Oleksandr Pushkar, Yevhen Hrabovskyi

Simon Kuznets Kharkiv National University of Economics,
department of computer systems and technologies

MODELING OF OUTSOURCING OF BUSINESS PROCESSES OF IT COMPANIES

The purpose and tasks of the research

The purpose of the work is to develop economic and mathematical models of outsourcing business processes of IT companies. This will make it possible to improve the decision-making support process by creating appropriate economic and mathematical tools.

To achieve the goal, the following tasks were solved:

– analyze and formalize the interaction of the IT company with partners;

– to develop a procedure for choosing strategic advantages, taking into account the wishes of its outsourcing partners;

– to carry out an experimental implementation of the proposed economic and mathematical models in the conditions of “Chameleon Soft” IT company.

Strategic priorities of the company

The strategic advantages of an IT company regarding business process outsourcing can be described in the form of a tuple:

$$P = \langle BF, OK, RZ, KS \rangle, \quad (1)$$

where BF is the number of business functions that are outsourced;

OK – the amount of the company's investment (in monetary terms) for compensation for participation in outsourcing;

RZ – the amount of available resources to support the main business processes;

KS is the number of jointly implemented business processes.

An optimization model for determining the amount of IT company investments

The IT company seeks to reduce its investments to cover the cost of its participation in the outsourcing network, which can be mathematically described in the form of an objective function:

$$\psi_{20} = \frac{OK}{\mathrm{RK}} + \frac{\mathrm{RZ}}{VZ} \to \min_{OK,\mathrm{RZ}}, \tag{2}$$

where VZ – the total cost of the logistics system of IT outsourcing.

The k-th outsourcer seeks to minimize the expression:

$$\psi_{2k} = \frac{\mathrm{RZ}}{\mathrm{BS}} \to \min_{\mathrm{RZ}}, \tag{3}$$

which reflects his desire to maximize the amount of his RZ reserve stock in a given proportion.

The efficiency criterion is:

$$\psi_2 = \frac{OK}{RK} + \frac{OZ}{\mathrm{VZ}} - \frac{RZ}{BS} \tag{4}$$

Limitations of the model are:

$$0 \le OK < BS, \tag{5}$$

$$0 \le OZ \le \sum_{r=1}^{R} OT_r. \tag{6}$$

The results of the experiment

Output data of the model

Data / Stand up environment	SZ_r, $		OT, $	ER, $	RK, $	VZ, $
	Segment 1	Segment 2				
CC_1	1200	1980	21000	61510	18540	1937,5
CC_2	1850	2100	15800	27540	9020	1500
CC_3	1600	2110	11530	55000	17140	1230

For the condition CC_1:
S_1 = <2100; 2617,5; 3290; 3>;
S_2 = <6611,9; 1145,8; 4123; 2>;
S_3 = <3145,6; 2664,5; 2700; 2>.
For the condition CC_2:
S_1 = <1810; 2181,2; 3219; 2>;
S_2 = <7140; 1984,3; 765,4; 5>;
S_3 = <4213,5; 1579; 1123; 4>.
For the condition CC_3:
S_1 = <1023; 2412; 1540; 4>;
S_2 = <1145,6; 2540; 1002,1; 3>;
S_3 = <1176,7; 2020; 982; 3>.

$$PM_1 = \begin{pmatrix} \overline{3887,6} & 3141 & 532,4 \\ 10579 & 4096,6 & 469 \\ 3383,7 & 4680,3 & 865,6 \end{pmatrix} \quad (7)$$

$$PM_2 = \begin{pmatrix} \overline{0,480} & 1,310 & 1,051 \\ 0,995 & 0,475 & 0,670 \\ 0,587 & 0,295 & 0,575 \end{pmatrix} \quad (8)$$

Program script of the result of the experiment

```python
from pulp import *

# Створення змінних рішення
projects = ['Project1', 'Project2', 'Project3']
resources = ['Resource1', 'Resource2', 'Resource3']

# Кількість доступних ресурсів
available_resources = {'Resource1': 100, 'Resource2': 150, 'Resource3': 200}

# Кількість ресурсів, потрібних для кожного проекту
resource_requirements = {'Project1': {'Resource1': 20, 'Resource2': 30, 'Resource3':
                         'Project2': {'Resource1': 15, 'Resource2': 25, 'Resource3':
                         'Project3': {'Resource1': 25, 'Resource2': 35, 'Resource3':

# Створення змінної для оптимізації
prob = LpProblem("ResourceAllocation", LpMinimize)

# Створення змінних рішення
project_vars = LpVariable.dicts("Project", projects, lowBound=0, cat='Integer')

# Додавання обмежень
for r in resources:
    prob += lpSum([resource_requirements[p][r] * project_vars[p] for p in projects])

# Додавання функції мінімізації (можна змінити на максимізацію прибутку)
prob += lpSum([project_vars[p] for p in projects])

# Вирішення задачі
prob.solve()

# Виведення результатів
for p in projects:
    print(f"{p}: {int(value(project_vars[p]))} units")

print(f"Total cost: ${value(prob.objective)}")
```

Conclusions

1. This paper analyzes and formalizes the IT company's interaction with partners. As a result, the goals and limitations of the process of commercial interaction of the IT company with outsourcers were determined.

2. The proposed procedure for choosing the strategic advantages of the IT company, taking into account the wishes of its outsourcing partners.

3. An experimental implementation of the proposed economic-mathematical models was carried out in the conditions of the IT company "Chameleon Soft" based on the use of the Python language and the PuLP library.

THANK YOU FOR ATTENTION