International Business Management 10 (23): 5592-5595, 2016
ISSN: 1993-5250

On Modelling of Different Sectors of Economy in Terms of Sustainable Development

A.A. Lubnina, A.N. Melnik and M.V. Smolyagina
Institute of Management, Economics and Finance,
Kazan Federal University, 420008 Kazan, Russia

Abstract: Modern industrial production consumes much energy, capital and labour to maintain adequate competitive position. Such development puts the reliability of industrial production at risk as well as can deprive future generations of the opportunity to meet their own needs. The study is aimed primarily to develop a method of assessing production reliability in various sectors of economy based on a balanced scorecard system in accordance with the concept of sustainable development. The key method of studying this issue is modelling that looks into a matter of this issue as an object-oriented and orchestrated process of improving different sectors of economy.

Key words: Sustainable development, economic reliability, social reliability, ecological reliability, cluster

INTRODUCTION

The reliability is a primary criterion of evaluating production in different sectors of economy which determine its competitive capacity. It is achievable using game-changing technologies, reducing adverse environmental impact, saving natural resources, taking high social responsibility in a way that facilitates the success of undertakings and assists in building a more efficient failure-free production stable to fluctuations in competitive playing field.

Generally, the reliability is understood to be a proper and failure-free functioning in the course of the time, i.e., the ability to discharge duties in due time. Sustainability of sectors means capacity for continuous discharge of duties in the event of acute fluctuations of market and business conditions, expected force-majeure events in future (Melnik and Mustafina, 2013).

Definition of such terms as the 'sustainability' and 'reliability' allows definite conclusions that both are close meanings. The sustainability of production is its reliability in a longer time including unstable market. Studying the reliability of production is of interest from the standpoint of sustainable development.

MATERIALS AND METHODS

Theory: The definition 'sustainable development' has been first used in a report made by the World Commission on Environment and Development (headed by Gro Harlem Brundtland) at UN in 1987. The commission has suggested the following definition of the sustainable development: it is a development to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development was officially accepted at the UN Conference on Environment and Development which had gathered representatives >70 countries. The conference issued reports in which it is proved that the world as a whole system has limited in growth, natural resources are almost depleted (oil, gas, ores, etc.) and the growth of industry came to its limits, beyond which the humanity is expecting a global disaster so we need a new concept of sustainable development.

Reliability is a complex definition to reflect industrial production from different positions. Like the sustainable development, a reliable development is a balanced development of three components: environment, economics and social (Fig. 1). The economic component is a basis of production reliability, it is achievable when saving total capital used for making profit. This includes an optimal use of non-renewable natural resources, attraction of innovative energy-saving technologies, minimisation, recycling and disposal of waste.

The ecological reliability of production lies in maintaining integrity of natural systems. Special attention is paid to the ability of ecosystems to self-recover. Mercantile interests of managers on the one hand and their insufficient understanding of environmental threat, on the other hand, prevent them from disregarding traditional stereotypes of behaviour. Further development

Corresponding Author: A.A. Lubnina, Institute of Management, Economics and Finance, Kazan Federal University, 420008 Kazan, Russia

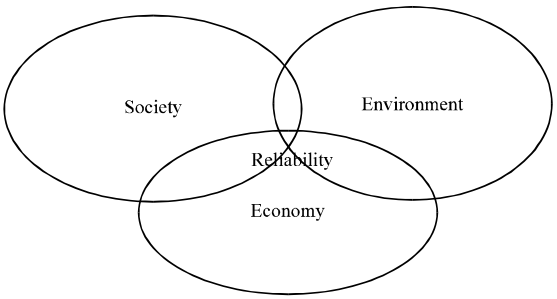

Fig. 1: Components a reliability

of sectors is what we need, taking an adequate environmental impact assessment into consideration. Social reliability is focused on human beings and preserving stability of public goods. This requires preserving quality of environment, cultural capital, creating a more efficient system of taking decisions which considers historical experience, traditions and variety of cultures.

Based on the proposed approach, it can be concluded that the reliability of sectors is possible through preserving and enhancing the environment, finding innovative opportunities associated with the use of resource-saving and energy-saving technologies as well as alternative, recoverable sources of industrial activity, creation of favourable ecological, economic and social conditions for the accumulation and utilisation of human capital (Novikova, 2015; Novikova and Beloborodova, 2014).

RESULTS AND DISCUSSION

Let us consider the indicators that can be used for measuring reliability performance of different sectors of economy. The proposed indicators allow the companies to establish objectives and to develop standards for internal benchmark tests at an achieved level of reliability and monitoring annual progress. The reliability indicators are discussed there.

Economic reliability: Industrial production index in percentage share of innovative goods, works, services in the total volume of shipped own-produced goods in Percentage; labour productivity (a ratio of added value to the average number of employees in thousand Rubles; depreciation of fixed assets in percentage; capital renewal coefficient in percentage; per capita investments to fixed assets in thousand Rubles.

Social reliability: Downsizing (percentage of overall retired); average monthly salary in Rubles; share in employees working in the adverse health environment (in percentage of total number of employees of respective gender engaged in the appropriate type of business); actual expenditures for compensations and personal protection equipment (estimated data in percentage).

Ecological reliability: Overall water consumption in thousand m^3 per 1 employed; contaminated wastewater released to surface water bodies in% of total fresh water consumption; pollutant emissions to atmosphere from stationary pollution sources in tons per 1 employed; screening and treatment of atmosphere contaminants released by stationary pollution sources in tons per 1 employed; formation of toxic wastes for the year in tons per 1 employed; waste disposal and neutralisation in tons per 1 employed; current environmental control costs in thousand Rubles per 1 employed; turnaround costs of fixed environmental control assets in thousand Rubles per 1 employed.

The next stage of the study lies in determination of a method of appreciating reliability of economic sectors. Based on all three components, the reliability level is thought to appreciate using a relevant indicator (In) which is calculated as a sum of indicators of three measures: economical (Iecon), ecological (Iecol) and social (Ic) with appropriate weight numbers. The Iecon, Iecol, Ic indicators are derived from other indicators and are calculated as aggregate indicators. They differ in dimensions, therefore, calculation of an aggregate indicator uses like-for-like dimensionless values say normalised measures. The procedure of normalising is as follows. A maximum and a minimum value is picked for each j-measurea, the maximum value M is equal to 1 while the minimum value m to 0. Let T be the current value, then:

$$I_j = \frac{T - m}{M - m} \quad (1)$$

For a measure with inverse relation, i.e. its minimum value is the best value, the score is calculated as follows:

$$I_j = 1 - \frac{T - m}{M - m} \quad (2)$$

The weight numbers determine the degree of preference for a measure used for calculation of an aggregate indicator, for what any scoring system can be applied (this method uses a 3-score system of weights). A measure (measures) with a higher priority becomes 3 scores while the others are given 2 or 1 depending on priority. The scoring system moves from weight numbers to relative weights so calculated that their sum is 1 when calculating an aggregate indicator. A relative weight number (K_i) is calculated by the following Eq . 3:

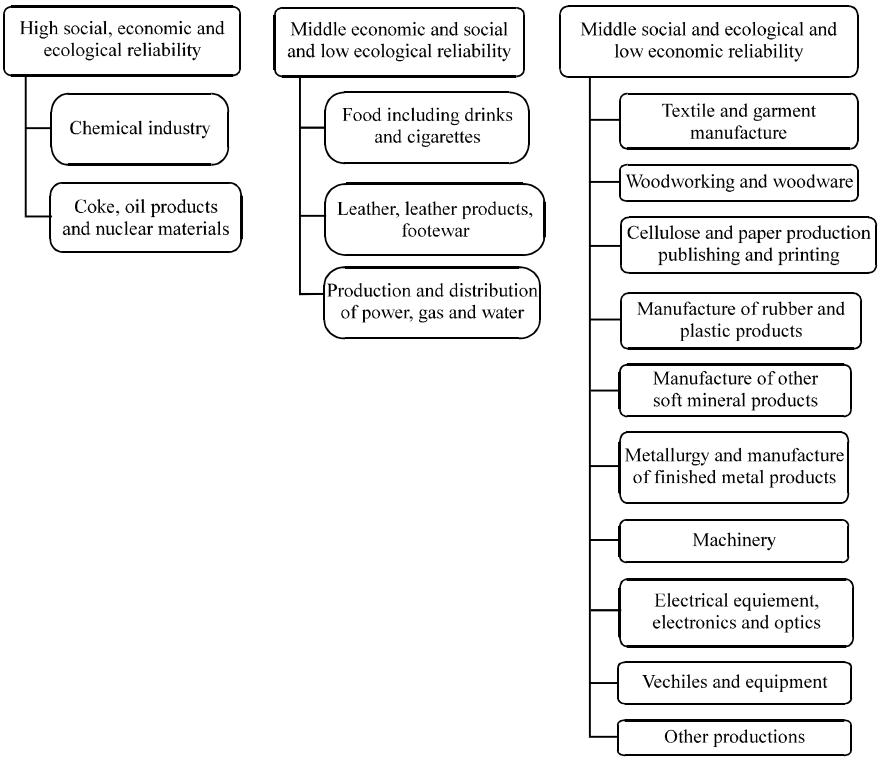

Fig. 2: Groups of Tatarstan's sectors in terms of reliability capacity of economy components (2014)

$$K_i = \frac{VB_i}{\sum_{i=1}^{n} VB_i} \quad (3)$$

Where:
VB_i = A scoring system based weight number
I = Indicator
n = Number of indicators

An Aggregate Indicator (AI) is a sum of indicators at a lower level in the hierarchy of indicators corrected for the relative weight number. The aggregate indicator takes the value from 0-1:

$$AI = \sum_{i=1}^{n} (I_i \times K_i) \quad (4)$$

Where:
AI = Aggregate Indicator
I_i = Normalised measure
K_i = Relative weight number
n = Number of measures that form the aggregate indicator

This method enables calculation of such aggregate indicators as Iecon, Iecol, Ic. Therefore, In is defined as a sum of indicators with suitable weight numbers:

$$In = I_{econ} \times K_i + I_{ecol} \times K_i + Ic \times_i \quad (5)$$

Where:
In = Production reliability indicator
I_{econ} = Economic reliability indicator
I_{ecol} = Ecological reliability indicator
Ic = Social reliability indicator
K_i = Relative weight number

When calculating an integral indicator "Production Reliability" based on the priority, the indices used became the following weight numbers: economic reliability-3 scores, social and ecological reliability-2 scores each. A clustering analysis is applied to grouping the sectors of economy with close reliability values. In according to this method, economic, ecological and social indices are calculated and, therefore, the production reliability index for every sector of the Republic of Tatarstan economy. The resulting values are presented in Table 1.

The analysis has shown that chemical industry is the most reliable sector (integral indicator of production reliability was 0.58 in 2014) demonstrating high economic, social and ecological indicators. The other Tatarstan's sectors of economy do not demonstrate equally unambiguous characterisation of production reliability. A clustering analysis is conducted to grouping the sectors of economy with close reliability values (Fig. 2).

Table 1: Reliability of Republic of Tatarstan sectors in 2014

Types of business	Economic	Social	Ecological	Production reliability
Chemical industry	0.49	0.60	0.63	0.58
Manufacture of coke, refined petroleum and nuclear products	0.69	0.55	0.42	0.53
Production and distribution of power, gas and water	0.46	0.50	0.45	0.47
Other productions	0.22	0.45	0.59	0.45
Leather, leather products, footwear	0.41	0.38	0.45	0.42
Manufacture of rubber and plastic products	0.22	0.55	0.45	0.41
Cellulose and paper production; publishing and printing	0.28	0.44	0.49	0.41
Electrical equipment, electronics and optics	0.27	0.49	0.40	0.39
Textile and garment manufacture	0.29	0.39	0.45	0.39
Food including drinks and cigarettes	0.42	0.46	0.30	0.38
Vehicles and equipment	0.27	0.32	0.44	0.36
Machinery	0.20	0.43	0.41	0.35
Metallurgy and manufacture of finished metal products	0.22	0.35	0.45	0.35
Woodworking and woodware	0.21	0.45	0.35	0.34
Manufacture of other soft mineral products	0.16	0.43	0.40	0.34

Companies of the second group should review further development to reduce adverse environmental impact. The third group companies are recommended to improve the competitiveness of their products, innovative and investment activity, financial sustainability through optimum consumption of non-renewable resources, employment of game-changing energy and resource saving technologies and reduction of wastes to minimum (Kalenskaya 2014; Valeeva *et al*., 2014).

CONCLUSION

The key results of the study are categorisation of production reliability assessment criteria for different sectors of economy; development of a production reliability assessment method to be used in various sectors of economy based on a balanced scorecard system dictated by the concept of sustainable development; production reliability assessment in different Tatarstan's sectors of economy. The analysis of Tatarstan's production reliability has shown that such industries as chemistry, coke, oil products and nuclear materials demonstrate high reliability. The analysis has also revealed Tatarstan's sectors of economy with low reliability which efficiency and stability requires enhancement. Therefore, the developed assessment method is good for target-focused control of the production reliability in different sectors in line with the concept of sustainable development.

ACKNOWLEDGEMENTS

This research was funded by the subsidy allocated to Kazan Federal University for the state assignment in the sphere of scientific activities.

REFERENCES

Kalenskaya, N., 2014. The model of infrastructural support of regional innovative development. Mediterr. J. Soc. Sci., 5: 317-323.

Melnik, A.N. and O.N. Mustafina, 2013. The organization of Russian power market in modern conditions. Middle East J. Sci. Res., 13: 91-94.

Novikova, E. and A. Beloborodova, 2014. An assessment of the efficiency of the information system of design-and-survey organizations based on the analysis of the information capacity of projects implemented. World Appl. Sci. J., 29: 20-25.

Novikova, E.N., 2015. Design of a marketing information system. Mediterr. J. Soc. Sci., 6: 141-145.

Valeeva, J., N. Sharafutdinova and V. Kulkova, 2014. Quality management systems role in operation of retail trade networks. Life Sci. J., 11: 555-558.