РАЗДЕЛ VIII. МЕНЕДЖМЕНТ

Bondarevskiy A.S., Lebedev A.V.
Pseudo-control in ERP control systems

*JSC «Angstrom-T»
(Russia, Zelenograd, Moscow)*

doi: 10.18411/gdsn-25-12-2018-11

idsp: scienceconf-25-12-2018-11

The defining attribute of automated management systems of the industrial enterprises ERP is an approach process. Here, - approach carried out in ERP systems is main, target management operation.

Such approach and the ERP systems implementing it were introduced in the 2000's and following years by such ISO international standards, as GOST R ISO 9001-2001 [1, p. IV], GOST R ISO 9000-2001 [2, p/ 4], and GOST R ISO 9001: 2015 [3, p. 3].

Now, ERP systems are the most well-known and widely applied means of industrial enterprise automated management, both in Russia and abroad.

Among these systems, according to TAd viser research center, the highest ratings are awarded to 1C:ERP, «Galactika ERP0», SAP ERP, MS Dynamics AX, MS Dynamics NAV.

These ERP systems use several dozens of various functional operations such as: production management (drawing up roadmaps, tracking the production release of device batches, handling batches to be released into production, establishing group and personal tasks for work, etc); fund management (acceptance of payments, formation transactions, calculating VAT, etc); human resource management (registration of personnel, maintaining the staff list, etc)

From all these kinds of operations "control ERP system" exactly Control makes less 50 percent of make less than 50 percent from all existing operations. 50 percent consist of only classical control. In this case - operations which are defined as reproduction of the required task, - settings - free information [5]. At the same time, - reproduction of a setting - free information in such look, preferable to the user, as substances (matters (case of material management), or

- information [too free, but different from a setting - free information's what, this time, - is already information free-predpoch tritely for the user (a case of information management)].

Fig.1. Flowcharts of material and information management

Examples of material management, - "manipulation of start of parties" (see above) and management in industrial control system".

Examples of information management (see above), - "drawing up route charts", "drawing up group and personal tasks for work".

And further we will note that, - it follows from requirements of the ISO standards [1-3] marked above, the automated management exercised in the ERP systems aims at achievement by the enterprises of "the planned results". I.e., - aims at providing with the enterprises operated by the ERP systems, preset values of target technical and economic indicators.

Fig.2 Illustration of multidimensionality of an object of management of a regogulirovaniye with object feedback

In this case, - such as, for example, release of the set quantity of the made products at, say, receiving the maximum profit and observance of restrictions for, let us assume, profitability of production, payback periods of investments, return of loan investments, etc.

Qualitative (precision), - having the guaranteed results of management. Here, - the material and information management closed i.e., - with feedback (I. Polsunov-T. Crapper-J.Watt-N. Wiener).

2) Management multidimensional, i.e., - multicoherent (M.D. Mesarovic) [6].

And as shows the analysis marked above rating in Russia and behind a boundary of ERP control systems, in all of them not only that the stated control is exercised only for 50%, but this management is also is total to straight lines, - opened (without feedback). I.e. this management represents not guaranteeing workmanship executive influences. And, - the main thing, this management as it appears, is not multidimensional (multicoherent), and only one-dimensional (one-coherent). I.e. it turns out that real-life control systems of ERP marked higher than 1) and 2) to requirements of standards

ISO as it appears, don't satisfy. And it, thus, means that now all operating systems of automated management of ERP systems of ERP are only in names, - nominally, and actually they aren't such systems.

Exit, - in reengineering of what unfairly is called today as "the systems of automated management of ERP".

1) Transition from the management of type applied today in the ERP systems direct - opened (without feedback) regulations on the regulation pretsi-zionno-guaranteed, here, - with feedback.

2) Multicoherent management regulation with feedback.

3) Modeling of an object of management.

4) Check of controllability of objects of management [the ERP systems of subitem 1), 2)] by R.E. Kallman's criterion [8].

5) In case of non-performance of criterion of R.E. Kallman, - implementation in the ERP systems nonclassical (not Wiener) coordinate and parametrical unitary enterprise of a ravleniye. Here, as it turns out, - managements on model and in the accelerated time scale [9]. So:

1. Transition to closed, - with feedback, to regulation. Multicoherent regulation with feedback. Modeling of an object of management.

The offered transition from applied today in the ERP systems direct-razomk nuty (without feedback) regulations on precision, - with feedback, material or information regulation is presented in fig. 2. time scale [9]. So: precision, - with feedback, material or information regulation.

Fig. 3. Transition from direct - opened (without feedback) regulations on

And further we note that even upon transition to it, - precision, management - regulation, the main requirement of the ISO standards [1-3], - achievement by the enterprises with the ERP systems of "the planned results", i.e., - providing with the enterprises operated by the ERP systems, preset values of target technical and economic indicators nevertheless isn't carried out.

The reason, - use in today's ERP systems as objects of management of subsystems the enterprise (in this case, - the subsystems production providing, accounting and economic and financial) separately.

Here, and it turns out that for implementation of the main requirement of the ISO standards [1-3], - achievements by the enterprises with the ERP systems of "the planned results" (providing with the enterprises operated by the ERP systems, preset values of target technical and economic indicators) should be used it is called by above a subsystem of the industrial enterprises not as today, independently, - separately, and joint in total, - kros-sirovanno.

Below, - in fig. 3, such object of ERP management demanded by the ISO standards [1-3] is presented, - krossirovanny main subsystems of the industrial enterprise.

Fig3. Object of ERP control system correspond of ISO standards

Check of controllability of objects of management by R.E. Kallman's criterion

For this purpose, on the basis of presented in fig. 3 flowcharts of an object of management of the ERP systems, we will write down his equations (for simplicity, - without criterion functions of a financial subsystem of R3). In this case, - such equations, as

$$R_1 = S_1 W_1 W_2 = S_1 W_1 = S_1 \frac{G_1(p)}{F_1(p)} \quad (1)$$

$$R_2 = S_1 W_1 W_3 = S_1 W_2 = S_2 \frac{G_2(p)}{F_2(p)} \quad (2)$$

Where:

S_1 and S_2 - Laplace's transformations from the corresponding temporary originals;
 $G_1(p)$, $G_2(p)$, $F_1(p)$, $F_2(p)$ – polynoms from p (p – argument in Laplace's operator)

We will rewrite the equation(1) in following view :

$$R_1 F_1(p) = S_1 G_1(p), \text{ or, simply } R F_1(p) = S G_1(p)$$

From where follows, that:

$$(p^n + a'_{n-1}p^{n-1} + a'_{n-2}p^{n-2} + \dots + a'_2p^2 + a'_1p + a'_0)R = (b'_mp^m + b'_m p^{m-1} + b'_{m-1}p^{m-1} + \dots + b'_2p^2 + b'_1p + b'_0)S \quad (3)$$

Where $m < n$

After that will transform the equation (3) in the system of the operator matrix equations of states n -го порядка, having presented her in the matrix normal form of Cauchy:

$$pR = A'R + B'S \quad (4)$$

we will make the same for equation (2):

$$pR = A''R + B''S \quad (5)$$

After that, having united the matrix equations (4) and (5), we will get final equation, - which describe presented on fig.3 block schema of object of management of the ERP control systems. In our case we will get matrix equation:

$$pR = AR + BS \quad (6)$$

Using A and B coefficients of resultant equations (6), we will design a matrix of controllability of R.E. Kallman [8]:

$$\|B|AB| \dots |A^{n-1}B|\| \quad (7)$$

Then criterion of controllability of R.E. Kallman for the linear stationary objects described by the equations (1),(2) will have an appearance:

$$\text{rank}(\|B|AB| \dots |A^{n-1}B|\|) = N \quad (8),$$

Where N – rank matrix A in equation (6).

And now we will pay attention that as shows the analysis, all objects of management presented by krossirovanny main subsystems of the industrial enterprises, if still to operate them Wiener, - coordinate, methods, are uncontrollable.

There, - uncontrollable by criterion of controllability of R.E. Kallman (8), in this case has

$$\text{rank}(\|B|AB| \dots |A^{n-1}B|\|) < N \quad (9)$$

Physically it means existence in such objects of management not control execution - output variables coordinates. In the case under consideration, - uncontrollable target functions - R1, R2.

Solution: transition from taking place now coordinate (Wiener, - cybernetics of the 1st order) managements to coordinate parametrically management [9] (cybernetics of the 2nd order of St. Beer, W.R. Ashby, U. Mac-Kallokh, G. von Foerster, G. Beytson).

The beginning of hard works on coordinate parametrically management, in this case, - to control of aircraft, it is accepted to carry to 1968 when at Institute "Automatic equipment and telematics" the Academy of Sciences of the USSR (nowadays - "Institute of problems of management" of RAS) has been created by the academician of Academy of Sciences of the USSR B.N. Petrov the laboratory No. 42 of the same name headed by professor V.Yu. Rutkovsky [10]. At the same time as the operating influences in the marked management not only entrance coordinates of objects historically are used, - aircraft, but also parameters of control facilities these devices. But it is known that the academician B.N. Petrov pointed also to a possibility of parametrical impact not only on means, but also to objects of management. Here, thus, - influences technogenic, because impacts on aircraft.

Feature of coordinate steam of metric management offered for reengineering of the ERP systems, here, thus, - systems not technogenic, but social, is influence not on real means and objects of management, and, - impacts on models of objects of management. And for this reason, - implementation of management in the ERP systems according to fig. 5 is. In this case, - implementation of coordinate and parametrical management [9]:

- on model of the ERP systems,
- in the accelerated time scale,
- in regime of the adviser.

Fig. 5 The flowchart of coordinate and parametrical management in the ERP systems

As shown in fig. 5, model of a control object of the ERP systems (in this case, - imitative) together with the control algorithm it, here, - optimum (extremal regulation [11] with restrictions) are programmed on a computer. At the same time results of it (in fast time scale) controls, - best values of coordinate of $S1m$ and vector of parameters Rm are transferred to the expert-operator who having evaluated them by criteria of physical implementability and feasibility, transfers, this time, already estimates of $S1$ and P $S1m$ variables and Rm to a circuit of real time, - to a control object of the ERP systems (i.e. the ERP systems).

Conclusions

1. In today's ERP systems control is exercised by only 50% of operations. The others are operations of monitoring and processing of information (a phenomenon of "pseudo-management" in ERP control systems).

2) At the same time management of item 1, except for industrial control system, is opened, - without feedback. And it means, - not guaranteeing target naznachey.

3) At the same time management of item 1 is one-coherent, - ERP focused on the main subsystems (production providing accounting эконо мическy, financial) separately. And it means, - not fulfilling the requirement of the ISO standards, fundamental for the ERP systems. In this case, - ERP of the purpose which isn't carrying out control systems: achievement by such enterprises of "the planned results" (i.e. not providing with the enterprises with the ERP systems of preset values of target technical and economic indicators).

4) Result of limitations of subitem 1-3: now all operating systems of automated management of ERP systems of ERP are only in names, - nominally, and actually they aren't such systems.

5) An exit, - reengineering of control systems of ERP which functionally consists in:

a) Creation of models of objects of management of the ERP systems, - imitating models systemically the main subsystems of ERP connected (krossirovannykh).

b) To check of these models (objects of management of the ERP systems) on performance of criterion of controllability of R.E. Kallman.

c) In case of not performance of this criterion, - use in the ERP systems of multicoherent coordinate and parametrical management.

d) Technical realization of reengineering of control systems of ERP: implementation in them multicoherent with feedback coordinate параметрического managements on imitating model of an object of management. Here, - optimum control by means of an algorithm of extreme regulation with restrictions in the accelerated time scale and in regime of the adviser.

e) Result of reengineering of control systems of ERP, - implementation of requirements of the fundamental ISO standards by them and, therefore, - performance of ERP of the purpose by control systems.

1. GOST R ISO 9001-2001. - M.: StandartInform, 2001 (Standard ISO 9001. Version 2001. Demands)
2. Standard ISO 9001. Version 2001. Basic provisions and vocabulary
3. ISO 9001:2015. Quality management systems - Requirements // <https://www.iso.org/standard/62085.html>
4. TAdviser// <http://www.tadviser.ru/index.php/>
5. Bondarevsky A.S. Concept and varieties of information//Modern science-capacious technologies. - 2006. - No 6
6. Mesarovic M. D. Takahara Y. General systems theory: mathematical foundations. - New York San Francisco London: Academic press, 1975
7. Beer St. Cybernetics and Management. - London: English Universities, 1956
8. Kalman R.E.. On the general theory of control systems//Proceeding first IFAC Congress on Automatic Control, Moscow, 1960. Vol. 1. - London: Butterworths, 1961
9. Bondarevsky A.S., Lebedev A.V. About second order cybernetics: the scientific bases and criterion of applicability of coordinate-parametric control//International Journal of Applied and Fundamental Research - 2010. - No. 5
10. Petrov BN, Rutkovsky V.Yu., Zemlyakov S.D. Adaptive coordinate-parametric control of non-stationary objects. - Moscow: Nauka, 1980
11. Tsien H.S. Engineering Cybernetics. - New York, Toronto, London: McGraw-Hill Book Company