UDC 003.5+658.8

2. BIG DATA IMPLEMENTATION AND USAGE INDICATORS IN THE ORGANISATIONAL MARKETING

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Annotation. This paper explores the assessment of Big Data implementation in organisations through technical compliance and alignment with marketing goals. It details requirements for classifying projects as Big Data, evaluates economic efficiency using a defined model, and examines operational metrics related to internet marketing. The findings highlight the integral relationship between Big Data effectiveness and organisational performance, emphasising the importance of data-driven marketing practices.

Keywords. Big Data, economic efficiency, technical compliance, marketing alignment, CRISP-DM methodology, internet marketing metrics, data-driven marketing.

The proliferation of Big Data technologies has transformed the landscape of organisational decision-making and marketing strategies. Understanding how to effectively assess the implementation of Big Data within an organisation is crucial for maximising its potential benefits. This expanded examination delves deeper into the frameworks and methodologies for evaluating Big Data projects, emphasising the importance of aligning technical specifications with strategic marketing goals [1].

The use of Big Data in an organisation's activities can be assessed using two approaches:

1. Compliance of implemented Big Data technologies with specific technical characteristics, which include volume and speed of data processing, formats and the number of data sources used [2].
2. Alignment of Big Data with targeted marketing implementation indicators. Organisations have certain expectations regarding the final results of this technology's effectiveness when implementing Big Data, such as an increase in the number of clients, a reduction in customer acquisition costs, and similar outcomes.

In terms of technical characteristics, a project falls into the category of Big Data if it meets the following requirements:

1. Volume and collection speed requirements. The accumulated data volume exceeds 100 TB, or there is an annual data growth rate of 80% or more, or the data flow rate is 60 GB/s or higher.
2. Heterogeneity and speed of data streams requirements. In the project you must use two or more data formats/sources, or the project should involve processing a high-speed stream of events [3].

The economic efficiency can be assessed using the following model, which considers the economic effectiveness of an information system as a share of business profit per unit of costs. The model consists of the following stages:

1. Assessment of costs for the analytical system using the Total Cost of Ownership (TCO) methodology.
2. Assessment of profitability W (the value of the organisation's profit expressed as a monetary amount adjusted to a specific point in time) of the combination of business processes that utilise Big Data technologies over the specified period.
3. Calculation of the contribution d_i of each decision-making process to the profit.
4. Calculation of the contribution s_i of the studied system to each decision-making process ($\forall i: 0 \leq s_i < 1$).
5. Calculation of the actual economic efficiency indicator (Formula 1):

$$E = \sum_i s_i d_i \frac{W}{C}. \quad (1)$$

This model is based on the CRISP-DM methodology – an analytical model for implementing Big Data in an organisation's business processes, consisting of a six-phase cyclic process:

1. Business Understanding (identifying business goals and determining how Big Data can address them). In this initial phase, organisations focus on understanding their strategic objectives and how Big Data can enhance decision-making processes. This involves engaging key stakeholders to define specific business problems or opportunities that the organisation aims to address. Clear, measurable goals should be established, such as increasing sales, improving customer retention, or optimising operational efficiency.
2. Data Understanding (collecting initial data and identifying its quality and relevance). Once business objectives are clearly outlined, the next step is to gather relevant data from various sources. This can include internal data from databases, CRM systems, and ERP systems, as well as external sources like social media, market research, and third-party data providers.
3. Data Preparation (cleaning and organising data for analysis). Data preparation is a critical phase that involves transforming raw data into a format suitable for analysis. This process can be labour-intensive and requires careful attention to detail.
4. Modeling. In the modeling phase, data scientists and analysts choose the most suitable analytical techniques based on the business objectives and the nature of the data. Modeling is an iterative process; multiple models may be tested to identify the one that best meets the project's objectives. Hyperparameter tuning and cross-validation techniques are often employed to enhance model performance and avoid overfitting.
5. Evaluation (assessing the model's effectiveness and making necessary adjustments). This phase involves performance metrics, validation techniques and business evaluation. If the model does not meet performance expectations, adjustments may be necessary, such as refining the data preparation steps, selecting different modeling techniques, or incorporating additional data sources.
6. Deployment (implementing the model within business operations and monitoring its performance). Key activities include integration, monitoring, maintenance and updates. Effective deployment transforms analytical insights into actionable strategies, enabling organisations to leverage Big Data for informed decision-making and improved business outcomes. Continuous feedback loops between the deployment phase and earlier phases (especially evaluation) promote a culture of iterative improvement and adaptation.

Challenges in Big Data Implementation. Despite the potential benefits, organisations face numerous challenges in implementing Big Data technologies. Data privacy concerns, regulatory compliance, and the integration of legacy systems with new data architectures are significant hurdles. Organisations must also contend with the skills gap in data analytics, as the demand for qualified data scientists and analysts often exceeds supply. Moreover, the sheer volume of data can lead to information overload, making it difficult for teams to extract actionable insights without proper data governance frameworks in place [4].

To address these challenges, organisations should invest in training programs to upskill their workforce and foster a data-driven culture. Establishing clear data governance policies will help mitigate risks associated with data privacy and security. Furthermore, employing advanced analytics tools can streamline data processing and enhance the decision-making process.

To calculate the economic efficiency of Big Data, it is necessary to forecast key parameters (Table 1) of future project activities.

Table 1 – Variables used to assess the effectiveness of Big Data technology

Variable Name	Unit of Measurement	Description	Calculation Method
Years	years	Target payback period for investments	Are considered to be known input parameters of the problems.
ROE	%	Target return on equity	
CapEx	currency units	Initial investments in Big Data	
OpEx	currency units.	Annual expenses for Big Data	30% of CapEx
N	people	Number of analysts	Determined by the client
Salary	currency units	Annual cost per analyst	Market value
Tasks	projects	Number of projects per analyst per year	Market objective value
Success	%	Share of successful projects by analyst	
Value	currency units	Average economic result from a successful project	
BDValue	%	Contribution of Big Data technology to results	According to the EAIS methodology

Taking into account the above variables, the feasibility of the purchase is determined using the following Formula 2:

$$\begin{cases} E = \frac{BDValue*N*Value*Success*Tasks-N*Salary-OpEX}{CapEx} \geq ROE \\ Years * (BDValue * N * Value * Success * Tasks - N * Salary - OpEx) \geq CapEx \end{cases}. \tag{2}$$

To determine BDValue it is necessary to establish the values of contributions d_i и s_i according to the EAIS methodology. To determine d_i expert assessments of the relative importance of the previously discussed stages of the business process are used. To structure the expert assessments, it is optimal to construct a pairwise comparison matrix and, based on it, obtain a vector of the relative importance of the business processes.

For determining the values of s_i in the absence of statistical data, Formula 3 is applied, where P_i – represents the probability of an analyst making the correct decision without the use of Big Data.

$$s_i = \frac{1 - P_i}{2}, \tag{3}$$

where P_i – represents the probability of an analyst making the correct decision without the use of Big Data.

BDValue will then be calculated using Formula 4:

$$\sum s_i * d_i. \tag{4}$$

At the operational level, the effectiveness of using Big Data can be assessed using familiar metrics from internet marketing, such as CR (Conversion Rate) and BR (Bounce Rate) (Table 2). In general terms, it can be concluded that the implementation of Big Data is considered effective if the quality of customer-targeted actions has increased while their cost has decreased.

Table 2 – Metrics for evaluating the effectiveness of Big Data in internet marketing

Metric	Description
CR – Conversion Rate	The number of users who perform a target action on the website.
CTR – Click-Through Rate	The ratio of clicks to the number of impressions of an advertisement.
BR – Bounce Rate	The number of users leaving the site after viewing only one page without performing any target action.
CPC – Cost Per Click	The cost of one click on a link for display advertisements.
CPA – Cost Per Action	The ratio of the cost of display ads to the number of completed target actions.
CPL – Cost Per Lead	A variant of CPA, representing the cost of generating one lead.
CAC – Customer Acquisition Cost	Reflects the total expenses incurred by the organization to acquire a new customer.
AOV – Average Order Value	The ratio of the total value of all customer orders to the number of orders.

Future Trends in Big Data Utilisation Looking ahead, the landscape of Big Data is expected to evolve significantly. The integration of artificial intelligence (AI) and machine learning (ML) with Big Data analytics will allow organisations to automate insights generation and improve predictive modeling capabilities. This will enhance the ability to tailor marketing strategies to specific customer segments and optimise operations in real-time [5].

Moreover, the rise of edge computing will shift some data processing closer to the source of data generation, reducing latency and improving response times. Organisations will increasingly adopt hybrid cloud models to balance the benefits of on-premise and cloud-based data storage solutions. As data privacy regulations continue to tighten, businesses will need to prioritise compliance while leveraging Big Data technologies to maintain competitive advantages.

Thus, the effectiveness of implementing the Big Data concept is inextricably linked to the operational performance indicators of the organisation and its ultimate financial results. From the perspective of internet marketing, as noted earlier, Big Data mainly enables the personalisation of communications between the organisation and its end consumers. At the same time, the maximum benefit from using Big Data can only be achieved through the integration of data-driven marketing practices into the organisation's management processes.

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