Chemical Technology, Control and Management

Volume 2018
Issue 3 *SPECIAL ISSUE 4-5*

Article 39

10-19-2018

Information-algorithmic support of decision-making in problems of primary processing of cotton-raw processes.

D.A Khalmatov
Tashkent Institute of Textile and Light Industry

G.R Alimova
Tashkent Institute of Textile and Light Industry

Kh.B Mirzaakhmedova
Tashkent Institute of Textile and Light Industry

U.O Khujanazarov
Tashkent Institute of Textile and Light Industry

Information-algorithmic support of decision-making in problems of primary processing of cotton-raw processes.

Cover Page Footnote

Tashkent State Technical University, SSC «UZSTROYMATERIALY», SSC «UZKIMYOSANOAT», JV «SOVPLASTITAL», Agency on Intellectual Property of the Republic of Uzbekistan

ISSN 1815-4840
CHEMICAL TECHNOLOGY. CONTROL AND MANAGEMENT
2018, Special issue №4-5 (82-83) pp.173-177. https://doi.org/10.34920/2018.4-5.173-177
International scientific and technical journal
journal homepage: https://uzjournals.edu.uz/ijctcm
Since 2005

INFORMATION-ALGORITHMIC SUPPORT OF DECISION-MAKING IN PROBLEMS OF PRIMARY PROCESSING OF COTTON-RAW PROCESSES

D.A.Khalmatov[1], G.R. Alimova[2], Kh.B. Mirzaakhmedova[3], U.O. Khujanazarov[4]

[1,2,3,4]*Tashkent Institute of Textile and Light Industry*

Abstract: *On the basis of the system-structural approach the formalized multilevel structure of information interaction technological to operation at the clap-raw processing, allowing to present in the uniform form set diverse the information and providing uniform information base for technological monitoring at decision-making support.*

Situational models of process of functioning of the technological units, considering multi-variant approach of modes of functioning of the units corresponding to various industrial situations are developed.

Algorithms of a choice of rational operating modes of technological units on the basis of the analysis of the generalised parametres corresponding to production schedules and operating modes of units are developed.

Keywords*: Information base, technological aggregates, information flows, model, rational mode, situation, algorithm, multi-level structure, system-structural approach, multi-level structure, raw cotton, situational models*

Introduction. In the conditions of complexity, dynamism and indistinctness of the characteristics of the production processes of cotton ginning enterprises (ХОП), the accumulation of knowledge about the models of the object, the methods of solving automation tasks, and also the tools corresponding to them is becoming more and more popular.

Large volume, complexity and interconnectedness flows and operational hundred yew cal information in accounting, control, and process control for cotton production causes so create an integrated information database (DB) for the automation solutions of control problems in the cotton industry.

To solve these problems, both completeness and reliability, as well as complex processing of all the accumulated technical and technological information on the processing of raw cotton, are needed. In the integration of these data, in their complex processing with the help of adequate models and tools for data collection, processing and storage, there are considerable reserves for improving the efficiency of operation of technological equipment and production.

On the other hand a number of tasks related to the creation of a common information space for primary processing of the control process of raw cotton, is the basis of information and control system for cotton production, we have not been adequately studied and addressed.

Materials and methods. Existing enterprise primary processing of raw cotton are characterized by a large number of processing units, performing various function x and x are related to each other like material, and the information plane [1].

Production of processing cotton functionally permit decomposition into sub whose structure x varies in time depending on factors such as changing the quality requirements of cotton fibers and raw cotton parameter, as well as the operation modes and states of units, varying e Technological regulations and production situation.

The activities of modern ginneries (CVD) associated with the movement of the interconnected and volumetric flow of material and information resources. Such resources management under the conditions of a dynamically changing environment requires quick decisions in a short time. The solution of this problem in modern conditions is impossible without the use of the achievements of information technology ency- variables.

Based on the study it especially the processing of raw cotton can be concluded that the complexity of the process control problems of processing of raw cotton is caused by presence of the following important factors:

- continuous-discrete technological cycle of primary processing of raw cotton in a multi-stage production process;
- the limitations of the composition of technological equipment and its use;
- probabilistic nature of the change in the parameters of processed cotton;
- complexity of processing raw cotton of different varieties and species on the same type of technological equipment;
- a plurality of parameters, where must be taken into account in decision-making;
- the multivariate acceptance of technological decisions depending on different production situations.

This circumstance to a certain extent complicates the decision of the task of making managerial decisions in different production situations.

One of the main problems in this case is the formation of an integrated information environment is, by creating a system based on a single data structure to use large data warehouses, as well as a universal integration platform that would bring together disparate technologies into a single product that allows you to solve the problem of enterprise application integration [2].

Such partitioning is, information flows creates prerequisites for structuring and and ordering and information exchange mechanism between the subsystems and management levels, allows creating be united th informational th based in production.

For creation of uniform information base of manufacture representation of managerial process of information streams in the form of the counts who are convenient for evident reflexion of interrelation of the mechanism of an exchange of the information between levels and subprocesses, being on one level is offered. Thus process of functioning of system during each moment of time can be characterised a condition r of th phase S-go a mode j of th process of functioning at λ th level of hierarchy. Splitting of process of functioning of difficult system into phases, modes and hierarchy levels allows to receive more trustworthy informations about a course of technological process and it is essential to simplify its description, allowing to consider multi-variant approach of operating modes of units [3].

At such approach the basic interest is represented only by such properties technological units which are essential to interface of the information streams received from each unit. Sets of entrance X and target information Y streams of units of system are with that end in view allocated Q.

Sets of entrance and $[X^{(jk)}]$ target streams $[Y^{(jk)}]$ of the information of the unit Q_j, the units interconnected among themselves in the information plan of the unit Q_k, are defined by parities

$$\begin{aligned}[X^{(jk)}] &= G_{kj}^{-1}\{[Y_l^{(k)}] \cap G_k([X_i^{(j)}])\} \\ [Y^{(jk)}] &= [Y_l^{j}] \cap G_k([X_i^{(k)}])\end{aligned}, \quad (1)$$

Where the operator G_{kj}^{-1} defines communication between entrance and target parametres j of units. Sets entrance and $[X_i^{(j)}]^*$ target information $[Y_l^{(k)}]^*$ of all units of system, are defined by parities:

$$[X_i^{(j)}]^* = \bigcup_j [X^{(j,0)}] \quad and \quad [Y_l^{(k)}]^* = \bigcup_k [Y^{(k,0)}] \quad (2)$$

According to the technique of decomposition of system accepted above on local elements it is possible to describe process of processing of a clap-raw at all levels of management of object in the form of set of the co-operating elements representing $\left[Q_{sr}^{j}\right]^{\lambda}$ fixed conditions of object on various phases of its functioning.

The combination of discrete managerial process and is discrete-process production on set of diverse parametres of processing of a clap-raw, uncertainty of an estimation of its condition and ambiguity in a choice of ways of the decision-making, which characteristic for management of process of processing of a clap-raw, construction of the situational models allowing квантовать information streams of operating influences on time and size cause. The situational model of

process of processing of a clap-raw as object of management is represented in terms of the accepted signature

$$M_{OY} = \langle O, \Omega, \Omega_\delta, P_S(\Omega), P_t(\Omega_\delta) \rangle \quad (3)$$

where $O = O_{CO} \cap O_{EO}$-set of the information on parametres of processes of processing of a clap-raw (drying, clearing, ginning etc.); O_{CO}-set of parametres, characterizing objects of control (CO); O_{EO}-set elementary operations; $\Omega = \langle O_1 \times O_2 \times O_3 \times ... \times O_n \rangle$-space of conditions of a control system, η-quantity of the information on clap-raw processings; Ω_δ-set of production schedules of processing of a clap-raw $\Omega_\delta \supset \Omega$; $P_S(\Omega)$-restrictions on production schedules $P_S(\Omega) \to \Omega_\delta$; $P_t(\Omega_\delta)$-rules of transitions of operating modes of units in space of conditions (a choice of a trajectory of movement): $\Omega_\delta^1 = P_t(\Omega_\delta^2)$, where Ω_δ^1, Ω_δ^2-conditions CO in the course of transition.

Industrial - i ю it is possible S_i to present a situation on set of conditions CO according to the accepted designations of concepts of a kind

$$S_i = \langle \Omega^{S_i}, P_{ij}(\Omega_\delta), U_K(t), \Omega_\delta^K, \varphi(\Omega_\delta^T, U_K(t)) \rangle, \quad (4)$$

where Ω^{S_i}-set of conditions CO making a situation S_i; Ω_δ^T-current condition CO; $P_{ij}(\Omega_\delta)$ -rules of formation of conditions Ω^{S_i}, for $P_{ij}(\Omega_\delta) \to \Omega^{S_i}$ ОУ at transition from j-oh to i-oh situations; $U_K(t)$-operating influences directed on final condition CO according to the purpose of management; Ω_δ^K -set of desirable final conditions CO; $\varphi(\Omega_\delta^T, U_K(t))$-rules of transformation of sizes of operating influences for transition CO from flowing in a new condition Ω_δ^H $\Omega_\delta^H = \varphi(\Omega_\delta^T, U_K(t))$

Splitting of space of conditions elementary ОУ on set of situations allows to construct space of situations in which decision-making for the account of a choice of sequence of change of situations or a trajectory of movement ОУ according to the management purpose is realised

The model of search of rational operating modes of units, характеризирующихся certain conditions on some time interval at the $[t_n, t_k]$known parametres of process corresponding to a certain structural condition, is represented in a kind:

$$\begin{array}{l} d_1, d_2, d_3, \ldots, d_w \in \\ \in \{D\}, f_1, f_2, f_3, \ldots, f_v \in \\ \in \{F\}, w << |\{D\}|, v << |\{F\}| \end{array}, \quad (5)$$

Also allows to order them on degree of importance of the given information:

$$\begin{array}{l} R(d_z) > R(d_x) > R(d_c) >, \ldots, \\ > R(d_t), \ z, x, c, t \le w; \\ R(f_{z1}) > R(f_{x1}) > R(f_{c1}) >, \ldots, > \\ > R(f_{t1}), \ z1, x1, c1, t1 \le v \end{array}, \quad (6)$$

where $d_1, d_2, d_3, \ldots, d_w$ and $f_1, f_2, f_3, \ldots, f_v$ - the information necessary for decision-making in the considered industrial situation; $R(d_z)$-rank of the information characterising d_z degree of importance of the information; w, v-quantity of the information, characterising an industrial situation; $z, x, c, t, z1, x1, c1, t1$-known constants; | | - a symbol of capacity of set.

Set of the interconnected functional blocks on the basis of information streams of entrance and target values of parametres and execution mechanisms define process structure.

Thus, during any any moment of time the condition of units of the enterprise is characterised S by set where $P_S = \langle X(t), Z(t) \rangle$ - $X(t)$ set of generally interconnected parametres, and on time depend both values of these parametres, and their structure, $Z(t)$-set of values of these parametres. Change also $Z(t)$ occurs $X(t)$ situationally, i.e.

$$(X(t_{i+1}), Z(t_{i+1})) = F(X(t_i), Z(t_i), A(t_{i+1})), \quad (7)$$

where $X(t_{i+1}), Z(t_{i+1})$ - values $X(t_i)$, after a $Z(t_i)$ fulfilment $(i+1)$ - th situations; - t_i, t_{i+1}-times of a fulfilment of two consecutive (i th and $(i+1)$ th) situations; $A(t_{i+1})$-attributes $(i+1)$ of th event; F - functional dependence of characteristics of units of the enterprise on occurring events.

As enterprise units represent system with the management, one part of parametres ($X(t)$

accordingly - and values $Z(t)$) is management parametres $X_C(t)$, and another - condition parametres $X_S(t)$.

On the basis of these models the algorithm of performance of operation of processing of the information is developed, allowing to define a rational variant of technological modes of units from set of the variants, corresponding to production schedules in a situation considered to time. The analysis of the generalised parametres corresponding to each level, a phase and a mode of functioning of units is thus made. On an algorithm input the vector of the parametres, containing defined information and forming j - group arrives

$$\widetilde{Y}_j^{(k)} = \left|\widetilde{y}_{j1}^{(k)}, \widetilde{y}_{j2}^{(k)}, ..., \widetilde{y}_{jn}^{(k)}\right|^T \qquad (8)$$

Set of possible values of parametres by means of $y_{j1}^{(k)}, y_{j2}^{(k)}, ..., y_{jn}^{(k)}$ display факторизации

$$V_j^{(k)} : \widetilde{Y}_j^{(k)} \to {}^{\Phi} Y_j^{(k)} \qquad (9)$$

Breaks into not crossed classes forming quotient sets:

$${}^{\Phi} Y_j^{(k)} = \{{}^{\Phi} y_{j1}^{(k)}, {}^{\Phi} y_{j2}^{(k)}, \ldots, {}^{\Phi} y_{jn}^{(k)}\} \qquad (10)$$

To each degree of product availability supervised the parametres defined as a result of processing of the information, there corresponds a certain subset of current values of parametres of the group united by some general properties, i.e. such for which the same decision can be accepted. Set of controllable parametres of technological units we will present in a kind:

$${}^{O} Y_j^{(k)} = \{{}^{O} y_{j1}^{(k)}, {}^{O} y_{j2}^{(k)}, \ldots, {}^{O} y_{jn}^{(k)}\}, \qquad (11)$$

where ${}^{O} y_{ji}^{(k)}$, $i = 1, n$-number of a condition of the parametre $y_{ji}^{(k)}$, defined on factorial space of its possible conditions ${}^{\Phi} y_{ji}^{(k)}$, about the help from implication displays is put in conformity a quotient set: group parametres

$$H_{j1}^{(k)} : {}^{O} Y_j^{(k)} \to {}^{\Phi} Y_j^{(k)}, \qquad (12)$$

And also a vector of probabilities of occurrence of a condition of units

$$H_{j2}^{(k)} : {}^{O} Y_j^{(k)} \to P_j^{(k)} \qquad (13)$$

Sets ${}^{\Phi} Y_j^{(k)}$, also ${}^{O} Y_j^{(k)}$ form the $P_j^{(k)}$ initial data for algorithms and are formed beforehand prior to the beginning of information processing.

For reception of an estimation of the generalised parametre on kth layer under the information containing in time section j of th group, it is necessary to execute display

$$\theta_j^{(k)} = \eta_{j1}^{(k)} \cap \eta_{j2}^{(k)} \cap \psi_j^{(k)}, \qquad (14)$$

where $\eta_{j1}^{(k)}$-display классифицирования a current vector of estimations of parametres (8) in a current vector of numbers of conditions of the parametres defined on a quotient set (10); $\eta_{j2}^{(k)}$-display классифицирования a current condition of units on set of possible kinds (11); $\psi_j^{(k)}$-display of estimation of a current condition of units of a controllable subsystem.

Display is set $\eta_{j1}^{(k)}$ in a kind

$$\eta_{j1}^{(k)} : \widetilde{Y}^{(k)} \times {}^{\Phi} Y_j^{(k)} \to {}^{T} Y_j^{(k)}; \qquad (15)$$

$${}^{T} Y_j^{(k)} = \{{}^{T} y_{j1}^{(k)}, {}^{T} y_{j2}^{(k)}, \ldots, {}^{T} y_{jn}^{(k)}\}, \qquad (16)$$

where ${}^{T} y_{ji}^{(k)}$, $i = 1, n$-current issue of a condition of parametre $y_{ji}^{(k)}$.

Display is defined $\eta_{j2}^{(k)}$ as

$$\eta_{j2}^{(k)} : {}^{T} Y_j^{(k)} \times {}^{O} Y_j^{(k)} \to Y_j^{(k+1)}, \qquad (17)$$

where $Y_j^{(k+1)}$-set of current values of the generalised parametre received $Y_j^{(k+1)}$ as a result классифицирования on k-м level. Display is set $\psi_j^{(k)}$ in a kind

$$\Psi_j^{(k)} : Y_j^{(k+1)} \times P_j^{(k)} \to \widetilde{Y}_j^{(k+1)}, \qquad (18)$$

where $\widetilde{Y}_j^{(k+1)}$-set of estimations of the generalised parametre received $y^{(k+1)}$ on an exit of algorithm, realising a problem of processing of the information.

In the course of performance of operation of processing of the information the matrix showing every possible operating modes of units (tab. 1 is formed.)

The choice of rational modes of units on this matrixes is carried out on following algorithm

1. On the basis of the analysis of indicators of a processed clap-raw the set of the decisions providing performance of the plan is formulated and $Y = \{y_l\}$, $l = \overline{1,k}$ registers in the left column of the table of conformity.

2. On the basis of the analysis of production schedules of a condition of the equipment the set of the conditions influencing the decision is formulated.

3. On the basis of the analysis of a condition of the equipment for each condition the set of values of this condition (the operating modes of the equipment corresponding to performance of production schedules) is defined. $X = \{X_{ji_j}\}$ $i_j = \overline{1, n_j}$ set of possible decisions and $Y = \{y_l\}$, $l = \overline{1,k}$ set of possible values of conditions $X = \{X_{ji_j}\}$, define a $i_j = \overline{1, n_j}$ matrix of conformity dimension: $K \times \sum_{j=1}^{m} \sum_{i_j}^{n_j} i_j$.

Table 1.

A matrix of multi-variant approach of operating modes of units.

Variant of technological process (index $i = \overline{1, I}$)	Сорти a made clap-raw (index $m = \overline{1, M}$)																	
	1				2				…	m				…	M			
	Stages of technological process (index $l = \overline{1, r_1}$)				Stages of technological process (index $l = \overline{1, r_2}$)				…	Stages of technological process (index $l = \overline{1, r_m}$)				…	Stages of technological process (index $l = \overline{1, r_M}$)			
	1	2	…	r_1	1	2	…	r_2	…	1	2	…	r_m	…	1	2	…	r_M
1	q_{11}^1	q_{11}^2	…	$q_{11}^{r_1}$	q_{12}^1	q_{12}^2	…	$q_{12}^{r_2}$	…	q_{1m}^1	q_{1m}^2	…	$q_{1m}^{r_m}$	…	q_{1M}^1	q_{1M}^2	…	$q_{1M}^{r_M}$
2	q_{21}^1	q_{21}^2	…	$q_{21}^{r_1}$	q_{22}^1	q_{22}^2	…	$q_{22}^{r_2}$	…	q_{2m}^1	q_{2m}^2	…	$q_{2m}^{r_m}$	…	q_{2M}^1	q_{2M}^2	…	$q_{2M}^{r_M}$
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
I	q_{I1}^1	q_{I1}^2	…	$q_{I1}^{r_1}$	q_{I2}^1	q_{I2}^2	…	$q_{I2}^{r_2}$	…	q_{Im}^1	q_{Im}^2	…	$q_{\mathrm{Im}}^{r_m}$	…	q_{IM}^1	q_{IM}^2	…	$q_{IM}^{r_M}$

4. For each decision in y_l l th line of the table in cages corresponding to those values of conditions for which the given decision exists, are filled with units.

Results. On the basis of the developed models of managerial process processing of a clap-raw and algorithms of a choice of rational operating modes of technological units creates a program complex of KSPPUR ХОП, allowing to automate the decision of a problem of technological monitoring and acceptance of administrative decisions.

The programmno-tool environment of support of formation of a database of process of processing of a clap-raw and acceptance of administrative decisions is developed at the various industrial situations, allowing to unite information streams for operative multilevel decision-making in problems of management of process.

Discussion and conclusion. On the basis of the system-structural approach the formalized multilevel structure of information interaction technological to operation at the clap-raw processing, allowing to present in the uniform form set diverse the information and providing uniform information base for technological monitoring at decision-making support.

Situational models of process of functioning of the technological units, considering multi-variant approach of modes of functioning of the units corresponding to various industrial situations are developed.

Algorithms of a choice of rational operating modes of technological units on the basis of the analysis of the generalised parametres corresponding to production schedules and operating modes of units are developed.

REFERENCES

1. Directory on clap preprocessing. In 2 t./I.T.Maksudov. – Tashkent: Меҳнат, 1994.-573 with.
2. Chernorutsky I.G. decision-making Methods. – SPb.: BHV-Peterburg, 2005. – 456 p.
3. Setmetov N.U. Algorithmization of process of acceptance of administrative decisions in manufacture of primary processing of a clap-raw//Chemical technology. Control and management. - Tashkent, 2011. - №5. – С.87-90.