

Research and analysis of informational flows in the enterprise management system (on the example of "Lugansk cartridge works")

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S u m m a r y . This article reviews informational flows of manufacturing enterprise in order to reveal dubbing points, information excess or lack, the reasons of its failure or delays and documentation flow further optimization for management efficiency increase. The two level technology with the application of matrix model and networks graphs is being used for the analysis. This article analyses management logical structure for the matter of lack of contradictions.

Key words . Informational flow, documentation flow, intensity, network model, matrix model, logical structure.

INTRODUCTION

The issues of management board timely provision with required information are mainly defined by the shortcomings of informational flows at the company [12, 13, 14, 18]. The informational flow is the information physical transfer from one department to another [1, 19]. The informational flow intensiveness and speed make direct influence over company management efficiency [4, 16]. The company heads (general director, financial director, department directors) should have up-to-date information and in case of deviation from plan, concerning costs most of all, should have the possibility to make timely corrections. The basis for informational flow researches lies at the existing documentation flow at the company [8, 15, 17].

OBJECT, SUBJECT AND AIM OF RESEARCH

The article business research units' lies at business processes related to the management of Lugansk cartridge works. Lugansk cartridge works is the only company in Ukraine which manufactures bullets taking into account international standards [9]. Such level is being provided by the work of powerful engineering department and modern manufacturing base. Currently the concept of Lugansk cartridge works is to widen the nomenclature of manufactured products, which have demand at international market, including the products manufactured in accordance with the standards of leading international bullets manufacturers using rotor technology potential capacities.

The company activity scope lies not only at the manufacturing of wide range of bullets, manufacturing and supplying of rotor type equipment, instruments and technologies, required for bullets manufacturing.

Lugansk cartridge works has the license for the manufacturing and supplying of bullets for small arms (SAB), sport- small arms (SSAB) and bullets elements. The research subject lies at informational flows, accompanying manufacturing process.

The analysis goal lies at the detection of dubbing points, information excess or lack, the reasons of failures and delays and the company documentation flow further optimization for management efficiency growth.

RESULTS OF RESEARCH




The following multi level technology of informational flows presentation is applied for the analysis:

- matrix model, allowing to formalize the company documentation flow in general;
- allowing clear reflection both departments interconnection via informational flows and used types of documents.

Matrix model (table. 1) reflects the company departments interconnections via informational flow movement. The informational flow from the source to the receiver is defined as IP (i, j), where:


























- i* – number of line in the table (information source);
- j* – number of column in the table (information receiver).

Explanations to table. 1:

-  – information flow within department;
-  – information flow between departments;
-  – not considered information flow.

Using network model (fig. 1) [3] we can calculate the departments load for the processing of incoming (management) and forming of outgoing information about performance and/or condition. The company department are displayed in form of nodes, informational flows are presented in form of graph arcs. Besides this in case of the availability of data on time consumption the model allows the assessment of documents processing terms and the time of their passing from operational level of management to the tactical and strategic management level.

Table 1. The matrix model of information flows involved in the production process

Source information departments of the enterprise, involved in the manufacturing process)	Recipient of the information											
	Store №10	Pantries	3 area (sleeve)	5 area (sleeve)	7 area (bullet)	1 area (assembly, packaging)	2 area (assembly, packaging)	Store FG №20	Quality control department	Accounting department	Planning department	Dispatching department
	1	2	3	4	5	6	7	8	9	10	11	12
Store №10	1											
Pantries	2											
3 area (sleeve)	3											
5 area (sleeve)	4											
7 area (bullet)	5											
1 area (assembly, packaging)	6											
2 area (assembly, packaging)	7											
Store FG №20	8											
Quality control department	9											
Accounting department	10											
Planning department	11											
Dispatching department	12											

The network model division into two informational subsections with various tops (departments) and two multitudes of informational connections: management and report ones allows the construction of hierarchy structure of manufacturing management and informational support (fig. 2, 3).

The informational flow content (arcs) is presented below in form of documents types list [10]:

- IP (1,1) – 1) incoming orders registration register,
2) cards of stocktaking,
- IP (1,10) – 1) incoming orders,
2) incoming invoices,
3) intrashop requirements,
- IP (2,1) – 1) intrashop requirements,
2) consignment note for materials interior transfer,
- IP (2,2) – 1) stocktaking cards,
2) register for incoming order registration,
- IP (2,10) – intrashop requirements,
- IP (2,11) – bill of materials consumption,
- IP (3,2) – 1) intrashop requirements,
2) consignment note for materials interior transfer,
- IP (3,4) – order for product elements manufacturing,
- IP (4,4) – register of manufacturing assessment (sleeve),
- IP (4,6) – paper note on cartridge cases receipt;
- IP (4,9) – Submission,
- IP (4,12) – report on the performance of daily norms on sleeve manufacturing,
- IP (5,2) – 1) intrashop requirements,
2) consignment note on materials interior transfer,
- IP (5,5) – manufacturing amount registration register (bullet),
- IP (5,9) – Submission,
- IP (5,12) – report on the performance of daily manufacturing norm on bullets,
- IP (6,2) – 1) intrashop requirements,
2) consignment note on materials interior transfer,
- IP (6,6) – 1) register on the stocktaking of obtained sleeves,
2) manufacturing amount registration register,
- IP (6,7) – task and schedule of products manufacturing,
- IP (7,7) – 1) party forming register,
2) stocktaking register,
3) manufacturing amount register,
- IP (7,8) – approval register stub note,
- IP (7,9) – submission,

- IP (7,12) – report on the performance of daily norm on cartridge,
- IP (8,8) – ready products stocktaking register,
- IP (8,10) – Invoice,
- IP (9,8) – quality control department master's resolution on dropping party,
- IP (9,9) – 1) passport of approved products,
2) passport for disapproved products,
3) accompanying sheet "conditionally disapproved",
4) submission,
5) register of stocktaking and approval on the flow conditional waste,
6) register of stocktaking of final waste at waste isolator,
7) control cards,
8) register for registration of control cards processing results,
9) register of final stocktaking of the waste at the area,
10) report of the final waste,
11) register of waste reports registration,
12) information about waste and technological losses,
- IP (9,10) – 1) waste report,
2) report on the write off of final waste;
- IP(11,8) – acceptance and delivery act (commissioning report),
- IP (12,3) – task on the manufacturing of product elements,
- IP (12,5) – task and schedule of bullets manufacturing,
- IP (12,6) – task and schedule of products manufacturing.

Having analyzed the monthly documents amount of each type, we can define the informational flow intensiveness (table. 2).

The overall intensiveness of informational flow accompanying manufacturing process at the plant is equal to 3798 documents per month.

The incoming and outgoing informational flows for each network model arcs are summed for the definition of the most loaded departments participating at the processing of the documentation flow [11, 20] accompanying manufacturing process. The amount of monthly documentation processed by the departments is displayed in table. 3.

Total makes 4263 documents. The overall flow intensiveness and the amount of processed documents differ from each other as one document can be used at the activity of several departments and these departments employees spend their time for its processing.

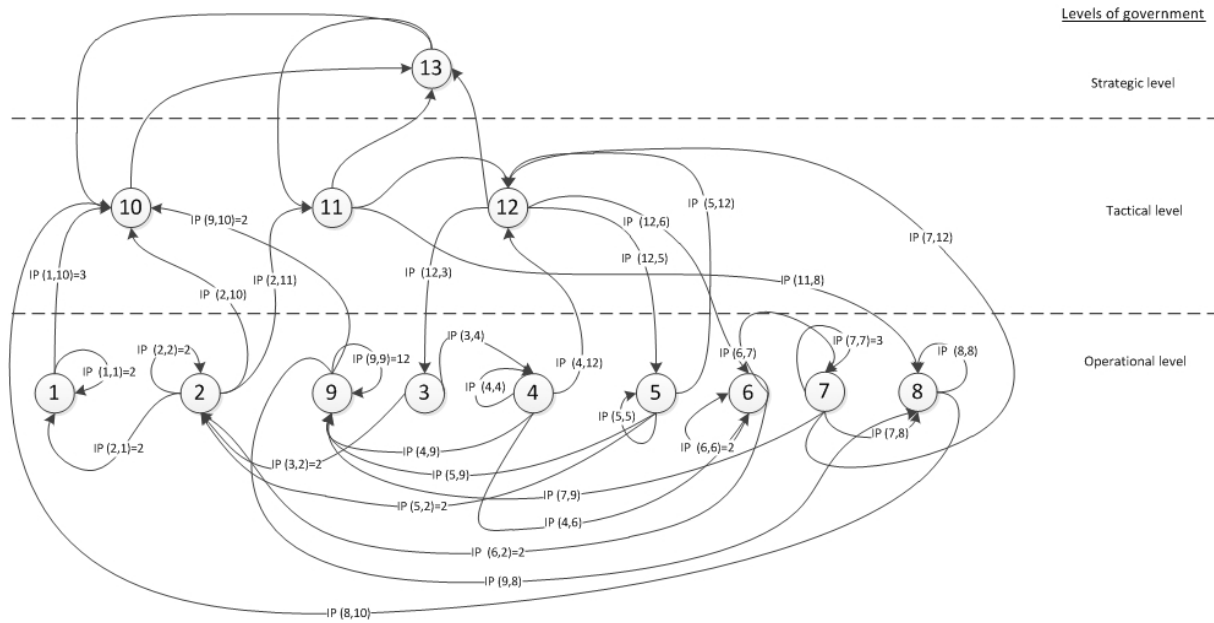


Fig. 1. The network model of informational flow of the production process:

- ① – material store №10;
 - ② – pantries;
 - ③ – area №3 (sleeve);
 - ④ – area №5 (sleeve);
 - ⑤ – area №7 (bullet);
 - ⑥ – area №1 (assembly);
 - ⑦ – area №2 (assembly);
 - ⑧ – store FGN№20;
 - ⑨ – quality control department;
 - ⑩ – accounting department;
 - ⑪ – planning department;
 - ⑫ – dispatching department;
 - ⑬ – leadership;
- – movement of information flow;

Table 2. The intensity of the documents flow per month

Information flows	The number of types of documents in information flow (pcs/pp)												In total													
	1	2	3	4	5	6	7	8	9	10	11	12														
IP (1,1)	271	27	390	312									661	339												
IP (1,10)	271	271	51	51	105	53							427	375												
IP (2,1)	105	53	14	7									119	60												
IP (2,2)	201	161	116	12									317	172												
IP (2,10)	246	49											246	49												
IP (2,11)	1	2											1	2												
IP (3,2)	82	16	11	5									93	22												
IP (3,4)	1	1											1	1												
IP (4,4)	44	4											44	4												
IP (4,6)	22	4											22	4												
IP (4,9)	44	44											44	44												
IP (4,12)	44	22											44	22												
IP (5,2)	82	16	11	5									93	22												
IP (5,5)	22	2											22	2												
IP (5,9)	22	22											22	22												
IP (5,12)	22	11											22	11												
IP (6,2)	82	16	11	5									93	22												
IP (6,6)	22	2	22	2									44	4												
IP (6,7)	1	1											1	1												
IP (7,7)	10	1	10	1	44	4							64	6												
IP (7,8)	10	2											10	2												
IP (7,9)	44	44											44	44												
IP (7,12)	44	22											44	22												
IP (8,8)	91	9											91	9												
IP (8,10)	40	40											40	40												
IP (9,8)	10	10											10	10												
IP (9,9)	300	90	50	15	100	30	100	30	100	10	50	5	90	45	90	9	50	5	50	25	50	5	50	50	1080	319
IP (9,10)	50	100	6	12									56	112												
IP (11,8)	40	40											40	40												
IP (12,3)	1	1											1	1												
IP (12,5)	1	1											1	1												
IP (12,6)	1	1											1	1												
In total													3798	1786												

Table 3. The volume of documents by department and per employee

Departments	Volume		Volume per employee	
	pcs	pp.	pcs	pp.
Material store №10	780	399	780	399
Pantries	596	238	99	40
Area №3 (sleeve)	94	23	94	23
Area №5 (sleeve)	155	76	155	76
Area №7 (bullet)	160	58	160	58
Area №1 (assembly)	67	10	67	10
Area №2 (assembly)	163	75	163	75
Store FG № 20	191	101	191	101
Quality control department	1190	429	70	25
Accounting	713	464	238	155
Planning department	41	42	41	42
Dispatching department	113	58	57	29
In total:	4263	1972	2114	1032

Table 4. Comparison of informational flows intensiveness at network model of managed informational flow network and network model of informational flows about condition

Departments	Management documents amount	Amount of documents about the condition
Material store №10	0	119
Pantries	119	279
Area №3 (sleeve)	93	1
Area №5 (sleeve)	110	1
Area №7 (bullet)	137	1
Area №1 (assembly)	94	23
Area №2 (assembly)	98	1
Store FG № 20	40	60
Quality control department	66	110
Accounting department	0	769
Planning department	10	1
Dispatching department	3	110
In total:	770	1475

The network models (subsections) with two types of informational connections: management and informational one about the changes and conditions of the manufacturing are constructed for the research of manufacturing process management structure [5] (fig. 2, 3). The results of the first subsection analysis (fig. 2) allowed to construct hierarchy structure and information provision for decisions making process. As the first subsection base and anti base of the second one are similar [2] we can say about the absence of contradictions at management logical system.

Moreover it is important to calculate time parameters of informational flows passing from informational sources to management strategic level besides material and labor costs. In order to do this we need data on the time of documents processing and storage. From these two indices we need to select the maximum one it is applied to the arc of information condition (fig. 3). Taking into account this hierarchy model data we calculate the

length of all possible ways from information sources arcs to management arcs and select the maximum one [6]. It is impossible to conduct manufacturing process complete analysis at strategic level without the data from lower position levels (tactical and operational ones). In accordance with the aforementioned information we find critical way corresponding informational flow with maximum passing time. Critical way is equal to 50 days.

The comparison of management information intensiveness and informational flows on the manufacturing process condition (table 4) allows making the conclusion that the intensiveness of informational flow about the condition is twice more than management flow intensiveness.

It doesn't contradict to the theoretic notions about manufacturing management organization. On the other hand it emphasizes the amount of excess information about manufacturing process condition at the works.

CONCLUSIONS

Thus, the application of matrix and network models of informational flows research and analysis at Lugansk cartridge works allowed making the following conclusions:

- the overall intensiveness of documentation flow accompanying the company manufacturing process is equal to 3798 documents a month; overall load to one employee is equal to 118 documents a month, material costs are low – about 178,6 UAH per month, the time of documents passing from operational to strategic level is equal to 50 days;

- the most loaded departments relatively to documentation flow are: engineering department (1190 documents a month), material store № 10 (780 documents), stowages (596 documents), accounting department (713 documents);

- the manufacturing management logical structure is without contradictions i.e. without transitive dependency and recurrence in management influences interchange;

- the informational flows are excessive, they are dubbed and parallelly processed;

- currently the accounts closing, the current months cost and financial forming is done to 20 of the following month. The most up-to-date information is the information on the amount of issued products (daily reports from the departments) and money flow on the account. The company management board uses the information of two month up-to-date for strategic solutions taking.

In order to increase the information obtaining speed from operational to tactical and strategic levels it is required to implement the automated system of manufacturing process management. This automation means first of all, the presence of electronic the data storage (DS) [7]. Having one single DS allows enterprise to allocate a number of advantages:

1. The DS contains the information the required for the entire time period – up until a few decades in a unified information space. This opens up opportunities for in-depth analysis of industrial, business and economic activities of the enterprise.

2. DS will eliminate inconsistencies in the data at the stage of collecting information before plunging into one database.

3. The universalization of access to data. DS provides the opportunity to receive any reports and analyze them based on a single source of information that allows users to integrate data

entered and accumulated in various operational systems for further comparison and analysis.

4. Solves the problem of conflicts that occur when users attempt to get simultaneous access to change and/or add data.

5. Allows the construction reports based on relevant, reliable and not conflicting data.

6. Acceleration of obtaining analytical reports, without expenses for aggregating (calculation of the total, average, minimum, maximum performance).

Thus, the introduction of ACSME will create a single information space for display of financial and economic activity of the enterprise, covering the main business processes. This will give the company's management and managers ample opportunity for analysis, planning and flexible management of resources to enhance its competitiveness, will improve the efficiency of daily work in the production area.

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ИССЛЕДОВАНИЕ И АНАЛИЗ
ИНФОРМАЦИОННЫХ ПОТОКОВ В СИСТЕМЕ
УПРАВЛЕНИЯ ПРЕДПРИЯТИЕМ
(НА ПРИМЕРЕ ЛУГАНСКОГО
ПАТРОННОГО ЗАВОДА)

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А н н о т а ц и я . Исследуются информационные потоки промышленного предприятия с целью выявления точек дублирования, избытка и недостатка информации, причин ее сбоев и задержек, а также дальнейшей оптимизация документооборота для повышения эффективности управления. Для анализа используется двухуровневая технология с применением матричной модели и сетевых графов. Анализируется логическая структура управления предприятием на предмет непротиворечивости.
К л ю ч е в ы е с л о в а . Информационный поток, документооборот, интенсивность, сетевая модель, матричная модель, логическая структура.