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# FUNCTIONALLY LOGISTIC MODEL OF COMMERCIAL CONTENT PROCESSING



**In the given article is functional logistic model of commercial content processing as the content life cycle stage in electronic commerce systems proposed. The model of commercial content processing describes the information resources forming in electronic content commerce systems and automation technology simplifies the commercial content management. In the given article the main problems of electronic content commerce and functional services of commercial content processing are analyzed. The proposed model gives an opportunity to create an instrument of information resources processing in electronic commerce systems and to implement the subsystem of commercial content formation, management and support.**

**Key words: information resources, commercial content, content analysis, content monitoring, content search, electronic content commerce systems.**

**Запропоновано функціонально-логістичну модель опрацювання комерційного контенту як етап життєвого циклу контенту в системах електронної комерції. Модель опрацювання комерційного контенту описує процеси формування інформаційних ресурсів у системах електронної контент-комерції та спрощує технологію управління комерційним контентом. Проаналізовано основні проблеми електронної контент-комерції та функціональних сервісів опрацювання комерційного контенту. Запропонована модель дає можливість створити засоби опрацювання інформаційних ресурсів у системах електронної контент-комерції та реалізувати підсистеми формування, управління та супроводу комерційного контенту.**

**Ключові слова: інформаційний ресурс, комерційний контент, контент-аналіз, контент-моніторинг, контентний пошук, система електронної контент-комерції.**

## Introduction and the general problem formulation

Specialists in designing, implementation and deployment of electronic content commerce systems (ECCS) deals with the information resources processing at various levels. They contribute to the goal to increase sales volumes of content a regular user, the active involvement of potential users and the boundaries expansion of the target audience [1, 2, 5]. The special feature of ECCS is as follows [1-8, 10, 12]: open – access for all companies and users; global – access from anywhere in the world; unlimited in time – available at any time of the day/week/year; frankness – a low barrier to market entry; direct interaction with the user – reducing the channels of distribution and elimination of intermediaries production; information products and information services testing and implementation; automatic processing requests; automatically track information about users; reducing costs for the business operation; providing more information online.

## The problem of the relationship with important scientific and practical tasks

Urgency of ECCS implementation due to business globalization; increasing needs of content and quick access to the content for the successful conduct of e-business; uneven operation of business processes according to regions (countries, regions, etc.); the need to promptly, regularly and periodically receive the necessary content; time-saving to obtain the desired content; personalization in service in the

ECCS; with integration ECCS [2]. Advantages of ECCS implementation are to increase the efficiency of content obtaining; reducing the cycle of production and sales; reducing costs associated with the information exchange; openness about users; automatically informing users about the content; creation of alternative sales channels such as the newspapers or online logs in Internet [2, 5, 10].

**Recent research and publications analysis**

The initial information in process operation of ECCS is evidence of appointment and conditions of the system. They define the main purpose simulation ECCS. They also make it possible to formulate the requirements for systems $S$ and content processing subsystems. [2] Model ECCS is $S = \langle X, C, V, H, Function, T, Y \rangle$, which $X = \{x_1, x_2 \ldots, x_{n_X}\}$ – entrance effects on the system; $Q = \{q_1, q_2 \ldots, q_{n_Q}\}$ – the users impact on the system; $C = \{c_1, c_2 \ldots, c_{n_C}\}$ – the content impact on the system; $V = \{v_1, v_2 \ldots, v_{n_V}\}$ – the external environment; $H = \{h_1, h_2 \ldots, h_{n_H}\}$ – the internal parameters of the system; $Z = \{z_1, z_2 \ldots, z_{n_Z}\}$ –information resources components of system; $T = \{t_1, t_2 \ldots, t_{n_T}\}$ – time transaction of the content processing; $Y = \{y_1, y_2 \ldots y_{n_Y}\}$ – output characteristics of the system [11]. The quantities $x_i$, $c_r$, $v_l$, $h_k$, $y_j$ are the elements of disjoint subsets. They contain deterministic and stochastic components [11]. The process of ECCS $S$ operation described by the function $y_j(t_i + \Delta t) = Function(x_i, c_r, v_l, h_k, t_i)$ [2, 11], where $x_i$ – the requests for information of visitors/users to ECCS. According to Google Analytics from [5] $y_j$ – the number of visits per time period $\Delta t$; the average time on site (min: c); rate of failures (%); achieved goal; dynamics (%); the number of all browsing; the number of page views for each visit; new visits (%); absolute unique visitors; traffic sources in % (search engines, direct traffic or other sites). Effects of values $c_r$, $v_l$, $h_k$ on $y_j$ to ECCS is unknown and unexplored [2].

**Problems selection**

The ECCS model does not reveal the mechanisms of content processing. [2] Formal models of content management assignment for determining the aging (relevance) process of content stream. Some of them (logistics, analytical) are also intended to the thematic flow analyze [2-4, 6-8]. They do not solve the problem of the content formation and maintenance. They also solve the problem of not all content management, such as content submission plurality of end user according to his request, history or information portfolio; thematic content identification; automatic generation of digests and information portraits; content relationship tables building; content ratings calculation; information gathering from various sources and formatting; keywords/concepts identification; content duplicates finding; content categorization; selective dissemination of content [1-8, 10, 12]. Disadvantage of content management models is a connections lack between input data, content and output data in the ECCS [2].

**Goals formulation**

The purpose of the paper is the functionally logistic model creation of commercial content processing of the information resources formation in e-business systems. The work relevance is the need to operational/objective assessment obtain of competition in the financial market segment of commercial content and evaluate the financial market competitiveness of the content distribution. In the paper we will examine the stages of information resources processing and develop an optimal life cycle for content processing. Implementing of functionally logistic model of commercial content processing enables a means of information resources formation in e-business systems.

**Research results analysis**

The main subsystems of information resources processing in ECCS are the content formation, management and support, the circuit connections which is as follows [2]:

$$content\ formation \rightarrow content\ management \rightarrow content\ support.$$

Model of electronic content commerce systems presented as

$$S = \langle X, Q, Formation, H, C, V, Management, Support, Z, T, Y \rangle, \quad (1)$$

where the value $X = \{x_1, x_2 \ldots, x_{n_X}\}$ – set of input data $x_i \in X$ from different sources at $i = \overline{1, n_X}$; the value $Q = \{q_1, q_2 \ldots, q_{n_Q}\}$ – set of user queries $q_d \in Q$ while $d = \overline{1, n_Q}$; the value $Formation$ – the operator of content formation; the value $H = \{h_1, h_2 \ldots, h_{n_Y}\}$ – set of internal parameters $h_k \in H$ of the system $S$ when $k = \overline{1, n_H}$; the value $C = \{c_1, c_2 \ldots, c_{n_C}\}$ – set of commercial content $c_r \in C$ at $r = \overline{1, n_C}$; the value $V = \{v_1, v_2 \ldots, v_{n_V}\}$ – set of the influence parameters $v_l \in V$ of the environment on the system $S$ at $l = \overline{1, n_V}$; the value $Management$ – the operator of content management; the value $Support$ – operator of commercial content support; value $Z = \{z_1, z_2 \ldots, z_{n_Z}\}$ – set of information resource pages $z_w \in Z$ of in the system $S$ at $w = \overline{1, n_Z}$; the value $T = \{t_1, t_2 \ldots, t_{n_T}\}$ – time $t_p \in T$ transaction of information resource processing in the system $S$ when $p = \overline{1, n_T}$; the value $Y = \{y_1, y_2 \ldots y_{n_Y}\}$ – set of statistical data $y_j \in Y$ in system $S$ at $j = \overline{1, n_Y}$.

ECCS operation described such relationships schemes of its main components (Fig. 1) [2]:

1) to information resource formation of system scheme is such: *data* $\rightarrow$ *cont ent formation* $\rightarrow$ *content database* $\rightarrow$ *management content* $\rightarrow$ *information resource of systems*;

2) for the answer formation to a user's query schema is such *the user query* $\rightarrow$ *content management* $\rightarrow$ *information resource* $\rightarrow$ *content support* $\rightarrow$ *database users*;

3) to a report create of the system operation to moderator scheme is such: *moderator requested* $\rightarrow$ *content support* $\rightarrow$ *user database* $\rightarrow$ *content management* $\rightarrow$ *report*;

4) for the internal parameters moderating of the system scheme is such *requested* $\rightarrow$ *c ontent formation* $\rightarrow$ *base* rules $\rightarrow$ support content $\rightarrow$ base rules $\rightarrow$ content management $\rightarrow$ result.

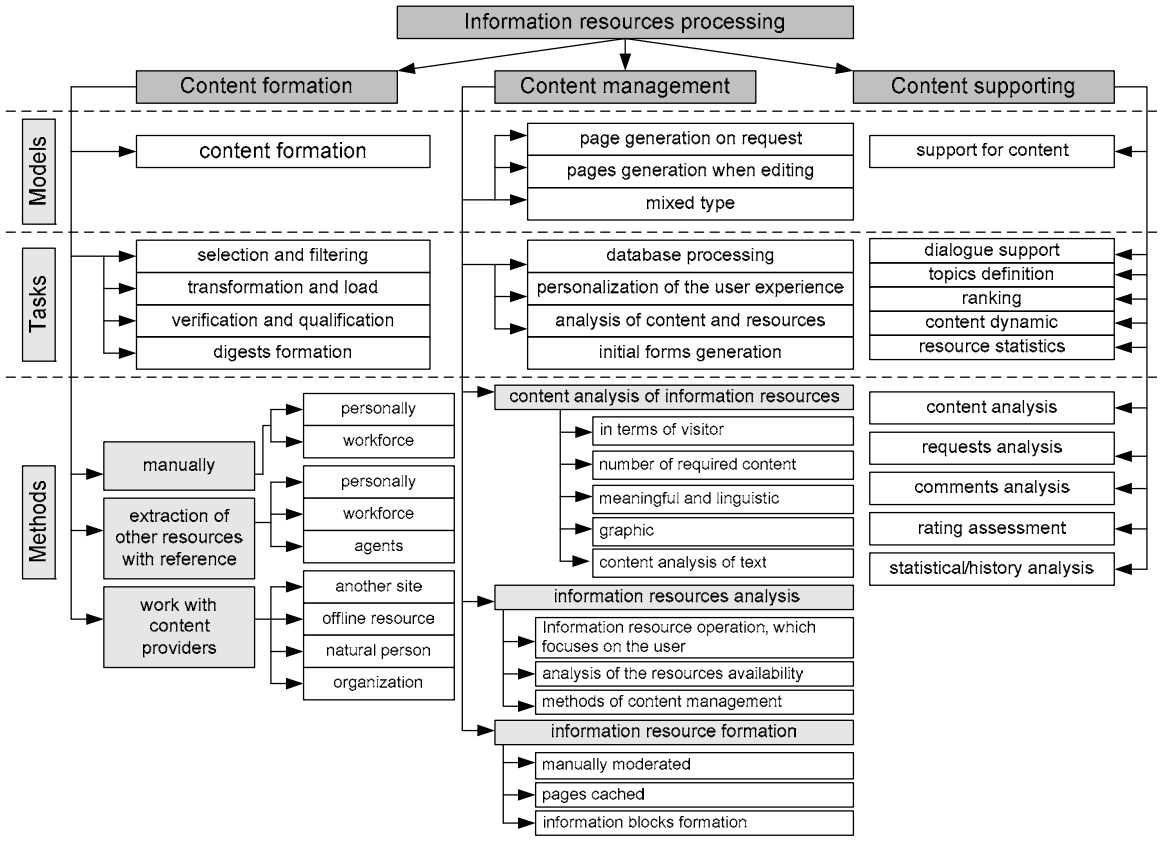
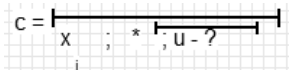



*Fig. 1. Features of information resources processing in electronic content commerce systems*

The content formation described by the operator form $c_r = Formation(u_f, x_i, t_p)$, where $u_f$ – conditions set for the content formation, ie $u_f = \{u_1(x_i), \ldots, u_{n_U}(x_i)\}$. Content is presented as follows:

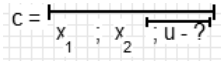
$$c_r = \left\{ \bigcup_f u_f \middle| (x_i \in X) \wedge (\exists u_f \in U), U = U_{x_i} \vee U_{\overline{x_i}}, i = \overline{1,m}, f = \overline{1,n} \right\}, \quad (2)$$

so, the operation performed elimination of therm $x_i$ and empty therm $*$ selection accordance to execute the specified conditions $u$ [9]:



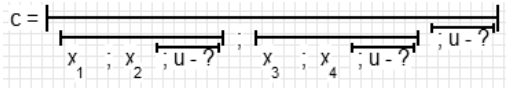

(3)

Then the elimination operation [9] of therm choice between $x_1$ and $x_2$ presented as

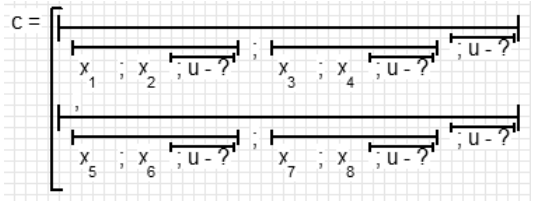



(5)

The elimination operation [9] with the increase of the input data $x_i$ from different sources is as equation (6). Content $c_r$ is formed by elimination in (7) from different data sources according to the specified performance conditions $u$ [9]. That is apply filter rules in (7) to select of relevant content from multiple of found content from relevant sources or created by moderators in ECCS.

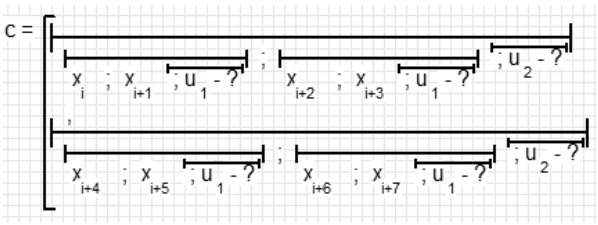



(6)

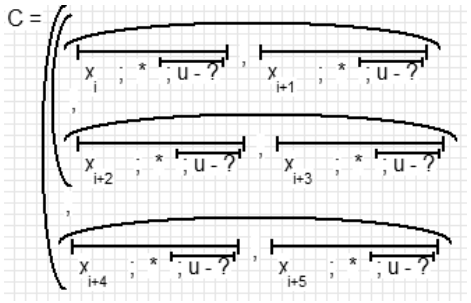



(7)

In this case there is the possibility of empty content $c_r$. It is therefore necessary to introduce refined set of elimination conditions $u_f$ [9]. It is also necessary to perform this operation in parallel with (8) for different input data. Sequencing operation (9) regulates the content $c_r$ formation.

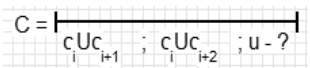



(8)

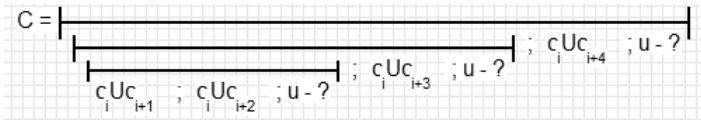



(9)

Elimination operation (10) contributes to a set formation of content $C$. Aggregate apply of elimination operations to multiple select of content $C$ promotes a set formation of relevant content. That are apply filter rules to the content set and not relevant content clipping in (11).

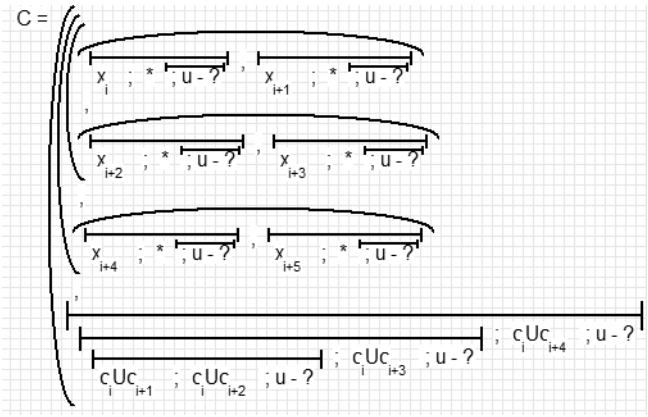



(10)

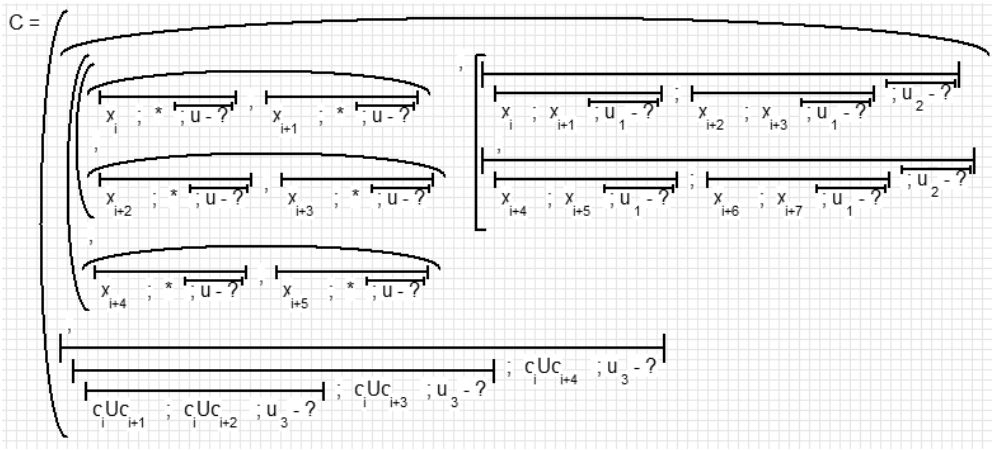



(11)

Equation (12) reveals the multiple collecting process of content $C$ from different sources of data. Here take into account the filter rules to identify not relevant content and content that does not comply with the requirements for the commercial content formation in the ECCS. Equation (12) finds no $c_r$ content duplicate that is found from different sources of data. This deficiency is taken into account in the equation (13).

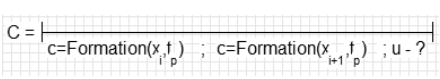


(12)

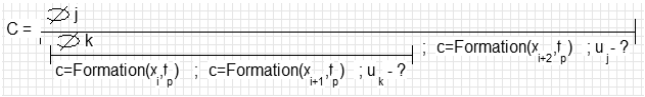


(13)

Elimination operation forming a plurality of commercial content is (14). Repeat elimination in (15) can start the set forming process of relevant content recursively depending on the time setting $t_j$ [9]. This option is set by the moderator in ECCS of set $T = \{t_1, t_2 \ldots, t_{n_T}\}$ for each source of data separately.

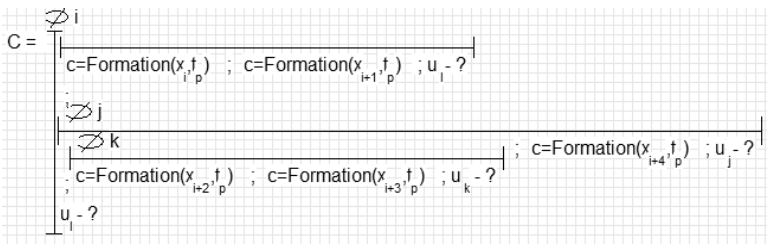


(14)



(15)

Sub cyclic elimination in (16) generates a relevant commercial content set without duplication from a limited list of information sources. The relevant content multiple formation is recursive, depending on the conditions $u_i$ of data formation and filtering. These conditions are specified by moderators in ECCS of rules set $U^i = \{u_1, u_2 \ldots, u_{n_U}\}$ for each source of data separately and common rules set $U = \{u_1, u_2 \ldots, u_{n_U}\}$ for all sources by previous content analyzing from these sources. Cycle sequencing application to cyclic elimination operations in (17) for the commercial content formation can extend the list of information sources and more accurately stage of content duplication identification. The relevant content multiple formation is recursive, depending on the time setting $t_p$ and the conditions $u_i$ of dataformation and filtering.



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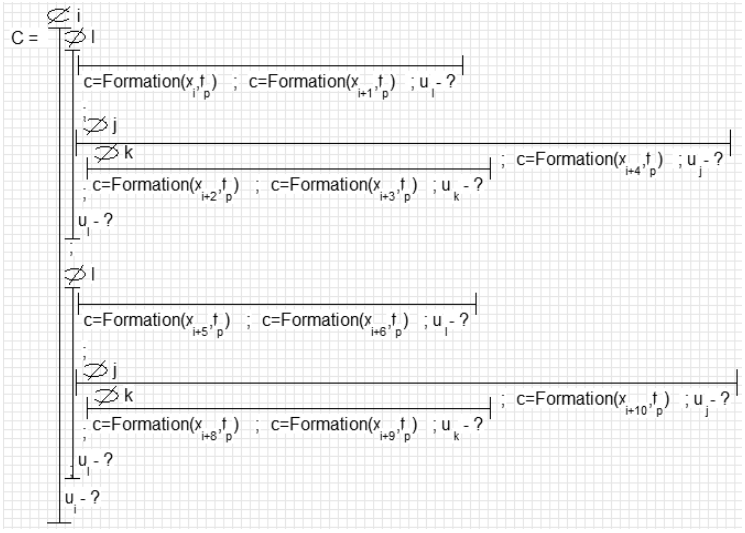


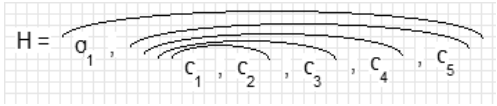
(17)

Content management step describes the operator form $z_w = Management(q_d, c_r, h_k, t_p)$, where $Q = \{q_1, q_2 \ldots, q_{n_Q}\}$ – set of user queries; $h_k$ – the set of content management conditions, ie $H = \{h_1(c_{i+1}, q_d), \ldots, h_{n_H}(c_{i+n_H}, q_d)\}$. Management of commercial content presented as

$$z_w = \left\{ \bigcup_{k=1}^{n_H} h_k(c_{i+1}, q_d) \middle| \begin{array}{l} (c_{i+k} \in C) \wedge (q_d \in Q) \wedge (h_k \in H_q), \\ H = H_{q_d} \vee H_{\overline{q_d}}, i = \overline{1, n_C}, d = \overline{1, n_Q}, k = \overline{1, n_H} \end{array} \right\},$$

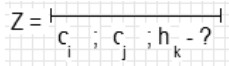
(18)

so the use of sequencing operations to relevant content select $c_r$ from content multiple $C = \{c_1, c_2 \ldots, c_{n_C}\}$ only by user request $q_d \in Q$:



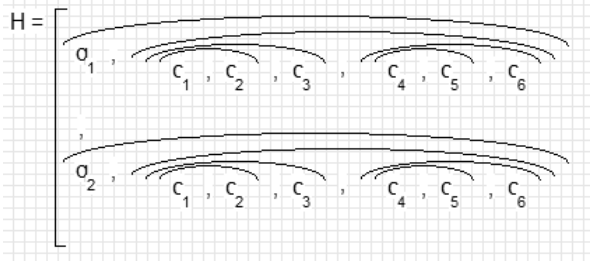
(19)

Elimination operations application to content select appropriate conditions $h_k$ is affect the process of information resources formation by user request:



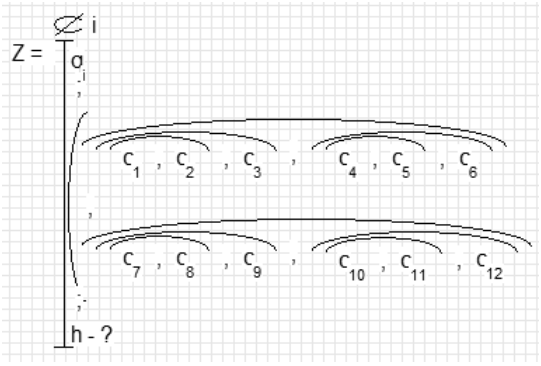
(20)

Set formation $H = \{h_1, h_2 \ldots, h_{n_Y}\}$ of content management conditions describes the parallelization operation of commercial content analysis $c_r$ according to user request $q_d \in Q$ in ECCS:



(21)

Cycle sequencing (22) generates pages plurality $Z = \{z_1, z_2 \ldots, z_{n_Z}\}$ of information resource in accordance with the content analysis of $c_r$ commercial content sets, $q_i$ user queries in ECCS and content management conditions $h_k$. Cyclic sequencing and elimination application in (21) of similar queries for users and for pages multiple caching $Z = \{z_1, z_2 \ldots, z_{n_Z}\}$ forms the resource according to the content analysis of commercial content $c_r$ sets, users' queries $q_i$ in ECCS and conditions $h_k$ of commercial content management. Parallelization operation (23) reduces the pages formation of information resource in the ECCS.



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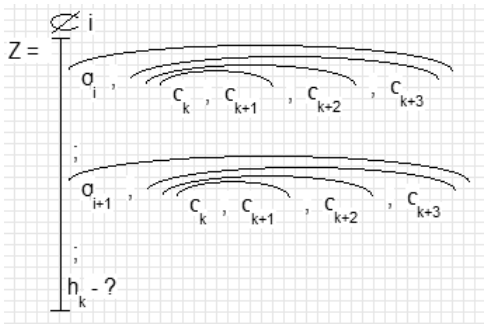

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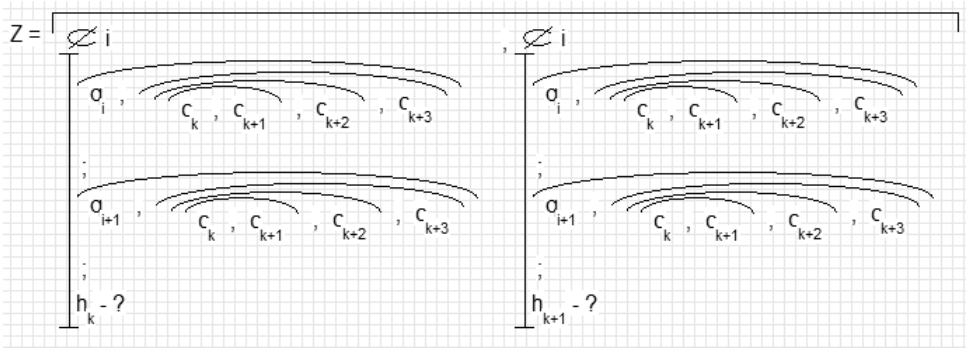
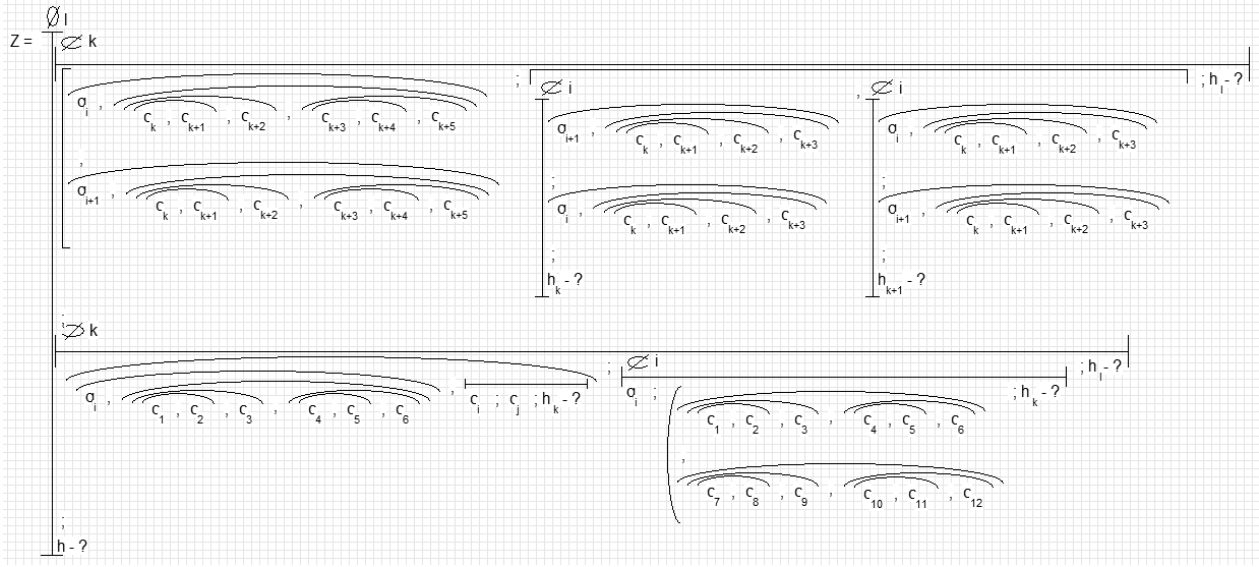


(24)

Application of sequencing, elimination and parallelization operations significant impact on the information resources process:



The content accompany step *Support* is described in the operator form

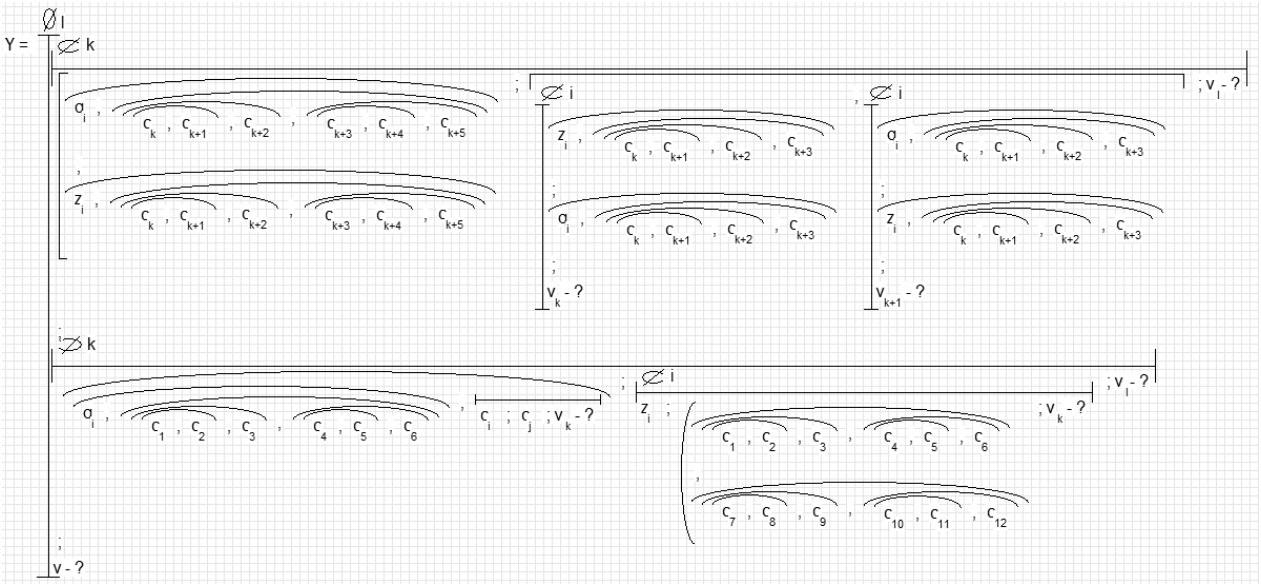
$$y(t_p + \Delta t) = Support(v_l, h_k, c_r, z_w, t_p, \Delta t), \tag{25}$$

where $v_l$ – conditions set of content support and external influences of environment on the system, is $v_l = (v_1(q_i, h_k, c_r, z_w, t_p), \ldots, v_{n_V}(q_i, h_k, c_r, z_w, t_p))$. Output statistics implemented are as

$$y_j = \left\{ \bigcup_l v_l \middle| \begin{matrix} (\exists q_d \in Q) \wedge (\exists z_w \in Z) \wedge (\forall v_l \in V) \wedge \left(\forall (c_r \wedge q_d) \in h_k\right), \\ V = V_{q_d} \vee V_{\overline{q_d}}, d = \overline{1, n_Q}, l = \overline{1, n_V}, w = \overline{1, n_Z}, r = \overline{1, n_C}, k = \overline{1, n_H} \end{matrix} \right\}. \tag{26}$$

The following equation reflects the commercial content support on the ECCS. That is describes the process of the users reactions analyzing for information resources processing in such systems. Functionally logistic model describes the ECCS operation process with basic processes of information resources processing as the content formation, management and maintenance. Statistics analysis of the ECCS operation conducted by regular/potential user reactions analysis to the system (visit, requests, search for

keywords, etc). Application of elimination, sequencing and parallelization operations in the proper order facilitates effective analysis of target/potential audiences response for(*to)* the ECCS functioning. It also helps to predict relevant changes in demand for commercial content. The general design principles of ECCS architecture allow implementing process of information resources processing to expand the similar systems functionality.



**Conclusions and recommendations for further scientific studies**

In the geven paper is functionally logistic model of commercial content processing in e-business systems developed. The model is based on the layered structure of processes. This model involves the division of the overall process into the following stages: content collection/creation from different sources; content formatting; key words and concepts identifying; content categorization; content duplicate detection; digests formation; selective distribution of content between moderators and users of ECCS. The model is based on the principles of content analysis. It automates the various steps of information product creating of this type without loss of content and lower quality. The method effectiveness confirms the results of its application in developing a number of commercial content projects. Developed automation commercial content processing allows to speed up the content formation, management and maintenance process. It also contributes to the rating increase of generated by their use with commercial information resources.

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