Use of operating processes charts in procurement management in a construction company

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Abstract. The paper proposes a method for compiling an operating processes chart for procurement management based on the well-known distribution matrix of administrative management tasks. To confirm the practical applicability of this tool, it was tested at a major road-building company, OAO TODEP. The compiled chart for the company's procurement activities is clearly presented in this paper with an assessment of the labor intensity for each task of the procurement process and the workload of the persons in charge.

1 Introduction

In conditions when a qualitative complication of management is occurring via increasing the role of socio-psychological technologies and introduction of automated software in all structural divisions, it becomes necessary to systematize and structure the process of work being performed.

Continuously changing conditions of the company's procurement activities over time lead to the need for adequate adaptation of the management system to them, including the organizational structure of management. First of all, it depends on the objective necessity and regularities of the market economic system associated with the meeting, first of all, individual needs, ensuring the interest of employees in the highest performance results, and making wide use of the achievements of scientific and technological progress. All this requires construction companies to adapt to new market conditions, to overcome the emerging contradictions in the economic and scientific environment [1].

Under these conditions, the issues of studying the improvement of the company's management structure become relevant. An important management function is organizing, which is establishing permanent and temporary relationships between all structural divisions of the company, fixing the order and conditions of operation [2].

The function of organizing is implemented in two ways: through the administrative and organizational management and through operational management. Administrative and organizational management involves the determination of the organizational structure of the enterprise, establishment of interconnections and distribution of functions between all

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departments, granting of rights and establishment of responsibility between employees of the administrative staff.

This involves the formation of the organizational structure of the company and the identification of factors and methods of building the organizational structure. At this stage, the arrangement of the managerial staff by services and divisions occurs, the process of forming job descriptions, as well as the separation of powers and responsibilities is emerging. An element of formation or improvement of the corporate organizational structure is an organizational toolkit, which is divided into the following types [3,4]: network matrix, responsibility assignment matrix (RAM), information technological model (ITM).

Network matrices are, as a rule, of a higher level of scientific development of network schedules and their application in practice is complicated by the limitation of the availability to all participants engaged in a particular type of activity in a company [5,6,7].

RAM has become very popular, used in the company's management system to share within the team the duties, rights and responsibilities of all participants engaged in a particular type of activity by tasks. Meantime, there are practically no limitations in the application of this type of organizational tool.

On the basis of RAM, the proposed information technology chart was applied to the construction company's procurement activities.

2 Methods

The compilation of RAM involves the provision of a comprehensive implementation of the assigned work and operations within the procurement process by setting the order of tasks in accordance with particular performers. The attitude of performers to the solution of a specific task is indicated by a symbol [8-10]. The procedure for implementing the management function in building RAM includes: setting responsibility for solving a particular task of the procurement process, describing the content of the performer's activities, preparing and maintaining the task. In order to identify the workload of officials and departments, it is necessary to establish the significance of the adopted symbols and evaluate the comparative (weight) estimates of these symbols. To this end, it is recommended to use one of the expert survey methods – operating with the preferences matrix. Tables 1-3 show the preference matrices in which the used symbols of RAM are compared with each other. In this case, the preference is divided into 3 levels in order of importance.

Thus, Table 1 presents the most significant preferences in the procurement management system, characterizing the responsibility for making decisions.

Table 1. Matrix of preferences in the first-level procurement management system.

Symbols	I	!	R	Sum of points	Specific weight of operations
I	1	0	2	3	0.33
!	2	1	2	5	0.56
R	0	0	1	1	0.11
Total				9	1

Accepted symbols for preferences in the first-level procurement management system:

I – the sole decision and personal responsibility for the solution of the problem (with signature);

! – personal responsibility in the collective form of decision-making (with signature);

R – participation in the collegial solution of this task (without the right to sign).

Table 2 presents the second level preferences related to the management of the procurement process.

Table 2. Matrix of preferences in the second-level procurement management system.

Symbols	P	O	K	H	U	Sum of points	Specific weight of operations
P	1	0	2	2	0	5	0.20
O	2	1	2	2	2	9	0.36
K	0	0	1	2	0	3	0.12
H	0	0	0	1	0	1	0.04
U	2	0	2	2	1	7	0.28
Total						25	1

Accepted symbols for preferences in the second-level procurement management system:

P – planning;

O – organizing;

K – control;

H – coordination;

U – participation.

Table 3 presents the third level preferences related to the management of the procurement process.

Table 3. Matrix of preferences in the third-level procurement management system.

Symbols	S	T	M	Sum of points	Specific weight of operations
S	1	0	0	1	0.11
T	2	1	2	5	0.56
M	2	0	1	3	0.33
Total				9	1

Accepted symbols for preferences in the third-level procurement management system:

S – approval;

T – performing;

M – making proposals.

The correctness of filling the matrix can be checked with the following conditions:

1) the sum of the estimates of symbols must be equal to the square of the number of symbols;

2) the sum of the estimates of any symbol horizontally and vertically should be equal to twice the number of symbols.

In the step-by-step implementation of the task, the coefficient of labor intensity of solving each management task is calculated by dividing the number of employees performing the corresponding operation by the total number of people employed in the procurement process.

Having calculated the weights of operations and the coefficients of labor intensity, one can:

1) find the complexity of the solution of each problem by the formula (1):

$$R_y = k_y * \sum_{p=1}^P B_{yp}, \quad (1)$$

k_y – coefficient of labor intensity of solving the y -th task, $y=1, Y$; B_{yp} – weight of operations by r -th employee on y -th task, $p=1, P$.

1) find the workload of employees in managing the procurement process.

3 Results

The proposed toolkit for improving the management of the procurement of material resources was tested in the procurement activities of the road construction company OAO TODEP, which operates in Tyumen Region in the Russian Federation.

The use of operating processes charts was recommended at OAO TODEP in the context of the integration of logistics activities and centralization of procurement. So, among the main areas and activities for the organization of a centralized procurement management system the following can be identified:

1) compilation of a responsibility assignment matrix (RAM), which will allow duly distributing the functions of procurement management by employees and departments of the organization (performers);

2) development of an operating processes chart to manage the procurement of material resources;

3) establishment of an ERP software product at the head office and branches of OAO TODEP to accelerate the process of transferring applications for material resources and more accurate generation of application data.

RAM for managing the procurement of material resources should include tasks to be carried out in managing the procurement process (Z) and a list of persons in charge in the structural units of the construction company (DL).

Tasks to be solved must be placed in strict sequence:

1. Identifying the need for material resources.
2. Inventory of the level of stocks of material resources in storage areas.
3. Formation of the plan for the procurement of material resources, taking into account the volume of orders and the time of their placement.
4. Control of procurement budget limits.
5. Identifying the type of procurement of material resources.
6. Market analysis of procurement sources of material resources and identifying of all possible participants in the input material flow.
7. Definition of criteria for the selection of participants of the input material flow.
8. Conducting an evaluation and selection procedure for participants in the input material flow.
9. Selection and establishment of a contractual relationship with a certified supplier / new supplier.
10. Order of material resources lot to suppliers.
11. Tracing the shipment of material resources.
12. Verification of received material resources.
13. Settlement with suppliers.
14. Calculation of the total cost of ownership of material resources.
15. Release of material resources from warehouse by orders.

The developed RAM of the procurement process of material resources for OAO TODEP is presented in Table 4.

Table 4. Responsibility assignment matrix in procurement of material resources.

Persons in charge and departments (DL)	OAO TODEP														DRSU (branch of OAO TODEP)												
	GM		PrM							FEM				PM			GM		FED			PM					
	GD	CE	DGDP	DGDC	DGDM	CT	ICD	DED	L	CA	A	HEFD	CEFD	HPD	SPD	ST	MD	BD	BCE	BCA	HPED	SPED	BHPD	BSPD	ACMP	SACMP	BDD
Tasks (Z)	1		H					RPT						KS					HS				KS	ROT			
2															KT										KS	ROT	
3		KS	KH											KS	ROT			KS	IHM								
4										KS	ROT	HS	RPT														
5		KS							RUM			KS	ROT	HS	ROT		RUM										
6		KS										HS		HS	RUM	ROT	ROT										
7		KS	RUM	RUM	RUM	RUM								KS	ROT	RKT	ROT										
8		KS							ROT					HS	RUM	ROT											
9		KS				ROT			ROT						HT												
10		KS	HS											H	KS	ROT									KS	RKT	
11			HS																						KS	ROT	ROT
12							ROT		RHT						XT										HS		
13										KS	ROT	HS	ROT														
14										KS	RUM	KS	ROT														
15															RUM					HS	ROT					ROT	

For coding data content, the following symbols are used for positions and structural units:

- 1. General management (GM) includes:
 - General Director, TODEP (GD);
 - Chief engineer, TODEP (CE);

- Director, TODEP branch (BD);
- Branch Chief engineer, TODEP (BCE).
- 2. Financial and Economic Management (FEM) includes:
 - Chief accountant, TODEP (CA);
 - Accounting, TODEP (A);
 - Chief accountant, TODEP branch (BCA);
 - Head of Economics and forecasting department (HEFD);
 - Specialist of Economics and forecasting department (CEFD);
 - Head of Planning and economic department (HPED);
 - Specialist of Planning and economic department (SPED).
- 3. Procurement Management (PM) includes:
 - Head of Procurement department, TODEP (acceptance of applications, verification of documents, decision making / refusal) (HPD);
 - Specialist of procurement department TODEP (SPD);
 - Specialist of tender procurement (ST);
 - Head of Procurement department, TODEP branch (BHPD);
 - Specialist of Procurement department, TODEP branch (BSPD);
 - Head of asphalt and concrete mixing plant, TODEP branch (ACMP);
 - Specialist of warehouse at asphalt and concrete mixing plant (SACMP);
- 4. Production Management (PrM) includes:
 - Deputy General Director for production (DGDP);
 - Deputy General Director for construction (DGDC);
 - Deputy Director General for maintenance (DGDM);
 - Chief Technologist, TODEP (CT);
 - Specialist of technical control department (TCD);
 - Design and estimate department (DED);
 - Dispatching department, TODEP branch (BDD);
 - Marketing department (MD);
 - Lawyers, TODEP (L).

The results of calculations of the complexity of management tasks and the workload on employees are presented in table 5.

Table 5. Evaluation of the complexity of management tasks and the workload on employees in the material resources procurement management system.

D L	OAO TODEP														DRSU (branch of OAO TODEP)										Sum	Sum DL	DL	k _y	R _y			
	GM	PrM							FEM			PM			GM	FED			PM													
	GD	CE	DGDP	DGDC	DGDM	CT	TCD	DED	L	CA	A	HEFD	SEFD	HPD	SPD	ST	MD	BD	BCE	BCA	HPED	SPED	BHPD	BSPD						ACMP	SACMP	BDD
1		004					087							023					015				079	103				311	6	27	022	069
2															KT										023	103		126	3	27	011	014
3	079	016												079	103			079	093									449	6	27	022	100
4										079	103	071	087															34	4	27	015	050

	15	14	13	12	11	10	9	8	7	6	5
441						079	079	079	023	023	079
122					015	015			072		
072									072		
072									072		
072									072		
175							103		072		
103				103							
087											
349				071			103	103			072
125		023	023								
278		072	103								
203		023	015							015	079
396		103	103								103
365					004	023		071	079	015	071
748	072			06		103	06	072	103	072	103
285								103	079	103	
278									103	103	072
079											
108											
0											
015	015										
103	103										
079											
103											
084											
388	103			015	023	023					
103					103	079					
					103						
	293	221	244	249	248	322	345	428	747	331	579
	4	4	4	4	5	6	4	5	10	6	7
	27	27	27	27	27	27	27	27	27	27	27
		015	015	015	019	022	015	019	037	022	026
	043	033	036	037	046	072	051	079	277	074	150

So, the busiest in the process of managing the procurement of material resources were the General Director, the head and the specialist of Procurement department of TODEP, and the specialist of the warehouse at asphalt and concrete mixing plant of the TODEP branch. This is due primarily to the fact that the General Director and the head of the Procurement department are coordinators of the procurement management process and are involved in almost all tasks. Specialists are the main performers of all functions related to the organization of the procurement process. In this regard, it may be recommended to transfer some operations to less busy employees.

To manage the procurement of material resources, it is important that all participants and documents of the procurement information system are identified prior to the commencement of the procurement process. In this regard, it seems effective to use the operating processes chart for the management of the procurement process, developed on the basis of RAM (table 6).

Table 6. Operating processes chart for management of procurement of material resources.

	Sources of information necessary for solving problems (incoming information)	Document obtained as a result of solving problems (outgoing	Task performers	Document users	Approval	Participation
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		information)				
1	Design and estimate documentation; Applications from divisions	Statement of material resources	DED, BCE, BSPD	SPD, HEFD	BHPD, HPD, BCE	
2	Stocks on the balance of the warehouse, statement of material resources	Record keeping of balance material resources in stock	SACMP	SPD	ACMP	
3	Statement of material resources, record keeping of balance material resources in stock	Procurement plan, Calendar schedule of resources delivery	SPD, BCE	CE	HPD, BD, GD	
4	Construction budget, Procurement plan	Cost estimate	SEFD	A	HEFD, CA	
5	Calendar schedule of resources delivery, cost estimate	Procurement rules	SEFD, SPD	ST, MD	HPD, HEFD, GD	L, MD
6	Price lists, catalogs of material resources, Internet materials	Marketing research report, offers from potential suppliers	MD	ST	HPD, HEFD	
7	Act 44-FZ, report by Client's focus group	Tender documents	MD, SPD	ST	HPD, GD	DGDP, DGDC, DGDM, CE, CT, L
8	Tender documents; Act 44-FZ, Tender procurement rules	List of attested suppliers	ST, L	SPD	HPD	
9	List of attested suppliers	Contract of supply / sale and purchase	L, CT	SPD	GD	
10	Procurement plan by material resources / suppliers	Request for delivery according to the list of suppliers, specification	SPD	SACMP	HPD, SACMP, CE, GD	
11	Cover letter from the supplier, shipping notice	Shipping notice, forwarding conditions	Supplier (PIC), BDD	SACMP	SACMP	
12	Passport, certificate, shipping documents	Memo on the validity, fault certificate, claims and	L, TCD	A, SPD	SACMP	

		accounting of purchases and supplies				
13	Invoice	Payment	A	SEFD	HEFD, CA	
14	Cost estimate	Payment schedule	SEFD	A	HEFD, CA	
15	Order	Act of fulfillment of order	HPED	SACMP, SPD	HPED	

This chart allows presenting procurement management in the form of information flows at all stages of the procurement process.

4 Conclusions

The obtained results of approbation of such an organizational tool as RAM and the operating processes chart confirmed the possibility of reducing the workload of employees whose duties include procurement management functions and the possibility of work distribution. Also, the process of procurement centralization will be facilitated by the introduction of a corporate information system based on ERP-management of materials flow in procurement activities.

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