Digital Models of Income and Expenditure Management and Accounting

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Abstract – The importance and significance of digitalization determined the research objective, which is focused on reproducing the distinctive model properties of digital income and expenditure management and accounting, including the specifics of their manifestation at the level of individual organizations. The convenience of studying the material is implemented through modelling based on the representation of income and expenditure management and accounting relying on the practice of particular organizations using models. The substantial description of the digitalized model structure allowed reproducing distinctive properties of digital income and expenditure management and accounting, including the specifics of their manifestation at the level of individual organizations. The corresponding digital model is identified as an analogue router of different information capacity, based on: an interconnected system of budgets and outputs of the main processes of the enterprise; interconnected systems of accounting, management accounts and management automation. The informational capacity of a digital model depends on how complex such relationships are.

Keywords – digital income, management, digital model, accounting.

1. Introduction

In modern conditions, the processes of converting information into digital form have created new

DOI: 10.18421/TEM92-22

<https://doi.org/10.18421/TEM92-22>

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Received: 20 Decembar 2019.

Revised: 14 April 2020.

Accepted: 20 April 2020.

Published: 27 May 2020.

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approaches to the use of digital resources in the management and accounting environments of the organization's business. To a greater extent, the transformations are caused by the processes of simplifying access to incoming data and the need to process large data volumes (in comparison with "standard" scenarios) in the work of financial services and in the accounting work of Accounts Departments [1]. In particular, the following items are changed:

- 1) forms of impact on the processes of the formation of economic benefits from the receipt of assets and (or) repayment of obligations. This is due to the evolution of heterogeneous architectures in a system that synthesizes an increase in the number of analytical processes;
- 2) the nature of interrelated activities or works. This is due to the use of large amounts of data about the objects of accounting and control, as well as methods for their processing and presentation in the form of an emanating spiral.

The topicality of the study is determined by the influence of the transformations described above, which created the prerequisites for the transition from a low-informative (closed) model of the organization's income and expenditures management and accounting to an open digital (digitalized) one. Open digital model:

- Uses analytical processes distributed across networks;
- Increases its information capacity to the level that identifies all possible measures to increase economic benefits to a sufficient extent.

The objective reasons that determined the need for research are directly related to a number of continuous phenomena that can be considered as the effects achieved by digitalization. For example, based on the practice of the Red Roof Inn hotel chain, the fast food chain Burger King, Cathay Pacific and other market leaders, "digitalization" allows doing the following in the income and expenditure accounting system:

- collect data from many available sources, clear them of errors;

- permanently visualize and forward commands imposing the specifics of managing the driving forces of profit growth.

A large number of specific conversions of information into digital form facilitate the management of factors determining the profit growth. Ford Motor Company, due to the ever-increasing losses of 2004-2008, switched to digitalization. In 2009, the company made a profit, since the new model, using descriptive and predictive modelling, ensured the stability and regularity of cash receipts from the principal activity. While in 2008 the Company's net loss reached \$14.77 billion, in the first half of 2010 the net profit amounted to \$ 4.7 billion (the value has been a record since 1998) [1].

It should be noted that, despite the existing interest in the study of the digitalized model, its structure often remains an intangible concept. This is quite problematic. It is the model structure that incorporates recognition, observation, genesis, maintaining the constancy of the laws and relationships of any modelled entities. The importance and significance of digitalization determined **the research objective**, which is focused on reproducing the distinctive model properties of digital income and expenditure management and accounting, including the specifics of their manifestation at the level of individual organizations.

The scientific value of the study is a meaningful description of the digitalized model structure, which is the basis of income and expenditure management and accounting. The criterion of scientific significance describes the value of the research results, which are manifested in a detailed analysis of all the structural elements of the digitalized model, providing an increase in the informational capacity of income and expenditure management and accounting.

2. Materials and Methods

Given the low level of scrutiny and development of the research topic, its theoretical basis was the scientific works which deal with:

- digitalization of the business [2], [3], [4];
- accounting in the field of income and expenditures [5], [6].

Considering that the issues of the research are covered indirectly in the above works, the author's vision of digitalization is based on the analysis of the practice - the experience of digital transformation of income and expenditure management and accounting of the world market leaders. Namely:

- Burger King Corporation (owner of a global fast food chain in 76 countries, with 90% operating under franchising);
- Red Roof Inn (owner of a global hotel chain in 242 countries);
- Cathay Pacific (a company that provides regular passenger and freight transportation to 109 destinations in 35 countries);
- Ford Motor Company (the fourth car manufacturer in the world in terms of output).

Fragment data from major automotive corporations General Motors (GM) and Toyota Motor Corporation were used in a number of comparisons.

The convenience of studying the material is provided through modelling based on the presentation of income and expenditure management and accounting (based on the practice of particular organizations), using models. Given the lack of relevant data regarding model structures that are fundamental to such models, the main emphasis is not on simulating their behaviour, but on structural modelling. The choice of methodology is due to the fact that the digitalized model is objectively characterized by only a few model elements of the phenomenon under consideration (architectural and algorithmic). Internal architectural or algorithmic elements of the income and expenditure management and accounting model can differ significantly (due to different user requirements). There will be other differences besides simple renaming of their constituent components.

3. Results

The model basis of digitalized income and expenditure management and accounting is considered as a structure containing a database integrated with the information system, as well as elements that require setting and scaling (Figure 1.), in accordance with: accounting and management needs; the scope (productivity), taking into account the characteristics of the formation of economic benefits of the organization.

The combination of setting and scaling mechanisms forms a digital model of income and expenditure management and accounting [7]. Digital models differ from non-digital ones by their information capacity. Namely, a comprehensive indicator of an increase in the number of analytical processes, scalability and simplification of data acquisition [8]. The main feature of the model framework is the rejection of the management and accounting database (DB), in their usual sense. Namely, as a single repository of structured data intended for subsequent processing [9]. Digitalization in the sphere of income and expenditure management and accounting gradually leads to the fact that the

database is integrated with the information system and accumulates sets of structured, semi-structured and unstructured data from disparate sources (remote monitoring devices, operation indicators, etc. [4], [10]). DBs at large enterprises can:

- be stored simultaneously in several cloud storages. So, in Cathay Pacific they are scattered between 20, in the Red Roof Inn - between 30, and in Ford Motor Company - between 55 systems [1];
- be connected by a variety of systems, including CRM (customer relationship management), ERP
- (production and operations integration management), EMM (mobile device

management), and WiS (remote monitoring of production lines). The production lines of the leaders of the world engineering market (Ford Motor Company, GM and Toyota) generate a huge volume of data on costs, which are available in the form of a log file [1];

- provide information processing using computers and their networks, operators, information support and software of management and accounting (i.e., integrated with the information system). For example, the database in the Ford Motor Company is combined with the Ford MoDe: Link information system, Toyota Motor Corporation - with the TPS information system, etc. [1].

Figure 1. The model framework of digitalized income and expenditure management and accounting (developed on the basis of [8])

¹ conversion of inputs to output processes, based on the settings.

² development of vertical and horizontal routes. It is necessary that the setting processes reflect the specifics of managing the factors that determine the growth of profits and provide information needs for accounting of income and expenditure. Scaling starts when there are networks, and leads to an increase in the performance of control and accounting systems.

³ computers, including their networks, operators, information and software for management and accounting.

Thus, the income and expenditure databases are transformed from the data repository into systems aimed at scalability and simplification of data acquisition (regardless of their type, format or style). The process of model generation is provided by many tools, which include [3]:

- 1) parallel parameter control algorithms: management partitioning/accounting partitioning of data; data sharding/resharding; replication of data for tracking and accounting;
- 2) data verticalization and horizontalization algorithms. They create the required number of route records that connect the system of management and accounting of income and expenditure and heterogeneous networks: analytical architectures (namely: class systems in

the space of accounting or managerial positions (accounts); hardware architectures (namely: systems of flow meters, indicators, equipment operation test sensors and other devices generating big data); information architectures (namely: directories, logs).

4. Discussions

Systemically presented results allow determining the digital model of income and expenditure management and accounting as an analogue router of different information capacities, which is based on: an interconnected system of budgets and outputs of the main processes of the enterprise; interconnected systems of accounting, management accounts and management automation. The informational power of

the digital model identified as good, medium and low, depends on how complex such relationships are (how well they reflect objects of accounting and management [11]).

Digital models of income and expenditure management and accounting require clarification of the object and subject of targeted impact. In this case, the object is understood as [12]:

- 1) any inflows of cash, tangible assets and a decrease in cash liabilities during a certain period;
- 2) any outflow of cash, assets, other property and/or the occurrence of an obligation leading to a decrease in the capital of the organization (excluding the reduction of contributions by decision of the owners of the property).

In this regard, it is advisable to configure the sphere to which the impact will be directed, namely, the regulation of its content, taking into account:

- 1) regulation of the parameters of the balance of receipts and expenditures, and their synchronization in time (using the system of restrictions in the budget system);
- 2) regulation of the compilation features of the digital model, due to the need for the correct translation of all constraint systems;
- 3) regulation of the digital model structure parameters in connection with the need to ensure the manageability of the sources of profit (loss) as a relatively independent types of activities.

Setting up a digital model, based on the characteristics of the balance of receipts and expenditures and their synchronization in time, aims at ensuring the financial balance of the organization on the basis of budget indicators. The distinguished balance characteristics are multi-aspect, therefore, they can negatively affect the performance and manageability of accounting and management databases. At the same time, digitalization (namely, the use of free object-relational database management systems that allow creating applications of any type [13]) creates the opportunity of dividing the balancing and synchronization processes into sets/sections, i.e. logical parts with triggers defined as functions that are triggered by data modification operations in databases. For example, an illustration of the corresponding setting of the Ford Motor Company's systems (Table 1.) reveals the use for this purpose of balancing by forms of solvency (in the transformed balance of income and expenditures) and synchronization, based on the possibilities of covering liabilities with its assets. At the same time, the practice of Burger King and Cathay Pacific distinguishes other partitions of income and expenditure and sections of related accounting processes according to conditional criteria of financial equilibrium, namely [1]:

- financial independence;
- effective use of borrowed funds;
- profit growth due to an increase in the production volume, etc.

Table 1. Setting up systems for balancing and synchronizing income and expenditures in time with a digital model of income and expenditure management and accounting of Ford Motor Company

Large tables for partition (table_master) / setting	Creating database partitions/sections*		Positive effect in working with databases	
	process characteristic	process start features (trigger)	productivity increase	manageability and extensibility
financial equilibrium at any point of time / programming mathematically formulated balancing systems	partitions formed on the basis of triggers, which include solvency forms for assets/liabilities (monetary and non-monetary form) sections of account data are formed on the basis of triggers: - for assets (monetary/non-monetary); - for liabilities (own/borrowed).	- triggers each time a record is inserted into table_master and creates a new partition, if necessary; - has a unique ID, which is indicated in the partition;	through: - splitting the detailed balance of income and expenditures into partitions; - binding of account data to the transaction solvency form	through: - the formation of requirements for resource allocation; - launch of triggers to check the added record for compliance with certain restrictions (for assets - with form and for liabilities - with content)
synchronization of income and expenditure of funds/programming of mathematically formulated synchronization systems	partitions formed on the basis of triggers, which include the forms of the future/current liquidity of the organization sections of account data are generated based on triggers to which liquidity forms are assigned	- given the multiplicity, they are performed in alphabetical order.	through: - splitting the budget of the balance sheet into partitions; - binding of account data to indicators of payment surplus/deficit	through: - requirements for resource distribution, the trigger system starts checking the added record for coverage of obligations with assets, the term for converting which into money corresponds to the period of repayment of obligations

* partitions/sections (or table_part ('_y', '_m', '_d')) are allocated based on specialized software. For Ford Motor Company, it's PostgreSQL, which splits tables for views based on unique nextval() triggers assigned to operations.

Source: compiled based on [1]

Given the multiplicity of goals for income and expenditure management, the formation of these elements cannot be standardized and requires great efforts, but it is justified in connection with the effects (where we attribute extensibility, increased productivity and database manageability).

Setting up the compilation features of the digital model is aimed at translating restrictions into an interconnected system of budgets that ensure a clear separation of its boundaries by budgeting objects (R&D programs are used for the cost of parameterizing specific outputs of the main processes, i.e., income-expenditures). So, based on the experience of market leaders, the translation process begins in the source language of a high level (formed by the features of balancing and synchronization). However, with the help of sharding it is translated into equivalent mathematically formulated systems for low-level objects,

distinguished by the structure of industries, areas of specialization or other activities [14]. With the full translation of all restriction systems, the database is divided into parts (service shards). Therefore, each object of budgeting receives: 1) a budget of income-expenditures; 2) a set of other budgets (including the cash flow budget and the budgeted balance sheet). For example, for Ford Motor Company, translation in a high-level source language is ensured by the distribution of data among low-level budget objects [1], determined by (Table 2.):

- type of production (in particular - mass, small-scale);
- the specifics of the model range (for manufactured models, these are operations of updating assembly units, components, equipment, etc. [15]);
- operational specialization of the divisions.

Table 2. Setting the compilation features of the digital model of income and expenditure management and accounting of Ford Motor Company *

Service shards for compilation			Features of the translation of constraint systems into the budget system	Translation points for the costs parameterization of the outputs of the main processes (or sharding key)	Positive effect in working with databases (Improving work productivity)
PT	OSD	MR			
for the individual order (small-scale production)	not provided		PT shard - separately for each order or batch (in budget forms for work in progress and production income, expenditures, cash flow and balance sheet). OSD shard - for production income and expenditures	PT – income and expenditures for the execution of an order/batch, for: work in progress (before transformation into finished products); for production; by stages of changes in net inflow/outflow; OSD – income and expenditures by carriers of operational work (technological lines, automatic lines, etc.)	from connecting the inputs of processes and operations based on the same value of the sharding key: - by types of production and passive objects that make up material flows and objects that implement the function of processing requests (prescribed in a set of other budgets);
mass production by model range	type of work	calculation object	PT shard - in accordance with the technological conditions of increasing production costs and sales revenue; OSD shard - on production costs and areas of work Shard MR - by objects of normative calculation	PT - technological conditions for increasing production costs, which are localized by the system; income and expenditures by the carriers of operational work; OSD – income and expenditures from the operational activities of the divisions in a mosaic representation of those operations; MR - mosaic analytics by the nature of the model range or the calculation purposes.	- by the specifics of the organization of the process of receipt of transfer batches to the warehouse, by the features of shipment of finished products; - by carriers of operational work; - by the stages of the budget process; - by the calculation object.

* the development of sharding protocols is implemented on the basis of the R&D program in the context of shards: PT – production type; OSD - operational specialization of the divisions; MR – model range.
Source: developed based on [1]

In the Red Roof Inn hotel chain, such low-level objects include: class and specialization of the accommodation inventory, operational specialization of divisions for managing the accommodation inventory [1]. For the Burger King fast food chain, standard methods of licensing franchisees (that is, objects are distinguished depending on the licensing methods) and local franchisors (as objects of selling sub-licenses on behalf of the company) and Burger King establishments are identified as service shards [1]. At the same time, setting up the compilation features of the digital model of income and expenditure management and accounting helps to increase productivity (by connecting the inputs of all processes and operations).

Separated low-level data is correctly “collected” to a high level (based on the same value of the sharding key), however, one request provides obtaining data from different shards by setting: 1) the specifics of predicting the characteristics of fluctuations in income and expenditure from making any changes to the production system; 2) areas of optimization of related operational budget indicators, thereby increasing the financial balance of the organization.

Setting the structural features of the digital model is applied when the organization simultaneously conducts several types of activities, considered as relatively independent sources of profit (master shards differing in final results) and auxiliary types of activity (slave shards). In this case: 1) master shards are aimed at creating an independent copy (repetition) of the basic system of budgets and outputs of the main processes of the enterprise based on distributed balance data [16]; 2) slave shards are aimed at a special area for outputs of the main processes that are assigned to master databases. At the same time, the Multi-master replication process is carried out taking into account the individual characteristics of income and expenditure management and accounting. Namely, the synchronous or asynchronous transfer of the processes of balancing, synchronizing and translating all systems of constraints into an interconnected system of budgets that allow them to be simultaneously changed, referring not to one mathematically formulated system of interdependent income-expenditure budgets, but to any copy of it (i.e. replication library). In particular, LAN Airlines, Avianca, Ryanair, Cathay Pacific, as structural features of a digital model, distinguish such master shards as [1]: passenger and freight transportation; route networks by region of activity, etc. For example, for Cathay Pacific master shards are

structured according to the main regions of activity, which are: Hong Kong and mainland China, America, Japan, Korea, Taiwan, Europe [1]. For auxiliary activities, slave shards are distinguished, in particular, code-sharing administration (this is the work of expanding and optimizing code-sharing agreements with the alliance companies), service on board, etc. [1]. Leaders of the engineering market (Ford Motor Company, GM and Toyota) determine master shards not only by product specialization of the final assembly of complex technical objects (or the creation of various machines described by a set of values of different types) [1]. The fact is that there are options when: 1) the manufacturing plant only assembles technical objects; 2) other types of activities are considered by the manufacturing plant as auxiliary, and by the producer - as the main ones (in terms of creation activities). Even the components of one part, such as a headlamp, can be produced by different plants, and assembled together by the manufacturing plant. Thus, slave shards are diverse here, since they can include the creation of devices for the production of technical objects and equipment for technical devices, as well as the production of technical devices, equipment under a contract and terms of reference. In fact, setting of structural features is aimed at:

- ensuring the manageability of such activities, based on system replication;
- the correct operation of the databases, in cases where the replication code is used. For example, GM management uses multiple copies of the same system of budgets and outputs of the main processes in different master shards. The process of tracking the income and expenditures of each replication is based on operating with the signs of a regular field of the Counter type [17]. Naturally, there is a problem of having multiple sources of income and expenditures with the same ID, but in different replications. In fact, management cannot combine replication data into a common database for further analysis [18]. Cathay Pacific uses a replication code (represented by a line of numbers and letters that guarantee uniqueness of values [18]) for this purpose, and a value of the Counter type is used only for accounting of income and expenditures.

Based on the characteristics of setting the model basis (the basis, compilation and structuring), a mechanism is formed that ensures that the work is oriented towards the needs of income and expenditure management and accounting. On the example of Ford Motor Company, an illustration of a fragment of the mechanism is presented in Table 3.

Table 3. A fragment of a mechanism that ensures orientation of work to the needs of income and expenditure management and accounting (for example, Ford Motor Company), USD

Balance элементов	Regulation of parameters for balancing income and expenditures and synchronizing them in time by the stages of changes in net inflow/outflow (predefined process)					Condition of financial equilibrium	Adjustment of the shard compilation parameters			Setting the structural features of master shards					
	I_{nmf}	I_{mf}	EQ	internal debt - BC	attraction of borrowed capital—BC		MSO/	FP ****	MP	balancing and synchronization	Master shard				
	Assets		Liabilities												
1	NPnmf=69,826.7	NPmf=1,896,674,7	DImf=1,428,973,2	DInmf-30,573,7	X	NPmf=1,343,081	MT - \$160,817.1;	ΔFP	Ford Transit	$DI_{mf}=EQ_{mf}(0)+\Delta DImf > 0$ $EQ > Imf$ $BC > 0$, $Imf + EQ > Inv$	Ford, Otoas				
	$\Delta BC_{nmf}=39,253$	$\Delta BC_{mf}=0$	X	X	BC=39,253	$\Delta BC_{mf}=0$									
2	IPnmf=39,253.02	IPmf=467701.45	X	IP=506,954.47	X	IPmf=467,701.45	M*** - 11,912.49; F/P*** – 29,781.22; W*** – 11,912.49; P/FA *** - 35,737.47; AP*** - 29,781.22, MT – 160,817.13	WP (taking into account internal prices \$1,191.25/product):							
	- PInmf=0	PImf=467,701.45	X	BCnmf=39,253.02	X	X									
3	$-\Delta W_{ea}=734,411.9$	X	$-\Delta W_{ea}=734,411.9$	X	X	X									
	$\Delta I_{nmf}=463,906.68$	$\Delta Imf=694,561.24$	$\Delta EQ=725,134.94$	$\Delta EQ_{nmf}=367,479.81$	$\Delta EQ=0$	$\Delta DK=300,481.28$									
	the amount of assets and liabilities in monetary and non-monetary forms reflected in the budget on the balance sheet, Δ is the operand identifier of the movement of assets and liabilities					monetary capital MC									

*(1) FR generated - generated financial resources or net inflow, which form own financial resources in combination with borrowed capital. NP – net profit generated by using production facilities (positive values); (2) FR distr - own financial resource, which is divided into disposable income/loss (DI or DL) and accrued income payable (IP). IP paid in the reporting period is transformed into paid income PI; (3) FRused – capital of the enterprise. Its part is sent to repay ΔBC , and its part remains as equity (EQ) and borrowed capital (BC) in monetary (mf) and non-monetary forms (nmf). Namely it is: wear growth ($\Delta Wear$); equity growth (ΔEQ) and borrowed capital growth ($\Delta EQ / \Delta BC$);

** service shards: MT – material and technical; M – metal structures; F/P – forging and pressing; W – welding; P/FA – painting and final assembly; AP assembly production.

*** in the intermediate consumption (connector): up to 0.036% of the cost of production of all products

****for work in progress (WP) before transformation into finished products; for the production of finished products (FP)

Source: compiled based on [1]

This happens on the basis of: 1) an increase in the number of analytical processes, since the management of many budgeting objects is implemented not as a management of a separate activity, but as a set of big data; 2) the orientation of the results of planning and development of income-expenditure budgets to translated mathematically formulated systems of balancing and synchronization and their replication.

Settings of the model basis ensure the operability of the digital model, based on determining the optimal network paths for their transmission to users in disparate databases. This process is quite specific due to the peculiarities of implementation. So, the result of routing is the recording of all routes in the routing table that determines all the possible networks and tools with which the setting package can be delivered to the recipient [19]. The following are distinguished among the routing tools:

- **verticalization** of the settings package, prescribing routes for increasing the information capacity of databases in the systems of income and expenditure management and accounting [20], by such information objects as:

1) reference databases (classic and detailed [17]), characterizing the objects of budgeting, dependent analytical sections for them. For example, the model base of Toyota Motor Corporation is focused on the classic version of directories. There are 4 reference structures in the system: organizational-staffing and financial structure (unlimited levels of verticals); currencies (in terms of dependent analytical views by exchange rates); products (in terms of dependent analytical views, natural accounting - cash accounting); consumers and suppliers (in terms of dependent analytical views by customers). The reference databases of Ford Motor Company and Cathay Pacific are focused on concretizing any information about objects of budgeting of income-expenditures and analytical data views for them [1]. For example, the Ford Motor Company system has over 100 reference structures. The base product is the output to which the structures are attached: movement, storage, responsible officer, part, product range, etc. [1];

2) the base of transactions, based on the establishment of a local format for each operation, taking into account the implementation of the management cycles and coordination in the income-expenditure format. Ford Motor Company, Burger King and other market leaders use the format for the implementation of order and processes management cycles, and coordination of operations based on the characteristics of the produced changes in income and expenditures (balance sheet and operating spheres) [1];

3) the simplest, self-describing or detailing bases of sources of income and expenditures [10]. For example, the Ford Motor Company uses a self-describing database of income and expenditures in

accounting and management, in the context of shards, based on schematic data from numerous: measuring instruments of electricity, water, gas, heat and other measuring instruments (including converters and complex installations); indicators and digital sensors for testing equipment operation; microcontrollers and wireless on-chip systems for load regulation. Cathay Pacific uses in this area the destructive structures of expenses and revenues that contain markers for separating the complex of operations on multi-level shards based on semi-structured data from remote controllers of measuring equipment [1]. Toyota uses the simplest databases in accounting and management, since each object is described by the same set of properties or characteristics identified by shards by masters Toyota, Lexus, Scion, Daihatsu, Hino [1].

For example, Ford Motor Company uses a self-describing database of income and expenditures in accounting and management in the context of shards, based on non-schema data from numerous measuring devices of electricity, water, gas, heat and other measuring devices (including converters and complex installations); indicators and digital sensors for testing equipment operation; microcontrollers and wireless on-chip systems for load regulation. Cathay Pacific uses in this area the detailing structures of income and expenses that contain markers for separating the complex of operations on multi-level shards based on semi-structured data from remote controllers of measuring equipment [1]. Toyota uses the simplest databases in accounting and management, since each object is described by the same set of properties or characteristics identified by master shards Toyota, Lexus, Scion, Daihatsu, Hino [1].

The analysis of the experience of virtualization of the settings package (Table 4.) allows stating that it forms data verticals of any complexity, reaching the required level of performance for each vertical component [2].

Table 4. The results of the analysis of the experience of verticalization of the settings package in income and expenditure management and accounting of market leaders

Scope of verticalization of the settings package	The feature of scaling the settings package to the expanded vertical			
	limiting performance to low or very low (for example, Toyota)	limiting performance to medium (for example, Cathay Pacific)	not limiting performance (for example, Ford Motor Company)	
income and expenditure budgets and related budgets (by item)	the simplest income-expenditure databases for master shards Toyota, Lexus, Scion, Daihatsu, Hino, classic reference	directories united by multilevel shards (structured) and contain detailing structures on	distinguishing feature work in parallel with structured and poorly structured data in very large volumes	illustration of routes for increasing information capacity databases of sources of income and expenditure: 1) databases of sources of expenditures accumulating data on the consumption of car paints, varnishes, primers, hydraulic oils, fuels and lubricants and liquid fuels *; 2) databases of sources of income

Primary information for calculating planned and actual values of income and expenditures -expenses	databases and their corresponding generalized transactions	them *		accumulating data on products (output sensors of the final assembly lines, sensors of position of finished products, sensors of process completion).
	budgets, requests, estimates, contracts, payment documents	budgets, requests, estimates, payment and other documents, and objects supporting financial logic*	budgets, requests, estimates, payment and other documents, hardware and software that generate large data volumes	basic reference structures: intermediate products (movement, storage location, responsible officer, parts, product range). Data can be displayed on completing lines, metal structures lines, blank and stamping lines, etc. database of transactions by blocks, by setting the format of the operation taking into account the implementation of order management cycles **

* include measuring devices and other measuring instruments; indicators and digital sensors for testing equipment operation; microcontrollers and on-chip wireless systems for load regulation.

** taking into account the implementation of order management cycles, based on the structures: "Payment – production – shipping" (prepayment mechanism); "Production – shipping – payment" (post-payment mechanism); "Shipment – production – payment" (for long-term contracts) and agreement of income-expenditures

Source: compiled based on [1]

- **horizontalization** of the settings package, prescribing routes for increasing the information capacity of databases in the network of income and expenditure management and accounting, namely by lines of information objects, such as: service shards (hereinafter referred to as "SS"), master shards, slave shards. For example, according to master shard of Ford Transit, Ford Motor Company (Otosan factory in Kocaeli, Turkey), systematized lists of objects for budgeting income and expenditures are scaled by service shards, including [1]: material and technical warehouse; metalwork shop Transit; thermal forging and pressing section; welding shop; painting and final assembly shop; assembly shop. At the same time, to horizontalize the settings package by the master shard, the Ford Transit wizard creates a network identifier based on (Table 5.):
 - determination of the address source of income and expenditures (which are completing lines, metalwork lines, blank and stamping lines, body line, etc.);
 - determination of the address process owner(s) (who are responsible for the entire horizontal process);
 - network parameters for posting values for accounting items and budget items (based on the income-expenditure grouping);
 - named lists of objects that describe the correspondence between the address source and the network parameter.

Table 5. The results of the analysis of the experience of horizontalization of income and expenditure management and the accounting settings package of the master shard Ford Transit, Ford Motor Company (Otosan factory in Kocaeli, Turkey)

Horizontalization sphere of the settings package (network)	Network identifier		targeted source of income and expenditures	address process owner
material and technical warehouse	named lists of objects that provide matching of address source-network parameters	network parameters for posting values to income-expenditures accounts and budget items	Completing lines	Planning Division, Accounting Division
Transit metal workshop	basic section - completing inventory items	Completing inventory items uses grouping of income and expenditures by completing lines The network includes 34 completing lines	Metalwork lines	Planning Division, Accounting Division
forging and	The basic section - "Frame" and "Body" blanks. Subsection - metal is marked, cut out at the exit of the workpiece	Products "Frame" and "Body" Transit. Refers to the value from the moment of acceptance of inventory items (metal). The network includes 7 lines, with 18 presses (served by 18 operators)	Blank and	Planning

pressing division	blanks and stamping. Subsections: blanks - bent frames, axles (stamping), body elements (stamping)	elements (up to 400 different body elements) It refers to the value from the time of delivery of the galvanized steel strip (income-expenditure grouping is applied along 32 blank and stamping lines, which are served by 32 operators)	stamping lines	Division, Accounting Division
welding shop	The basic section - finished body frame. Subsections (depending on model and body type): welding of parts of the bottom; welding of side panels and roof; welding of doors, hood and fenders and their hanging on the finished body frame	Bodywork welding It assigns to the value from the moment of delivery of parts from the thermal forging and pressing division until the moment of delivery to the conveyor via suspended lines. income-expenditure groupings on the body line and conveyor on suspended lines are applied.	Body line	Planning Division, Accounting Division
painting and final assembly shop	Basic section - painting the finished body frame Subsections: preparation for body painting (the body is covered with protective layers); body and bumper painting	Painting the finished body frame (14 colours) Posting is carried out from the moment of acceptance of the finished body to the moment of transfer to the assembly (income-expenditure groupings are applied for the lines of phosphating and electrolysis coating of the body, body painting sealing line).	Phosphating, electrolysis coating of bodies, painting sealing lines	Planning Division, Accounting Division
assembly shop	Basic section - final assembly Subsections - power units, chassis, windows, doors and interior elements.	For the assembly line where the body receives the missing elements, posting is carried out from the moment of acceptance of the painted finished body frame until the product is dispatched to the finished product parking lot. The network includes 14 final assembly lines (served by 28 operators).	Final assemble lines	Planning Division, Accounting Division

Source: compiled based on [1]

In fact, horizontalization of the settings package allows topologizing the parameters of the network of income-expenditures accounts and budgets and determining the rules for their posting.

As a result of combining the settings and scaling of data on income and expenditures, digital model zones are formed, which, based on the characteristics of generating signals about objects of income and expenditure management and accounting, differ in terms of information capacity. Ideally, the elements of the model framework are connected with remote data collection systems, and selected for accounting and management.

5. Conclusions

A substantial description of the digitalized model structure (the basis of income and expenditure management and accounting) allowed stating that it is specific in terms of:

- 1) an increase in the number of analytical processes. This feature is due to the needs in terms of information capacity, which increases with:

- search and exchange of information on income and expenditures;
 - orientation to the means of identifying objects in the system of income and expenditure budgets and other budgets (including the cash flow budget and the balance sheet budget);
 - systematization of accounting positions, income-expenditure budgets and other budgets (including cash flow budget and balance sheet budget);
 - coordination of objects of budgeting;
- 2) focus on adaptable databases of income and expenditures aimed at scalability and simplification of obtaining data regardless of their type, format or style;
 - 3) focus on many tools, which include algorithms for adjusting parameters, data verticalization and horizontalization.

The substantial description of the digitalized model structure allowed reproducing the distinctive features of digital income and expenditure management and accounting, including the specifics of their manifestation at the level of individual organizations.

The digital model of income and expenditure management and accounting is identified as an analogue router of different information capacity, based on: an interconnected system of budgets and outputs of the main processes of the enterprise; interconnected systems of accounting, management accounts and management automation. The informational capacity of a digital model depends on how complex the relationships are.

The directions of further research of the digital model of income and expenditure management and accounting of the economic entity are the following:

- 1) building a system of relational monitoring of income and expenditures, based on a freely distributed framework of relations;
- 2) improving the mechanisms for summarizing information about the quality zones of the model.

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