Algorithms and business models of financial outsourcing for sustainable development in industry

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Abstract. The work is devoted to the study of the use of business models of financial outsourcing in the institutional support of sustainable development. It is shown that a significant role in the sustainable development of the economy and environmental management can belong to clients of financial outsourcing services - small and medium-sized businesses (SMEs). The paper proposes to include an outsourcing company of financial outsourcing services in the infrastructure for supporting sustainable economic development of united territorial communities (UTC), which will increase the volume of revenues to the local budget and provide additional financing for SMEs, incl. whose activities are aimed at improving the environmental situation. A methodology for monitoring the revenue side of local budgets has been developed by processing monthly data "Openbudget" and "Opendata" by methods of predictive analytics. The proposed methodology has been tested on the example of the budget of Mariupol (Ukraine), as a city with a poor environmental situation, in which monitoring of the local budget will reveal additional sources of financing for the activities of SMEs - clients of financial outsourcing services aimed at improving the environment, as well as ensuring sustainable development of the economy of the territories and the country.

1. Introduction

Institutional support for the sustainable development of the economy of the formed territorial communities and the country includes the search for additional sources of financing for the activities of economic entities, including small and medium-sized businesses (SMEs), involved in the greening of territories where industrial waste accumulates on an increasing scale [1]. The processes of greening economic, social and other systems became widespread in connection with the transition of the concept of development from anthropocentrism to ecocentrism, i.e. shift of scientific vision towards responsibility for human actions, the consequences of social and economic components of human life, which it leaves to future generations [2-7, 9, 10]. This is especially important for the metallurgical industry of Ukraine, without which it is impossible to ensure sustainable development of the economy and fill budgets. The search for additional sources of financing to solve the problems of greening is relevant for the cities: Mariupol, Zaporozhzcie, Krivoy Rog, Dnepr. In these cities, in the process of metallurgical production, waste is generated, the disposal of which has become one of the most pressing topics of environmental protection today. Metallurgical waste contains a large amount of...
toxic chemicals. Waste (sludge, slag, broken lining, scale and dust) of metallurgical production is a big environmental problem in ensuring the sustainable development of the Ukrainian economy.

The negative impacts on the environment of cities with metallurgical production include [11-13]: soil pollution through mass storage of waste; discharge of untreated industrial water into water resources; huge emissions of harmful substances into the atmosphere. In world practice, all waste from metallurgical production is recycled. For comparison, in Mariupol only 10 - 15% of the total mass of waste is recycled. A significant part of them are simply thrown into dumps, or into fields set aside for burial of sludge, or somewhere else. Unfortunately, not only fertile soils, but also the waters of the Sea of Azov, become the place of discharge of metallurgical waste in Mariupol. For the greening of Mariupol, Krivoy Rog, Zaporozhzhie and nearby territories, financial support is needed for the creation and development of SMEs, business entities that will deal with waste disposal. In world practice, most of the waste of ferrous metallurgy finds its application through processing, including small and medium-sized businesses. They are used to extract metal-containing components and metals. Slag is a valuable building material used to obtain cinder concrete. Ceramic scrap is used in the repair of refractory equipment. The development of algorithms that simulate the methodology and methodology of business models of financial outsourcing in identifying sources of funding to support the creation and development of business entities, including SMEs in ensuring sustainable economic development, is relevant.

2. Related works
The problem of creating and using business models in financial management of business entities to ensure sustainable development of the economy has been little studied. Thus, studies [8] are aimed at studying the role of financial management in ensuring sustainable development of the economy. Based on a thematic analysis of resources provided by various scholars, it is argued that appropriate financial management models are needed to increase productivity while reducing financial risks [9]. The development of algorithms, reliable business models of financial outsourcing in ensuring sustainable development of the economy have not yet been shown as financial outsourcing services for business entities, including SMEs [14-16].

3. Materials and Methods
The possibility of applying the methods of predictive (predictive) analytics, built into analytical systems for managing revenues of local budgets, with the aim of increasing them, and the possibility of additional financing for the development of business entities, including SMEs, in ensuring sustainable development of the economy, has been investigated. The purpose of the study is to develop algorithms that simulate methods for managing tax and non-tax revenues to the local budget, using the example of the city of Mariupol, aimed at increasing funding for the activities of the subjects. To study the advantages of using business models of financial outsourcing, a set of relevant data was formed, imported from the monthly data "Opendata" of Mariupol for the period 2018-2020 (Fig. 1).

The main objectives of the study are: a) to develop a methodology for forming a set of data - revenues to local budgets by importing monthly data - "Open Budget" as a function of outsourcing financial outsourcing services ; b) to propose a method of data processing for outsourcing, using various tools of forecasting analytics, to identify significant and insignificant factors that affect the revenues of local budgets - the resulting factor.

Open data does not imply any restrictions and / or commissions. Moreover, the mission of open data is to make governments accountable to their citizens. To analyze significant and insignificant revenues to the revenue side of the local budget of Mariupol (Fig. 1), a correlation matrix was obtained, presented in Fig.2. The generation of open budget data helps to identify additional reserves to increase the revenue side of local budgets and support the development of small and medium-sized businesses as businesses in the circular economy.
Figure 1. Dynamics of revenues to the local budget of Mariupol, 01.01.2018-01.06.2020, UAH.
Source: prepared by the authors from the data "Openbudget".

To implement the methods of predictive analytics used the formula for calculating the Pearson correlation coefficient:
\[ r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}} \]  

(1)

where: \( x_i \) - the value of the variable \( X \); \( y_i \) - the value of the variable \( Y \); \( \bar{x} \) - the arithmetic mean of the variable \( X \); \( \bar{y} \) - the arithmetic mean of the variable \( Y \).

In order to optimize the calculations, formula (1) takes the following form:

\[ r_{xy} = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{n \sum x^2 - (\sum x)^2}[n \sum y^2 - (\sum y)^2]} \]  

(2)

|   | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | X18 | X19 |
|---|----|----|----|----|----|----|----|----|----|------|------|------|------|------|------|------|------|------|------|
| 1 | 0.393 | 0.075 | 0.359 | 0.101 | -0.283 | 0.103 | -0.236 | 0.214 | 0.430 | 0.716 | 0.082 | -0.034 | 0.020 | 0.194 | 0.000 | -0.324 | 0.083 | 0.291 | 0.655 |

**Figure 2.** Matrix of correlation of tax revenues (X1-X19) and the revenue part (VD) of the local budget of Mariupol (01.01.2018-01.06.2020).

### 4. Results

Correlation matrix of input factors, namely tax and non-tax revenues (revenues) and all revenues of the city's local budget of Mariupol is shown in Fig. 2. Analysis of Fig. 2. and Table 1 shows that the development of SMEs, especially those involved in solving the problems of greening the city of Mariupol, does not occur. It informs that the provision of sustainable development of the economy is not being observed. There is insufficient funding for the development of SMEs, which can improve the environmental situation in Mariupol. The proposed methodology for monitoring monthly receipts to the local budget of Mariupol makes it possible to timely identify insignificant indicators of receipts and correct them in a timely manner. To do this, you can change tax rates within the framework of the law, or discard these receipts as ineffective. The monitoring methodology makes it possible to identify additional sources of financing for the activities of small and SMEs [17-19]. Analysis of the dataset can be performed by financial outsourcing companies. To increase the speed of selection of the rate of tax and non-tax revenues to the local budget, the authors have formed an algorithm that simulates the operation of the analytical system [20-22].

Thus, it is demonstrated that business models of financial outsourcing in financial management of economic entities as possible participants in the processes of ensuring the economy of sustainable development will: reduce the cost of financial management of entities; identify additional sources of funding for entities through the use of forecasting tools in the processing of data sets generated from open data by outsourcing, which allows timely adjustment of tax rates, fees and charges under the law to ensure closed value chains and continuity of the circular economy [22].
Table 1. Determination of the strength of connection and direction between the input fields and the output field - VD (Y) - total revenues in the local budget of Mariupol (01.01.2018-01.06.2020).

| Notation | Tax definition                                                                 | Link strength | Direction                        |
|----------|--------------------------------------------------------------------------------|---------------|----------------------------------|
| X1       | Personal income tax paid by tax agents on the income of a taxpayer in the form of wages | 0.393         | Average-Strength Direct Correlation |
| X2       | Tax on personal income from cash security, cash rewards                         | 0.075         | Direct, weak in strength correlation |
| X3       | Personal income tax paid by tax agents on the income of a taxpayer on excellent wages. | 0.359         | Average-Strength Direct Correlation |
| X4       | Personal income tax paid by individuals based on the results of the annual declaration. | 0.101         | Direct, weak in strength correlation |
| X5       | Tax on immovable property other than land paid by individuals                   | -0.283        | Inverse, weak correlation         |
| X6       | Tax on immovable property other than land, paid by individuals who are owners of non-residential property | -0.103        | Inverse, weak correlation         |
| X7       | Immovable property tax                                                          | -0.236        | Inverse, weak correlation         |
| X8       | Land tax from legal entities                                                    | 0.214         | Direct, weak correlation          |
| X9       | Rent from legal entities                                                        | 0.430         | Direct, strong correlation        |
| X10      | Land tax from individuals                                                       | -0.116        | Inverse, weak correlation         |
| X11      | Rent from individuals                                                           | 0.082         | Direct, very weak correlation     |
| X12      | Transport tax from individuals                                                  | -0.034        | Inverse, very weak correlation    |
| X13      | Transport tax from legal entities                                               | -0.020        | Inverse, very weak correlation    |
| X14      | Tourist tax paid by legal entities                                              | 0.194         | Direct, weak.                    |
| X15      | Tourist tax paid by individuals                                                 | 0.000         | Negligible                       |
| X16      | Single tax from legal entities                                                  | -0.324        | Inverse                          |
| X17      | Unified tax from individuals                                                    | 0.083         | Direct, very weak correlation     |
| X18      | Tax from agricultural producers in which the share of agricultural production for the previous tax (reporting) year is equal to or greater than 75 percent | -0.291        | Inverse                          |
| X19      | Official transfers                                                             | 0.655         | Strong correlation                |

5. Conclusions
Currently, the metallurgical industry is increasing production waste, which has been accumulating in the central part of Mariupol for many decades, which significantly worsens the city's environment. There is no involvement of business entities, including small and medium-sized businesses in waste recycling, due to lack of financial support for their activities.

Tax, non-tax revenues in the local budget of Mariupol are not rational, not optimized and can not be aimed at financing the activities of economic entities, possible participants in sustainable economic development. The paper shows that the use of the business model of financial outsourcing will: obtain an optimized and rational local budget, reduce the cost of financial management, which is necessary for the development of a sustainable economy, the economy.

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