is based on model in **Fig. 1** (United Nations Publications, 2002).

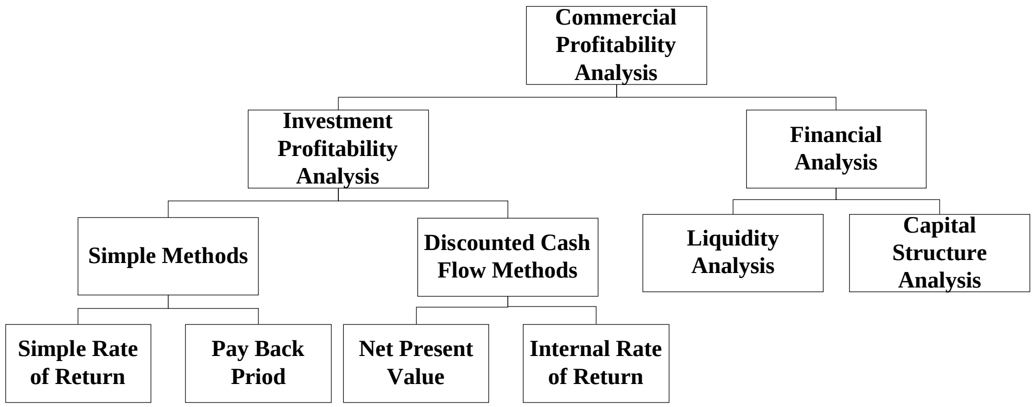

Fig. 1.Framework for evaluation of industrial projects based on UNIDO model
Ref: United Nations (2002) [13]

This method in many of the world countries is used as a basis of decision-making. But as it is shown in this graph, evaluation of the investment could be conducted in line with one of the branches of the figure. Even if all the mentioned (or not mentioned) indices to be estimated, no comprehensive mechanism to consider all aspects is not defined. On the other hand, the specific regional condition the effect of which is entered by discount rate in the calculation is considered the same in all industries and economic sectors of a region and even in some cases in the country's total area. This increases prediction deviations from reality.
The statistical population of investment projects consisted of 155 investment project investigated by Member companies of Fars Province Association of Credit Counseling Services from 2006 to 2010. Among these projects, 60 projects with confidence of 95% and 10% permissible error were selected randomly in groups. Status of the sample units is given in **Table 1**.

Table 1.Properties of investigated samples (Million Rials)

	No. of Samples	Fixed Investment Cost	Cash in Hand	Production Labor	Non-production Labor	Production Cost	Annual Profit	Annual Cash Flow	ROR	IRR
Food & Beverage	20	47844	25675	23.5	12.95	198184	36397	27529	21.4	38.8
Electricity & Electronics	3	27513	19270	16.7	6.3	169261	51286	26239	25.0	49.7
Cellulose	6	67350	11852	26.6	9	78996	27971	14331	23.2	38.5
Chemical	7	93219	16051	28.0	13	585854	65958	53360	23.7	23.0
Metal, Machinery & Fabrication	17	32357	32526	28.8	12.3	148313	29130	25288	22.4	39.2
Nonmetallic Mineral	6	7769	1915	10.5	4.7	20988	6451	5469	17.6	35.3
Textile	1	36030	32870	234.0	13.0	437690	47932	24228	26.0	34.0

Source: *Studies by by Member companies of Fars Province* Association of Credit Counseling *Services*
ROR: Rate of Return, IRR: Internal Rate of return

With regard to investment goal in the process of investment, obtaining the highest output of the existing resources and the balance of input and output, both of which are useful in the final decision making, CCR, BCC, output-oriented and input-oriented non- radial models are used to compare the power of each of these models in determining the evaluation result of a justification project. In this model, a total of 14 input variables and 2 output variables based on the pattern of UNIDO feasibility studies are considered. These variables are shown in **Table 2**.

Table 2.Inputs and outputs of DEA model

Inputs (Costs)				Outputs	
I_{1j}	*Land & Site Preparation*	I_{8j}	*Raw Materials*	O_{1j}	*Annual Profit*
I_{2j}	*Civil Works, Structures & Buildings*	I_{9j}	*Production Labor*	O_{2j}	*Annual Cash Flow*
I_{3j}	*Machinery & Equipments*	I_{10j}	*Non-Production Labor*		
I_{4j}	*Auxiliary & Service Plant Equipment*	I_{11j}	*Energy*		
I_{5j}	*Transportation & Handling Equipments*	I_{12j}	*Repair & Maintenance*		
I_{6j}	*Non-Corporate Fixed Assets*	I_{13j}	*Depreciation*		
I_{7j}	*Contingencies & Pre-Production*	I_{14j}	*Overhead*		

Source: United Nations (2002) [13]

In the DEA approach, when the model solved using the DEA Frontier software, the rate of the efficiency of each project obtained. Moreover, investment indicators based on the existing method extracted using *COMFARIII Expert* software. Then the correlation of the results between the two methods obtained using statistical analysis and SPSS18 software. Finally, by determining the appropriate plans, the feasible plans in the province were ranked.

4 Findings

According to existing data and the model solving, results of **Table 3** are obtained. Columns 6 to 13 of table represent technical efficiency of each project in the solution of four models of data envelopment analysis. Columns 3 to 5 show the values of the internal rate of return (IRR), Break-even point (BEP) and return of capital (ROR) of break-even point for each project as the result of feasibility studies.

Table 3.Results of justification evaluation by *COMFARIII* software and obtained results of the analysis of patterns of data envelopment analysis models

DMU	Main Product	IRR	BEP	ROR	CCR Input-Oriented		CCR Output-Oriented		Non-Radial		Non-Radial	
					CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS
1	Transformer	57	13	28	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Electronics Sys.	45	19	26	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
3	Electricity Counter	47	20	21	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
4	Cardboard Sheets	55	19	24	0.59	0.75	0.59	0.63	0.44	0.54	0.56	0.59
5	Carton	36	19	25	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
6	Craft Liner Paper	33	28	26	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
7	Tissue	36	24	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

DMU	Main Product	IRR	BEP	ROR	CCR Input-Oriented		CCR Output-Oriented		Non-Radial		Non-Radial	
					CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS
8	MDF Coat	32	23	25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	Office Supplies	39	21	19	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
10	PE products	39	24	29	0.58	0.84	0.58	0.61	0.29	0.64	0.31	0.42
11	Fiber Glass Parts	23	27	20	0.52	0.75	0.52	0.52	0.26	0.47	0.39	0.49
12	PE Products	29	32	18	0.67	0.99	0.67	0.96	0.26	0.53	0.66	0.94
13	Plastic products	18	37	19	0.67	1.00	0.67	1.00	0.35	0.93	0.51	1.00
14	Base Oil	41	14	27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Industrial Gases	37	16	25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	UPVC Products	44	12	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Grape’s Seed Oil	32	16	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Fruit Cold Store	88	5	25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Mineral Water	28	20	25	0.60	0.61	0.60	0.62	0.28	0.29	0.42	0.42
20	Mineral Water	47	21	22	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Industrial Kitchen	60	21	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Fruit Cold Store	30	29	19	0.86	0.89	0.86	0.87	0.49	0.53	0.72	0.77
23	Livestock Slaughterhouse	32	17	19	0.74	0.74	0.74	0.75	0.45	0.46	0.68	0.69
24	Dairy Products	30	29	19	0.27	0.53	0.28	0.28	0.21	0.36	0.26	0.28
25	Powdered Milk	34	26	19	0.41	0.47	0.41	0.41	0.28	0.33	0.33	0.34
26	Dairy Products	34	12	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Natural Essences	21	34	14	0.74	1.00	0.74	1.00	0.39	1.00	0.49	1.00
28	Rose Water	28	22	22	0.86	0.86	0.86	0.86	0.38	0.46	0.83	0.83
29	Poultry Slaughterhouse	60	18	24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30	Poultry Feed	27	26	15	0.75	0.81	0.75	0.75	0.36	0.51	0.57	0.62
31	Hydroponic Green	37	32	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
32	Flour	38	28	20	0.66	0.68	0.66	0.66	0.41	0.46	0.65	0.65
33	Silo	39	24	33	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
34	Animal & Aquatic Feed	42	20	33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	Packaging	53	15	18	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
36	Animal Enzyme	41	16	22	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Mechanized Parking	51	32	30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Office Supplies	69	18	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Office Supplies	40	23	17	0.73	0.89	0.73	0.79	0.53	0.69	0.63	0.66
40	Prefabricated walls	40	20	20	0.99	1.00	0.99	1.00	0.71	1.00	0.90	1.00
41	Car Parts	29	22	25	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
42	Metallic Tins	29	19	23	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
43	Rivet, Pin & Nail	24	25	34	0.68	0.68	0.68	0.69	0.41	0.44	0.68	0.69
44	Car Parts	40	18	21	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
45	Metallic Structures	33	20	19	0.54	0.64	0.54	0.56	0.37	0.46	0.49	0.52
46	Rebar	28	18	27	0.73	1.00	0.73	1.00	0.42	1.00	0.72	1.00
47	Fitting	60	12	17	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
48	Concrete Products	28	25	16	0.47	0.78	0.47	0.61	0.29	0.51	0.51	0.56
49	Concrete Products	19	39	21	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
50	Building Jacks	21	25	20	0.49	1.00	0.49	0.71	0.20	0.66	0.27	0.43
51	Ready Mix Concrete	29	20	20	0.69	0.85	0.69	0.75	0.42	0.56	0.69	0.74
52	Stone Powder	21	20	20	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
53	Double Glazing Glass	74	8	38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
54	Air Freshener	31	24	23	0.38	0.38	0.38	0.38	0.18	0.23	0.22	0.23

DMU	Main Product	IRR	BEP	ROR	CCR Input-Oriented		CCR Output-Oriented		Non-Radial		Non-Radial	
					CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS
55	Automatic Door	38	25	19	0.47	0.59	0.47	0.49	0.32	0.39	0.46	0.48
56	Machinery	21	24	29	0.51	0.79	0.51	0.62	0.29	0.49	0.99	1.00
57	Mosaic Equipment	35	20	19	0.99	1.00	0.99	1.00	0.75	0.93	0.99	1.00
58	Mosaic Equipment	43	23	20	1.00	1.00	1.00	1.00	0.93	0.93	1.00	1.00
59	Transformer	56	16	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
60	Garments	34	26	26	0.98	1.00	0.98	1.00	0.53	1.00	0.71	1.00

Source: Research findings

In order to investigate the relationship or lack of relationship between the rate of efficiency obtained from the radial and additive models of data envelopment analysis, the Spearman correlation coefficient was used. Result of determining the statistical parameters determined in this study is given in **Table 4**.

Table 4.Results of Spearman correlation coefficient test between indicators of UNIDO feasibility study method and the results of DEA efficiency results

UNIDO Feasibility Result	IRR		BEP		SROR			
DEA Results correlation Test Results	R	Sig	R	Sig	R	Sig	No. of Efficient DMU's	Efficiency variation range
CCR-Input Oriented	0.415	0.001	-0.273	0.035	0.108	0.410	33	0.724
CCR-Output Oriented	0.415	0.001	-0.273	0.035	0.108	0.410	33	0.724
BCC- Input Oriented	0.263	0.043	-0.089	0.499	0.015	0.908	40	0.622
BCC- Output Oriented	0.304	0.018	-0.121	0.355	0.069	0.598	39	0.718
NR-CRS-Input Oriented	0.521	0.001	-0.388	0.002	0.124	0.346	19	0.816
NR-CRS-Output Oriented	0.449	0.001	-0.337	0.008	0.132	0.316	33	0.779
NR-VRS-Input Oriented	0.388	0.002	-0.223	0.087	0.069	0.601	23	0.774
NR-VRS-Output Oriented	0.327	0.011	-0.146	0.264	0.079	0.549	39	0.770

CRS: Constant Return to Scale, VRS: Variable Return to Scale, NR: Non Radial
Source: Research findings

According to the statistical analysis conducted in this model and calculation of adjusted coefficient of determination, it seems that the most appropriate correlation between calculated efficiency of DEA models with project's IRR is related to non-radial input-oriented model of constant returns to scale. With respect to the calculated P-Value, the ratio between these two values is confident. In the case of the production percent in the break-even point, this model has the most appropriate adjusted coefficient of determination. Based on **Table 4** results, Non-Radial with constant return to scale and input oriented model has significant relation with IRR and BEP as well as highest correlation coefficient with them. But the all model results have no reliable correlation with investment rate of return (SROR). Reviewing the method to calculate return on investment in the study may determine to some extent the cause of this deficiency. What is considered as the return on the investment in this study is the simple rate of return on investment (accounting) in which the basis for determining the return on investment is expected profits in the income statement. But in the case of internal rate of return, criterion for project cash flow calculations is based on the current value. If the rate of return is calculated based on the present value of expected profits, then this inconsistency is somewhat elevated.

In column 8th of **Table 4**, the numbers of efficient units of each model are given. As it can be seen, in the non-radial input-oriented model in the constant state of returns to scale, 19 projects out of 60 projects are identified on the efficient frontier and the remaining 41 projects are located under the efficient frontier. This represents the proper power of separating projects in this model. The lowest efficiency variation range calculated in the model to efficient units also confirms suitability of this model. So according to what was said before, it is possible to consider non-radial input-oriented model in the case of constant returns to scale as an appropriate model to evaluate feasibility studies. Evaluation of the results of this model in comparison with various industries is shown in **Table 5**.

Table 5.Comparison of the industry group's efficiencies based on input oriented non-radial DEA model results

Industry Group	Sample Numbers	efficiency			efficient units percentage	Efficiency variation range
		Average	Min	Max		
Electrical & Electronics	3	0.723	0.857	1.000	33	0.143
Cellulose	6	0.651	0.439	1.000	33	0.561
Chemicals	7	0.682	0.255	1.000	43	0.745
Food and Drug	20	0.701	0.208	1.000	45	0.792
Metal	11	0.663	0.371	1.000	18	0.629
Non-metallic minerals	6	0.674	0.202	1.000	17	0.798
The machine building	6	0.664	0.184	1.000	17	0.816
Textiles	1	0.529	0.529	0.529	<0.1	-
Total	60	0.701	0.184	1.000	31	0.816

Source: Research findings

As it can be seen, among the groups of studied industries, the highest efficiency average is related to electrical and electronics group followed by food and pharmaceutical industries. The textile industry has the lowest average and conclusions in the case of this industry should be made carefully and with caution due to the existence of a project in the studied sample. However, after textile industry, cellulose industries in the studied sample have the lowest average efficiency. Regarding the number of efficient units in each industry, food and pharmaceutical industries have the highest percent of efficient unit in eight evaluated groups followed chemical industry in the next category. Efficiency variation range in the studied groups show that the lowest range of efficiency variation is related to electrical industry and the highest one is related to auto industry. These available data for experts and managers can be used as a tool based on the current situation to decide about appropriate policies for creation of infrastructures, financing and guiding investors.

5 Discussion and conclusions

Today, the framework provided by the United Nations Industrial Development Organization is the basis of final assessment of a feasibility study based on various financial and economic indices. This framework with its great strengths points could find a suitable place among investors, financing and influential institutions in the process of investment. However, the diversity and distribution of economic and financial indicators of a project caused some indicators to be faded in the project's final conclusion while others to be considered as the main basis for decision-making. The same issue may arise regarding inappropriate investment decisions. Volumes of required financial, human and infrastructure resources in investment lead to significant risk of incorrect conclusions from the evaluation (despite great care in data collection). Therefore, this study was an attempt to provide a comprehensive solution that is based on accurate data collection and calculation of a feasibility study to suggest a good summary of the status of a project.

This study uses data envelopment analysis model for determining the efficiency of a project compared with existing projects. Comparing some common patterns in data envelopment analysis, it seems that Non-radial input-oriented model in the case of constant returns to scale is appropriate. However, the remarkable point in this model is appropriate number of existing projects. This restriction will cause impracticality of the application of such a model for an enterprise with one or more projects. Generally, in a favorable investment climate in society the investment advisors are considered as one of the tools needed to evaluate investment ideas and this will partially solve the problem. On the other hand, financing institutions such as investment banks, government agencies and venture capitalists by having real data of a large number of projects can prepare and use an appropriate database to use this model. Experts and managers can use these data as a tool based on the current situation in developing appropriate policies underlying infrastructure, finance and investors guidance.

Among the studied industry groups, the highest average efficiency was related to electricity and electronics group followed by food and pharmaceutical industries. The textile industry has the lowest average and conclusions in the case of this industry should be made carefully and with caution due to the existence of a project in the studied sample.

However, after textile industry, cellulose industries in the studied sample have the lowest average efficiency. Regarding the number of efficient units in each industry, food and pharmaceutical industries have the highest percent of efficient unit in eight evaluated groups followed chemical industry in the next category. Efficiency variation range in the studied groups show that the lowest range of efficiency variation is related to electrical industry and the highest one is related to auto industry.

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