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COMPREHENSIVE METHOD OF COMMERCIAL CONTENT SUPPORT IN THE ELECTRONIC BUSINESS SYSTEMS

In the given article content lifecycle model in electronic commerce systems is proposed. The model describes the processes of information resources processing in the electronic content commerce systems and simplifies the content automation management technology. In the given paper the main problems of e-commerce and content function management services are analyzed.

Key words: information resources, content, content management system, content lifecycle, electronic content commerce system.

Запропоновано модель життєвого циклу контенту в системах електронної комерції. Модель описує процеси опрацювання інформаційних ресурсів в системах електронної контент-комерції та спрощує технологію автоматизації управління контентом. Проаналізовано основні проблеми електронної комерції та функціональних сервісів управління контентом.

Ключові слова: інформаційний ресурс, контент, система управління контентом, життєвий цикл контенту, система електронної контент-комерції.

Introduction and the general problem formulation

The current development of the Internet contributes to information needs increasing production factor or strategic resource. It also activates the new implementation forms of information services [1-8]. Informational product (commercial content) is documented information, prepared according to user needs and designed to meet them [1]. Actions for commercial content user providing are information services. Internet market is set of economic, legal, organizational and programmatic relations with the sale/purchase of information products/services between producers/suppliers and users [1, 8]. The concept of commercial content is defined as information resourcein filling in the electronic content commerce systems (ECCS); object of business processes in ECCS, such as paper, software, books, etc.; structured set of logically complete information to which the relationship between the user and ECCS; a set of data without predetermined patterns that exist only in electronic form; information for commercial purpose which indivisible in time; the main factor in the region formation of the ECCS functioning and purpose [1].

Problems of communication with important scientific and practical tasks

Theme actuality consists in rapid prevalence of Internet access; active development of e-business; information products/services set expanding; demand for information products/services growing; theoretical justification methods lack of information resources processing; needed to software unification for information resources processing and active development of research in e-business of Google, AIIM, CM Professionals organization, EMC, IBM, Microsoft Alfresco, Open Text, Oracle, SAP corporations and Lande D., Braychevsky S., Grigoriev A., Furashev V., McKeever S., Boiko B., McGovern G., Hackos J., Rockley A., Nakano R., Doyle B., Woods R., Halverson [1-8] in scientific papers.

Recent research and publications analysis

Commercial content is object to business processes in ECCS, for example, information product or the Web-site filling for online newspapers, online publishing, marketing research, consulting services, etc. [1]. The content lifecycle is a complex process that content takes place in the management through the various stages of publication [1]. Existing models of content lifecycle does not include all stages of the information resources processing: the content formation, management and support (Table 1). Initial information of ECCS operation is information about the purpose and conditions of the system. It defines the main purpose of ECCS simulation. It also contributes to the requirements formulation for systems model S and content management models [9]. ECCS model $S = \langle X, C, V, H, Function, T, Y \rangle$ is the variables set that describe the system functioning and form a subset which *is* given in Table 2. The quantities x_i, c_r, v_l, h_k, y_j are subsets elements that contain deterministic and stochastic components. ECCS S operation described by function $y_j(t_i + \Delta t) = Function(x_i, c_r, v_l, h_k, t_i)$ [9], where x_i are visitors/users requests to system. According to Google Analytics y_j are the visits number per time period Δt; average time of information resource visit (min:c); refusals indicator (%); achieved goal; dynamics (%); pages views number; number of page views per visit; new visits (%); absolute unique visitors; traffic sources in % (search engines, direct traffic or other sites) [4]. Impacts of values c_r, v_l, h_k on y_j as a result of the ECCS operation are unknown and unexplored [1-10].

Table 1

Models comparing of commercial content lifecycle

Model author	Formation	Management	Support
McKeever Susan	+/–	–	+/–
Bob Boiko	+/–	+/–	+/–
Gerry McGovern	+/–	–	+/–
JoAnn Hackos	+/–	–	+/–
Ann Rockley	+/–	+/–	+/–
Russell Nakano	+/–	–	+/–
The State government of Victoria	+/–	–	+/–
AIIM	+/–	+/–	+/–
CMP organization	+/–	+/–	–
Bob Doyle	+/–	+/–	+/–
Woods Randy	+/–	+	+
Halverson	+	+/–	+/–

Table 2

ECCS components

Definitions	values	range	Set
Input impacts on the system	$x_i \in X$	$i = \overline{1, n_X}$	$X = \{x_1, x_2, \ldots, x_{n_X}\}$
Content stream impacts to the system	$c_r \in C$	$r = \overline{1, n_C}$	$C = \{c_1, c_2, \ldots, c_{n_C}\}$
The environment impacts	$v_l \in V$	$l = \overline{1, n_V}$	$V = \{v_1, v_2, \ldots, v_{n_V}\}$
The internal (own) system parameters	$h_k \in H$	$k = \overline{1, n_H}$	$H = \{h_1, h_2, \ldots, h_{n_H}\}$
Output system characteristics	$y_j \in Y$	$j = \overline{1, n_Y}$	$Y = \{y_1, y_2, \ldots, y_{n_Y}\}$
Transaction time of content management	$t_i \in T$	$i = \overline{1, n_T}$	$T = \{t_1, t_2, \ldots, t_{n_T}\}$

Number of content streams is more than ways of products moving in industry [1]. Much of the content streams consists of easily formalized and automated procedures. The main problem is the lack of a common approach to process of ECCS modeling, design and development [1]. This justifies the purpose, relevance, appropriateness and areas of research. Existing e-commerce systems (ECS) do not support the entire lifecycle of content flow and do not solve the basic problem of information resources processing as

content development and implementation (Table 3). Lack of general and detailed classification of ECS and ECCS is leads to the problem of general methods definition and development for the algorithms/architecture design and development of the ECS and ECCS functioning [1].

Table 3

Characteristics comparison of e-commerce systems and electronic content commerce systems

Characteristics name of the system functioning	ECS	ECCS
Virtuality (lack of personal contact between the subjects of the buying / selling proccess)	+/–	+
Interaction (information for the user's query of interactively silent dialogue)	+/–	+
Globality (lack of time, space, assortment, trade, administrative, social and demographic boundaries)	+/–	+
Dynamic (the on-line trading ability to instant changes and adaptation to new conditions)	+/–	+
Efficiency (demand, profits, economic benefits and social impact)	+/–	+
The intangible goods presence (goods as an information product without tangible media)	–	+
The constant quantity of goods (goods production does not require replication, but only copies sending)	–	+
The growth of a goods variety (each product is unique)	+/–	+
Warehouse lack of storage for goods, there is only a repository for information producti	–	+
Product save in databases or repositories	–	+
The effectiveness of product promotions by keywords	+/–	+
Effectiveness of product search by keywords	+/–	+
Automatic detection and elimination of product duplication	–	+
Automatic detection of product aging in content	–	+
Automatic detection of product relevance	+/–	+
Automatic analysis of audience	+/–	+
Automatic creation of digests	–	+
Automatic creation of product	–	+
Automatic formatting of product	–	+
Impact of user experience to sales increase	+/–	+

Problems selection

A description of the commercial content flow and models building of information resources processing in ECCS is important and urgent [1-10]. When considering the dynamics of thematic content flow models limitation were revealed (Table 4).

Table 4

Models of text content processing

Model	Model features of the text content processing
Burton-Kebler	The model describes the process of content aging, losing its relevance, determination of individual topics or the entire content space, an exact solution in the form of exponents. It is questionable as to the results interpretation. Function is monotonically increasing, does not describe the processes of local extremes.
Space-vector	Significant terms definition in the content flow and relevant content from the set available. Mandatory ranking of content, parametric factors using that depend on time.
Linear	Determination of stream intensity over time in a linear dynamics of thematic content management.
Exponential	The model describes the process of content aging, losing its relevance. Correlation between individual content is insignificant.
Logistics	The model combines relative simplicity of the problem formulation with the possibility to vary the solution using of a parameters set with clear physical meaning. This is a description of a single thematic streem. The parameters dimension and their dimension is not taken into account.
Analytical	The model describes the process of content aging, losing its relevance. Obligatory presence is keywords dictionary.

This opens the way for further research. A formal model of ECCS does not reveal the mechanisms of content management. Formal models of content management appointment only to determine of the process aging (relevance) of content stream. And some of them (logistics, analytical) are designed for analysis of thematic content flow. They do not solve the problem of the content formation and support. Also they do not solve all the problems of content management, such as content submission plurality of end user according to his request, history or information portfolio; automatic detection of thematic content; automatic generation of digests and information portraits; tables construction of concepts relationship; concepts ratings calculation; information gathering from various sources and formatting; keywords identification; and content duplicate identification; content categorization; selective dissemination of content. Models shortcomings of content management are the lack of communication between input data, content and output data in the ECCS [1].

Goals formulation

The aim is to develop of standardized methods and software tools for information resources processing in the ECCS. The aim identifies the need to solve the following objectives:

- the electronic commerce systems classification to determine their characteristic patterns, trends, design and simulation process;
- a formal model development of electronic commerce systems to shortcomings identify of existing methods and means of resources processing;
- uniform development methods of information resources processing in electronic commerce systems to a generalized typical architecture create of electronic content commerce systems;
- architecture development of electronic content commerce systems for the stages implementation the of the commercial content lifecycle;
- software development of information resources processing in electronic content commerce systems to the time and cost reduce of content formation, management and implementation, the quality improving of information resources processing through the tried and tested solutions use.

Object of research is the lifecycle process of information products in the ECCS. Subject of research is uniform methods and software of information products creation, management and implementation. Studies performed during the work on the article and based on the methods of systems analysis (ECCS design), general theory elements of systems (ECCS design), the relational databases theory (database development), design theory by CASE-tools (ECCS design), set theory (models and methods development of information resources processing), probability theory (methods development, content key determining), mathematical linguistics (development methods for content analysis of textual information), mathematical statistics (methods development for the system analysis) and simulation theory (model and architecture development of ECCS).

Research results analysis

The general principles of ECCS architecture design allow to realize technology of a information resources processing effective (Fig. 1).

A formal model of electronic content commerce systems is a six elememts as

$$S = \langle X, Formation, C, Management, Realization, Y \rangle,$$

where $X = \{x_1, x_2, \ldots, x_{n_X}\}$ – input data set, $Formation$ – operator of content formation, $C = \{c_1, c_2, \ldots, c_{n_C}\}$ – a commercial content set, $Management$ – operator of content management, $Realization$ – operator of content support and $Y = \{y_1, y_2, \ldots, y_{n_Y}\}$ – initial information set.

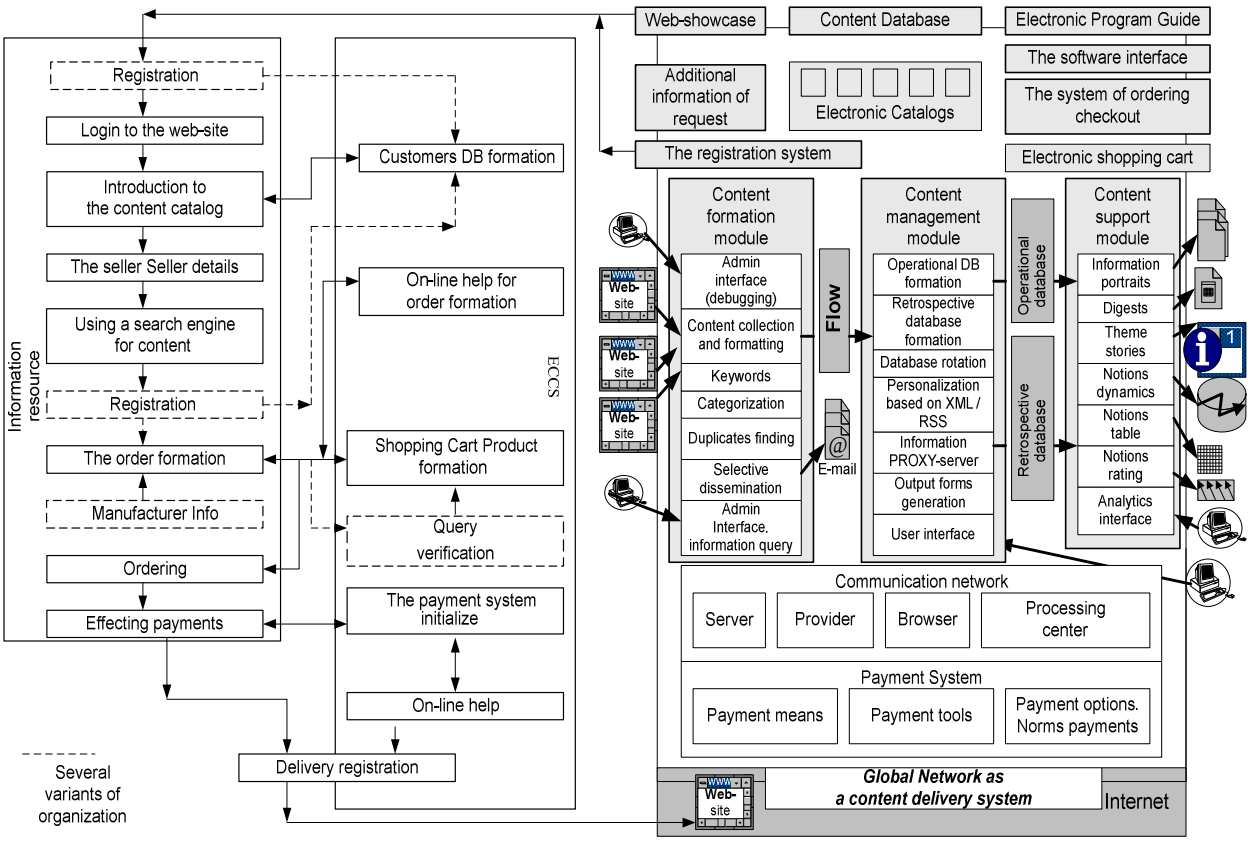

Fig. 1. Structural scheme of electronic content commerce systems

In Fig. 1 a typical diagram of ECCS is shown. The system provides the introduction, the content categories choice, content ordering, mutual settlements implementation, the order tracing (Fig. 2). There are different classes of ECCS and models variety of such systems. Nevertheless the article highlights the main patterns of transition from the processes of information resources formation to them support. Accordingly formal models of information resources formation, management and maintenance were proposed. These models allow to realize the ECCS architecture optimally. The complex method of the content forming provides an information gathering from different Web-site and and its formatting; content keywords and concepts identify; automatic categorization of content; content duplication identify; selective dissemination of content. Operative method of the content management provides database formation and access to it; operational and retrospective database formation; database rotation; user experience personalized; personal needs and sources maintaining; counting; statistical analysis of the users operation in the system; content search in the database; initial forms generation; information interaction with the database of other subsystems. Complex method of content support provides information portraits formation; digests formation; thematic content identification; concepts relationship tables construction; concepts ratings calculation; new developments identification, their tracking and clustering. The fully functional ECCS is characterized complex system of interrelated operations, methods, techniques (Fig. 2). The annotations database creating is a search images database creating of original content and their clustering (to the content group formation with close on some criteria of search images). Annotation base (search pattern of clusters used in the search process) is associated with the cluster base. Each entry corresponds to its specified cluster and description containing (Fig. 2). This description is made of automatic abstracting methods.

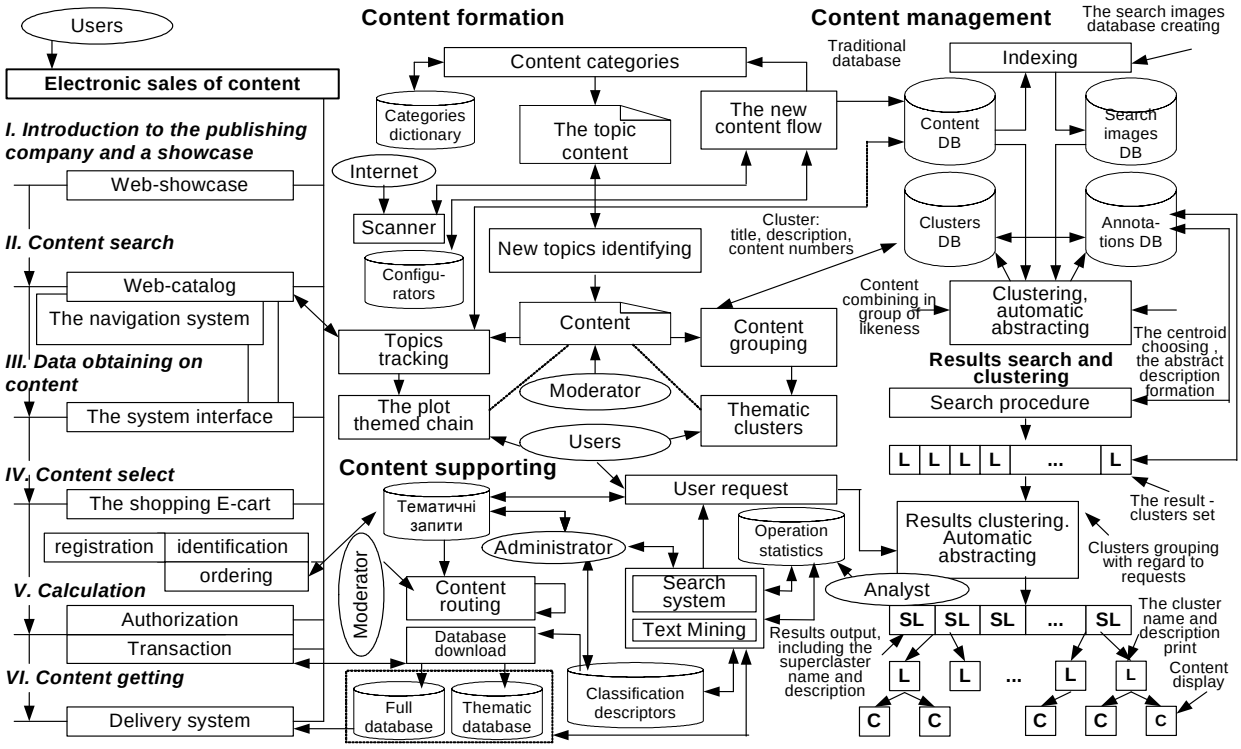

Fig. 2. Structural diagram of information resources processing in electronic content commerce systems

Problem new topics detection with content stream suggests that on the input of ECCS consistently receives new content. It comes directly from the scanning means (themed flow) or on the content router (systems of selective dissemination of content) and are selected by topic request. Next is to find and identify new topics that described in the content. They form a similar content chain (plot strings) by using separate software modules in a temporary retrospect. New topic content is the foundation for new groups of interdependent content (clusters). Technology of content syndication includes programs training for data collection with regard to the structural characteristics of individual sources; directly scanning of content; bring it to a common format in XML; content categorization.

Information portraits formation. Content analysis of textual information allows *to* determine the signs prevalence of researched content in ECCS. It is important not as an absolute, but *as* the relative importance of attributes, ie characteristics of the place (shares) among other features. For example, this is the percentage of forum users discussion of economic Issues concerning political or the percentage of positive comments on articles regarding *to* the negative and in respect of all comments on this category of articles in online newspapers. The degree of correlation between the features in the texts provides empirical data to understand ~~of~~ the functional links between elements reflected in the texts reality eg the audience mood determination of online newspaper about the economic or political situation in the country and/or world. If there are texts that have chronological sequence received number fixed in time portraits of the investigated reality (change in demand for a content category according to the season, such as winter read more fiction and detective stories – summer) or the target audience portraits (change in demand for a content category according to the article, for example, demand for political articles before the election). This allows to put forward hypotheses of the prognostic character about the system functioning.

Digest formation. In digest (a publications summary) formation using content analysis with regard to frequency weights of words from the concepts dictionary generated. The digest formation consists of algorithms of the concepts dictionary forming (alg. 1), of the content duplicate definition (alg. 2) and of the digest create (alg. 3).

Algorithm 1. Concepts thematic dictionary formation.

Stage. 1. Concepts alphabetical-frequency vocabulary formation.

Step 1. Sequential selection of all words in the input content stream.

Step 2. The alphabetical-frequency vocabulary construction based on content categories.

Step 3. Words normalization through automatic morphological analysis.

Step 4. The alphabetical-frequency vocabulary modification.

Step 5. Words assign of weight w (use frequency).

Step 6. Insignificant words deleting from the alphabetical-frequency vocabulary ($W \le k$, where k – threshold value of word extracting).

Stage. 2. The thematic dictionary choice as requested.

Stage. 3. Words weight adjustment of alphabetical-frequency vocabulary dictionary based on thematic dictionary.

Stage. 4. Words choosing at $N = n$ are with more weight w of alphabetical-frequency vocabulary, which $n = const$ is given by the moderator.

Algorithm 2. Duplicate content determination.

Stage. 1. The initial data formation.

Step 1. The moderator introduced of words in a string $m = const$.

Step 2. The moderator input strings unique coefficient ie $U = const$.

Step 3. Coefficient limits formation of the keywords use ie $K = [a_1, a_2]$, where $a_1 = const$ and $a_2 = const$.

Step 4. Content partitioning on n chains of m words.

Step 5. Frequency calculation of k_i keywords use.

Stage. 2. Content duplicates determination.

Step 1. Words strings comparison for all content.

Step 2. Chains uniqueness coefficients calculation u_i.

Step 3. Chains uniqueness coefficients comparison u_i with U. At $\frac{1}{n}\sum_{i}^{n} u_i < U$ mark the content as unsuitable.

Step 4. The frequency comparison k_i with coefficient K. If $k_i < a_1$ or $k_i > a_{21}$ then a content mark as unsuitable.

Algorithm 3. A digest create.

Stage. 1. Content Select based on its weight.

Step 1. Digest size C input.

Step 2. The algorithm 1 implementation.

Step 3. The weight consistent determine of each content as the weights sum of its individual words that $W = \sum w_i$.

Step 4. The input content stream sort from the weights values.

Step 5. Meaningful content duplicates definition for statistical criterion of text uniqueness $U \ge 0{,}9$ (alg. 2).

Step 6. Content filter of unsuitable for digests building (when $W \le l$, where l – Content removal threshold value by the self-education rules of content structuring and moderating) and statistically substantial duplicates.

Step 7. The choice of $V = q$ content with greater weight where $q = const$ and the moderator given.

Stage. 2. Digest text construction of selected content.

Step 1. Dictionary construction of selected content (alg. 1).

Step 2. Content analysis application to the text (Table 5).

Step 3. Sentences filtration that do not meet the semantic rules of content structuring and moderating.

Step 4. Hypertext presentation formation of digest, its contents and a link to the original source.

Stage. 3. Generated text edit of digest.

Step 1. The check amount of generated content c_i. If $c_i < C$, then step 2, otherwise stage 4.

Step 2. Content delete from the input stream that is used to the digest formation.

Step 3. Steps 1-2 implementation.

Step 4. Resulting append to the pre-formed digest and move to step 1.

Stage. 4. Digest text formation as a separate content and its maintaining in the database with reference on the source.

Table 5

Content analysis stages of textual information

Stage	Stage characteristics of content analysis
Total sources or content determination	Using a set of defined criteria which corresponds to each content: given type of source; one type of content; given the parties which involved in the communication process; message size matched (minimum / length); messages appearance frequency; messages distributing method; messages distribution space; messages appearance time, etc.
Content analysis selection	The selected set of content is formed on the criteria a limited sampling from a larger array of information. Its forming using the procedure from a set of precisely defined actions for processing without any changes of all objects study.
Linguistic units identifying	Compliance with strict requirements concerning the linguistic units choice for content analysis: large enough to interpret meaning; small enough not to interpret the many meanings; easily identified; units number is large enough for sampling. When taking of the themes analysis unit take into account that its size does not go beyond a paragraph; new theme arises with the new characteristics appearance of linguistic units.
Computation units finding and classifier formation	Computing units may coincide with semantic units, or have specific characteristics.In the first case, the analysis procedure is to the frequency calculate of the selected content unit use. Otherwise, the researcher proposes computation unit (physical length of the texts; text area, filled with informative units; the number of rows, paragraphs, characters, columns in text; the file size / type; pictures number with a certain content and story) based on the analyzed material and research purposes.
The procedure for calculating	Standard techniques for classification of selected groups of mathematical statistics and probability theory formulas.
Results interpretation	This includes all extracted text fragments. When forming conclusions do not take into account of the some results, without exception all. Here are identified and measured the text characteristics. They allow drawing conclusions about that wanted to emphasize or hide its author. Or they predict changes in demand for content based statistical set of calculated coefficients for the time period of specified category.

Topical stories identification in content stream. Content with new themes is the new groups basis of interdependent content in thematic stories identifying with the following procedures:

1) control within the system – level destination of user access to different content;
2) content integration – content moving to a new decision;
3) content support of various types – content storage and sorting in a central repository;
4) detailed documentation and context-intelligent help support;
5) rating system of site articles evaluation;
6) template changes – general formatting changes to the content of the part site reflects the entire site;
7) workflow support –automated business processes create for specific content;
8) content marking –new categories and markers adding to content before / after saving;
9) version control –new versions creating, view and return to the previous versions of content;
10) content analysis of text streams in the system;
11) visual administration tool – easy authors management of content, without resorting to programming, typically implemented using HTML-forms;
12) concepts relationship tables construction.

The concepts ratings calculation is based on procedure for results calculating of content analysis, taking into account the ratio coefficient c of positive and negative (for the selected item) estimates, opinions, arguments, as described in the user comments on the content ECCS. If the positive ratings number exceed negative number, then the formula is used $c = \frac{f^2 - f \cdot n}{r \cdot t}$, where f – the positive ratings number; n – negative ratings number; r – the volume of analyzed text content; t – the total volume of text. If the positive ratings number is less than the negative, then the formula is used $c = \frac{f \cdot n - n^2}{r \cdot t}$.

In Table 6 presents a available stages list of the commercial content lifecycle on the developed system. In Table 6 also presented the operation results of the developed systems from Google Analytics.

Table 6

The functioning results of electronic content commerce systems

№	Characteristic	Information resource				
		Fotoghalereja-Vysocjkykh	Vgolos	Tatiana	PressTime	AutoChip
1	Content formation subsystem	+/–	+	–	+/–	–
2	Content management subsystem	+	+	–	+	+
3	Content support subsystem	+/–	+	–	+	+/–
for the period from 10.2011 till 11.2011						
1	Visiting	142	199873	43	124653	372
2	Average Time of Online Spent (min: c)	2:04	2:48	3:40	2:18	2:49
3	Refusals Index (%)	61,27	65,99	60,47	59,89	58,06
4	Achieved goal	6	0	0	0	54
5	Dynamics (%)	-8,97	39,74	-58,65	23,18	17,72
6	Pageviews	349	425576	98	245632	1013
7	Pages number per visit	2,46	2,13	2,28	2,09	2,72
8.	New Visits (%)	70,42	36,84	55,81	23,54	75,27
9	Absolute Unique Visitors	112	98845	27	45321	290
10	Traffic Sources - search systems (%)	76,76	41,91	60,47	42,75	54,03
11	Traffic Sources - Direct Traffic (%)	11,27	10,50	39,53	10,50	26,34
12	Traffic Sources - Other Sites (%)	11,97	47,34	0	46,75	19,62
for the period from 10.2010 till 11.2011						
1	Visiting	2033	1813928	186	913929	2423
2	Average Time of Online Spent (min: c)	7:03	3:08	6:52	2:58	2:56
3	Refusals Index (%)	46,34	62,45	48,68	62,23	48,68
4	Achieved goal	253	0	0	0	449
5	Dynamics (%)	8,97	39,74	8,65	23,18	17,72
6	Pageviews	12694	4249331	802	2149567	8423
7	Pages number per visit	6,24	2,34	4,31	2,12	3,48
8.	New Visits (%)	55,53	35,34	22,04	25,65	65,37
9	Absolute Unique Visitors	1152	671308	41	334536	1592
10	Traffic Sources - search systems (%)	49,09	42,77	64,52	40,75	49,94
11	Traffic Sources - Direct Traffic (%)	20,17	15,76	22,04	16,53	29,67
12	Traffic Sources - Other Sites (%)	30,74	41,21	13,44	42,72	20,39

In Fig. 3 presents the functioning results of the developed systems from Google Analytics in graphs and charts. They imply that the presence of all stages of the content lifecycle on the site significantly increases the amount of visits and unique users.

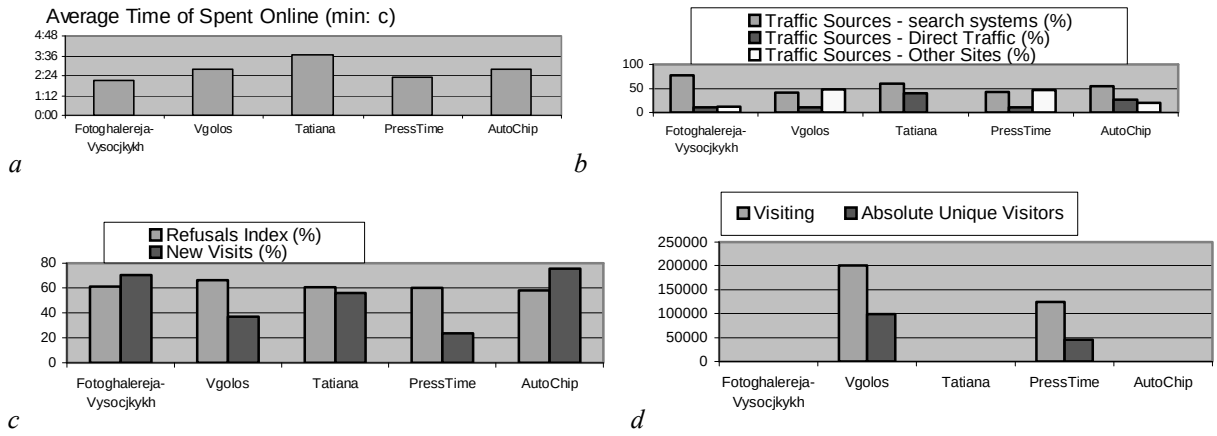

Fig. 3. Distribution of: a – the residence time; b – traffic; c – new visits and refusals; d – visit to the resource

Conclusions and recommendations for further scientific studies

This paper solves the problem of current scientific research and development of methods and means of information resources processing in ECCS. In the upshot used the classification, mathematical and software architecture and overall ECCS. In the paper the terminology and electronic content commerce systems are analyzed and classified to determine their characteristic patterns, trends, process design and simulation. The authors developed a formal model ECCS for shortcomings determining of existing methods and means of resources processing. They developed also standardized methods for information resources processing in ECCS. The architecture of modules is implementing stages of commercial content lifecycle in ECCS is proposed. Software for information resources processing increased attendance of electronic content commerce systems is suggested. From the perspective of systemic approach is applying the principles of information resources processing in ECCS. This made it possible to develop methods for the commercial content formation, management and support. The proposed integrated method of content support makes it possible to develop a module of commercial content realization.

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