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REVIEW ARTICLE

IDENTIFYING THE FACTORS AFFECTING THE PRODUCTIVITY OF THE STEEL INDUSTRY USING THE GRAND THEORY METHOD

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ABSTRACT

Productivity is the most important factor in the competitiveness of any industry. Since the steel industry is a resource-oriented industry and Iran owns the natural resources required by this industry, this industry is very substantial for the country. This study aims to identify the factors affecting productivity in the steel industry.

Method: Data were collected from 24 semi-structured interviews with managers and senior experts and analyzed by open, axial and selective coding methods using an approach called Grand Theory.

Findings: The effective factors identified in the productivity of the steel industry include:

- ✓ Human factors (manpower productivity, labor force congestion in the public sector)
- ✓ Technology factors (production technology, information technology infrastructure)
- ✓ Political factors (Sanctions, competitors, exports)
- ✓ Supporting factors (production capacity, infrastructure, reduction of bank interest rates)

Keywords: Productivity, Steel Industry, Grand Theory

1. INTRODUCTION

Nowadays, productivity is considered beyond a criterion, as a culture and attitude to work and life, and its improvement is the main source of economic development. Improving productivity has far-reaching effects on the main social, economic and political phenomena of society, such as reducing inflation, increasing public welfare, increasing employment, increasing political and economic competitiveness, and the like. From a systemic perspective, with the spread of this thinking at the level of economic resources of society, it can be concluded that raising the productivity of companies increases national productivity and it will lead to increased purchasing power and economic prosperity in the long run (Amiri et al., 2015).

The steel industry is one of the most important industries in the country; steel plays a key role in many industries, especially construction and automotive. This is mainly due to its low cost and high tensile strength (He et al., 2017).

Steel, as a pillar industry of economic development, has a significant impact in many countries (Hadi et al., 2018; Liu et al., 2019). However, due to the fact that the distribution of iron and steel is not balanced around the world (Debanjana et al., 2018; Park et al., 2019), in order to obtain the required resources, various countries play different roles in the steel industry chain, and form a complex worldwide trading network (Sujauddin et al., 2017; Xuan and Qiang, 2017). Countries are affected by different environmental and economic benefits and costs (Hasanbeigi et al., 2016; Mayes et al., 2018).

This industry, as a resource-oriented industry, is based on natural resources, which Iran benefits in abundance. This industry is able to process these natural resources of the country and create added value in them. Other important activities of the country's economy, such as metal industries and construction activities, are highly dependent on products from the steel industry.

Although the country has a variety of metallic and non-metallic minerals as well as rich energy resources, but based on sustainable development, their use in resource-oriented industries should be accompanied by their protection, which is largely dependent on productivity improvement. Also, improving the productivity of this industry makes the products of this sector more competitive, and besides developing exports and maintaining the foreign markets of its products, downstream activities of the domestic steel industry can achieve its products at a lower price.

The issue of productivity in the drafting of the law of the Fourth Economic, Social and Cultural Development Plan of the Islamic Republic of Iran, was considered as a basic principle in economic growth for the first time in the history of planning, and it was predicted that 31.3% of annual economic growth of the country should be achieved by improving the total factor productivity (TFP). In other words, from 8% of the average annual growth of the national economy in the years of the Fourth Development Plan, 2.5% was to be achieved by improving productivity or better use of previous investments (existing facilities) and 5% to be provided by increasing new human and physical investments. Given that the issue of productivity is the most important factor influencing the development of the country and can play a key role in its progress, it has been given strict attention in development programs. However, in the Fourth Development Plan, the growth of total factor productivity was announced at 1.1 percent and the share of total factor productivity in economic growth was announced at 25 percent, although these indicators were affected by the $ 120 oil price. In the fifth plan, the situation of productivity index fluctuates again and the growth of total factor productivity growth is -1.9% and the share of factor productivity in economic growth is reported to be almost zero (Arzani, 2016).

2. THEORETICAL FOUNDATIONS

2.1. Steel

Iran's steel industry has been growing in recent years. Iran is currently the tenth largest producer of iron and steel and intends to improve its position to seventh by increasing crude steel production and reaching a capacity of 55 million tons in 1404.

According to the report of the World Iron and Steel Association in 2019, Iran was ranked 10th in the world in terms of crude iron and steel production with a 30% growth. Meanwhile, the growth of crude steel production of other countries and even the top 3 countries has been very low or even negative in this year according to Figure 1. This growth trend has taken place while the United States has imposed sanctions on Iran's steel industry and banned the sale of steel equipment and raw materials to Iran.

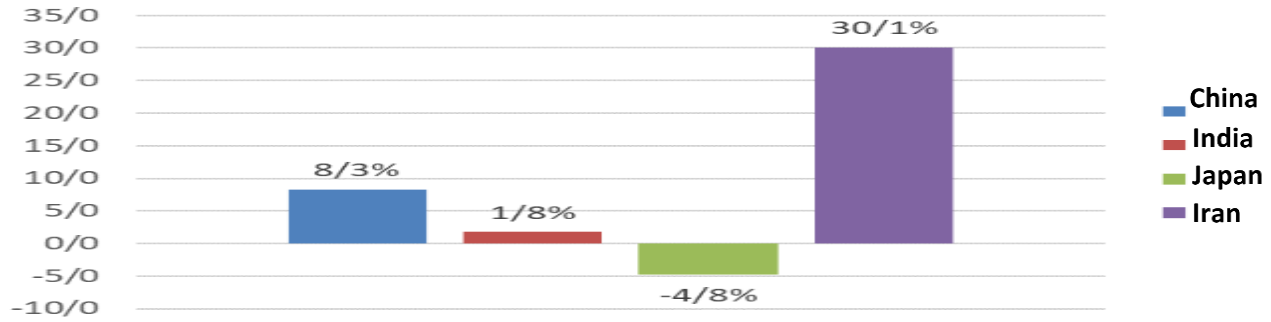

Figure 1. Comparison of Iran's steel growth rate with the top three countries (2019)

The growing trend of Iranian crude steel production continued even until January 2020; but with the outbreak of the Corona virus and the closure of industries, this production has been accompanied by a relative decline in the next three months of the present year. However, the indicators of the steel sector show that this market has a good potential to overcome these conditions and positive movements are expected in the second half of 2020. The following table compares China, India, Japan and Iran in terms of production in the first four months of 2020 compared to the same period in 2019:

Table 1. Comparison of production of China, Japan, India and Iran in 2019 and 2020

	China	India	Japan	ایران
January 2019	66,513,700	6,507,000	6.042.779	2,137,130
January 2020	79,929,300	9,320,000	8.244.200	2,300,000+
February 2019	60,076,800	6,296,000	5,617,577	2,122,700
February 2020	74,772,600	9,560,000	7,918,600	2,100,000
March 2019	66,152,400	6,677,000	6,675,049	2,350,000
March 2020	78,974,700	8,038,000	7,949,900	2,300,000
April 2019	69,834,100	6,016,000	6,448,847	2,250,000
April 2020	85,033,300	3,137,000	6,616,700	1,790,000

The number of Iranian products in 1998 for three categories of long steel sections (including beams, rebars, angles and studs), flat steel sections (hot sheet, cold sheet, coated sheet, etc.) and intermediate steel sections (including billet, bloom and slabs) are shown in Figure 2.

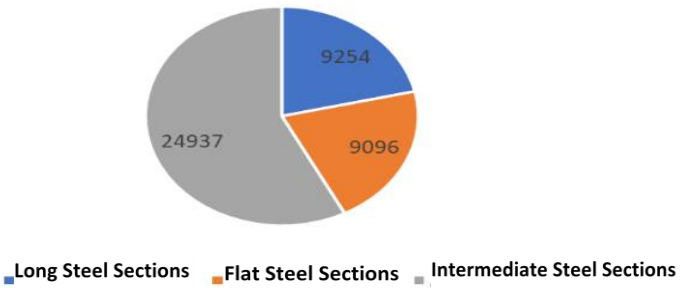

Figure 2. Share of various steel products in Iranian productions

2.2. Steel Export Status

Iran was the 18th largest steel exporter in 2017, which experienced a growth of 24 percent considering 9.2 million tons of steel export in 2018. In 2017, Iran's share of total steel exported worldwide was about 2%.

Between 2009 and 2018, Iran's steel exports increased by 1,084%, while imports decreased by 84%. In 2018, Iran's steel trade surplus reached 7.5 million tons, which shows an increase of 71% compared to 4.4 million tons of steel surplus in 2017. The value of Iran's steel exports in 2018 increased by 53% from $ 2.8 billion in 2017 to $ 4.2 billion. In 2018, Iran has produced about 25 million tons of steel products.

2.3. Research Background

Singh and Raina (2015) measured the efficiency and productivity of 46 Indian steel companies from 1999 to 2010 through data envelopment analysis. The results show that during the study period, the companies have gained TFP growth, which was due to the growth of technical efficiency and technical repairs. Shin (2012) calculated the production efficiency of Korean steel companies for the period 2002-2009 through data envelopment analysis and concluded that the global financial crisis led to an increase in scale efficiency and a decrease in the TFP of the studied steel companies. Ray and Paul (2010) examined indicators related to the productivity of the Indian steel industry. The results show that the partial productivity of raw materials, labor and capital in the industry has been declining, while the output of the Indian steel industry has been growing. The paper then examined the TFP changes in the Indian steel industry through data envelopment analysis, which indicated that the index was declining. This paper concludes that the growth of Indian steel industry is more in terms of factor growth than total TFP growth. The privatization process of the Indian steel industry has also had an adverse effect on the TFP growth.

3. RESEARCH METHOD

The general approach to the present study is a qualitative approach that has been performed using grounded theory, one of the strategies for conducting qualitative research. Grounded theory in its simplest form is the process of building a codified theory through organized data collection and inductive data analysis to answer new questions for those qualitative researches that lack sufficient theoretical foundations in the field of study. (Mansoorian, 2007).

To present grounded theory, a semi-structured interview method has been used to collect data. The process was such that after numerous studies and reviews and using the opinion of consultants, the final interview questions where initiated with senior managers of the steel industry. The statistical population of the study includes senior managers and experts in the field of productivity (with more than 10 years of experience), from which 24 people (Table 1) were selected as the research sample by purposive and snowball sampling methods. In the interview, interviewees were allowed to comment on the details of the main topic according to their knowledge and experience. The interviews continued until the theoretical saturation of the data was reached. The time interval for data collection is April to June 2016. To increase the accuracy of the data analysis, all interviews were recorded and then each interview was typed separately, word by word. In the first 24 hours, the researcher read each interview and noted the concepts that came to his mind carefully and line by line. This stage is one of the first stages of data analysis in grounded theory, which is called coding. Then, the collected data were analyzed using the data analysis method prescribed in Grand Theory.

Table 1. Demographic characteristics of experts

Title	Frequency	Percentage
Education		
P.H.D	12	50
PhD student	4	16.6
MA	8	33.4
Work experience		
11-20	5	21
21+	19	79

According to Table (1), the highest number of interviewees had doctoral education, equal to 12 people which constitutes 50% of the interviewees. Also, the highest number of interviewees, i.e. 19 people had a work experience over 21 years, which included 79% of the interviewees. The interview guide includes 2 main questions as follows:

What are the effective factors of steel industry productivity?

What are the effective components of steel industry productivity?

4. RESEARCH FINDINGS

Research findings were obtained from the answers of three groups of the statistical population collected from the interviews. For data analysis, the Constant Comparative Analysis technique by Strauss and Corbin (1998) has been used including three steps of open coding, axial coding, and selective coding:

A. Open coding

After duplicating an interview, open coding was initiated. The purpose of open coding is to break down the collected set into the smallest possible conceptual components. In open coding, the text of the interview was read over and over again, and after marking and breaking the data, every concept that came to mind was considered. There is no restriction on naming concepts in this section. So the number of codes was very large at this stage. But gradually, due to the duplication of information, these codes became less. Coding sometimes originated from the storage of concepts that the researcher had previously acquired in his or her professional studies, and sometimes the terms used by the interviewee were used. The recent codes are called live codes. A text can be coded with different perspectives. The issue of research, the researcher's intellectual and analytical horizon and the extent of his involvement with the research environment and the style of the interview text are among the factors that affect the coding of a text. In this part of the present study, similar concepts were identified and classified under subcategories and special categories. It should be noted that the category must be more abstract than the other concept. The name of the subcategory considered in this research is more abstract than the concepts that constitute the set of each subcategory. This trend is followed for categories. Thus, the factors introduced under the subcategories are the most abstract conceptual names that the research model is drawn by establishing a link between them.

B. Axial coding

Classification and categorization in open coding reduces the number of units that we have to work on. This helps the process of implementing grounded theory in the axial coding stage. Coding at this stage was done axially and according to the process embedded in the data. The Strauss-Corbin coding paradigm was used to facilitate the data embedding process. Accordingly, in this stage of classification, an attempt was made to place the codes around the common axis, in addition to considering the common characteristics and dimensions, based on the conditions, actions, reactions and consequences. In other words, at this stage, by establishing links between categories, information is linked by new methods. The link between the main categories and the known dimensions in the present study is shown in Figure 1.

C. Selective coding

Selective coding is the last stage of coding in which the main category is selected and its link to other categories is specified. Interpretation and expression of relationships between the main category and other categories is performed according to the proposed model of the research, because in axial coding, the basis of selective coding is being laid (Strauss and Corbin, 2016). In this study, categories of individual and environmental characteristics were identified. In other words, the above factors are the answer to the first research question, what factors affect the activities of startups in management students? Which will be

discussed in the following. In Table (2), the answers are coded by MAXQDA software and its results are shown in Table 2, and then the effective factors are identified and divided based on these codes.

Table 2, Categories

Axial Categories	Subcategories	themes	Frequency of interview answers	Percentage
Supporting factors	Reducing bank interest rates, infrastructure, laws and regulations, increasing production capacity	Reducing transportation costs, reducing bank rates, proper planning for infrastructure development, water and gas supply, government regulation and the impact of government location policies on the steel industry, the use of vacant capacities with the attention of the government	14	58
Human Factors	Manpower productivity, labor congestion in government factories	Work culture weakness, manpower productivity, positive attitude towards work, labor overcrowding in government factories and even factories assigned to the quasi-government sector due to the weakness of the social security system, the use of industrial employment instead, deficiencies in the storage of steel products	12	50
Technology factors	Production technology, information technology infrastructure	Utilization of production technology to reduce costs, utilization of sales technology to reduce costs,	8	33
Political factors	Sanctions, exports, emerging competitors	Sanctions, exports, emerging competitors	14	58

Supporting factors are among the factors in the productivity of the steel industry that have been endorsed by the interviewees. Bahraman (2019) stated that government regulations and supportive infrastructure are among the causes of productivity in the steel industry. The final research model is entitled Factors Affecting Productivity in the Steel Industry.

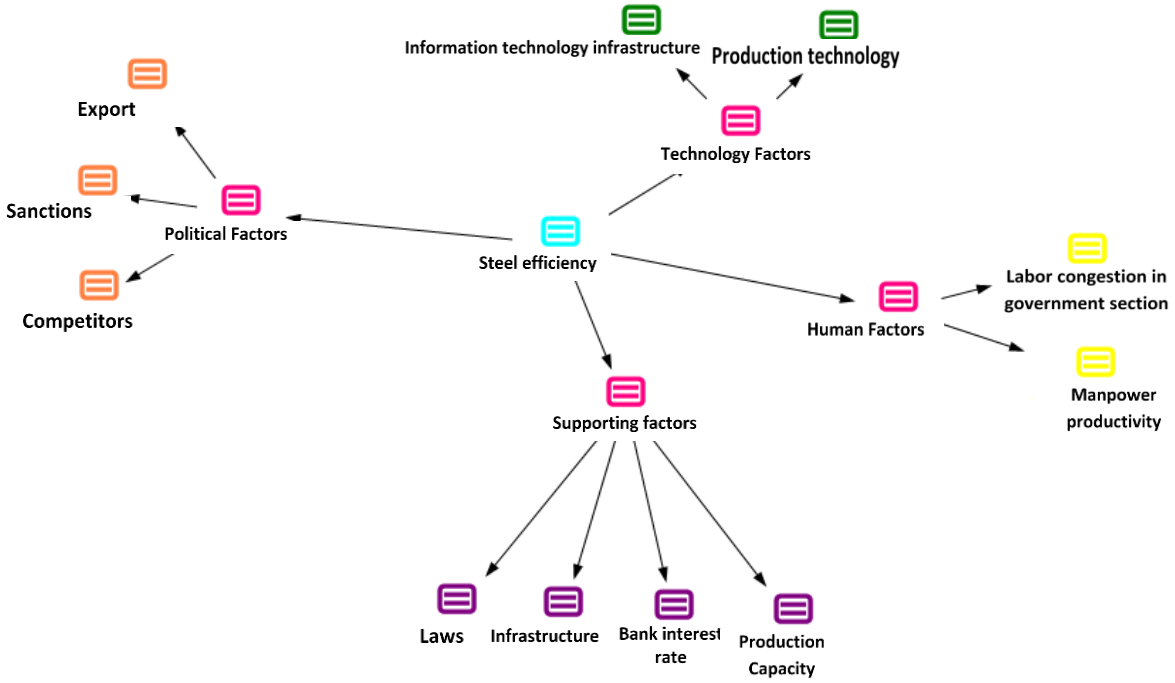

Figure 1, research model

5. DISCUSSION

The use of a qualitative approach (grand theory) has been the distinguishing point of this research from other researches in this field. The application of this approach is significant from two aspects, first, the application of a special method of data analysis in this approach, leads to the construction of concepts, including technological factors. Second, the data obtained in this study can be reused with another approach, for example, examining the factors affecting the productivity of the steel industry. This confirms that studies in the qualitative approach are conducted in depth.

The main purpose of this study was to identify the dimensions and components of productivity in the steel industry. Based on the findings of this study, in general, the effective components of productivity in the steel industry include

1- human factors (manpower productivity, labor force congestion in the public sector)

2- technology factors (production technology, information technology infrastructure)

3- political factors (sanctions, competitors, exports)

4- Supporting factors (production capacity, infrastructure, reduction of bank interest rates). According to the results, upgrading and updating the technology has an important role in the efficiency of the steel industry. Technology and knowledge of steel production is always changing and many experts in the world are working in this regard to introduce and use new technologies to produce one ton of steel with the least consumptions and resources such as raw materials, energy, capital and manpower and compete on their prices to stay in the market. Therefore, the cooperation of the country's steel companies with research and development units can be very effective in achieving this goal. Improving information technology (IT) infrastructure is another factor that is effective in increasing productivity in the steel industry, and in fact the data and information can help the industry by using powerful hardware.

In addition, the results showed that exports are effective in steel productivity, in order to increase exports, the necessary infrastructure such as road, rail, sea and ancillary facilities should be improved. In order to reduce the cost of production, which is due to the increase in the cost of energy, labor, etc., contrary to the declining trend in the selling price of products, costs undergo and increasing trend. In this regard, components that are not technically or politically available to companies should be considered and managed by the government.

According to the research results, it is suggested to reduce the interest rates of bank facilities. By reviewing the economics and industry in recent years, it can be seen that contrary to the definitions of Islamic economics, these banks have been able to own industrial enterprises instead of facilitating various sectors of the economy, including industry. In most companies, the share of financial costs is higher than many other costs. This indicates the inadequacy of the designed economic trends and it is necessary to divert the economy from the current mistaken path.

The country's infrastructure should be developed in accordance with the outlined vision of the steel industry. It should be planned to develop the necessary infrastructure such as the transport network (road, rail, sea), energy supply (electricity, gas), severe shortage of water resources, etc. Fields for beneficiation from comparative advantages should be improved by equipping production units with back-up infrastructure.

Human resource productivity should be increased through rewards, competency-based appointments, to create a positive attitude toward work. Recruitment and accurate employment and development of employees through training and appropriate needs assessments as well as effective evaluation can help improve productivity in all steel industries. Also, teamwork and increasing employee participation in the implementation of organizational strategies will improve productivity. Meanwhile, the role of transformational and participatory-managerial tools in organizations and the use of skilled, specialized and capable human resources in related jobs will be effective in promoting productivity.

Utilizing vacant capacities and completing development projects in the steel industry, which mainly needs financial infrastructure and foreign financing, requires the government to pay attention to providing these resources. On the other hand, by amending the privatization laws, the sale of unused or low-yield and non-profitable companies can be assigned to capable and experienced companies after careful evaluations, and then the above investment cost can be paid after launching and through the benefits of its production.

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