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# REFLEXIVE MANAGEMENT OF THE DIFFUSION OF ENTERPRISE INNOVATIONAL ACTIVITY RESULTS

***Urgency of the research.*** *The importance of reflexive management research is conditioned by the necessity of enterprise competitiveness insurance in a way of the increase of the level information supply and the ability to react to the changes of market juncture and consumers requirements.*

***Target setting.*** *Theoretical insight into the evolution of the notion reflexion and the investigation of the peculiarities of functional model structure of reflexive management are appropriate here.*

***Actual scientific researches and issues analysis.*** *Scientific research by O. V. Avilova, A. V. Burakova, V. M. Hurievska, O. V. Dobrozorova, R. M. Lepa, V. O. Lefevra, V. Ye. Lepskyi, M. V. Malchik, V. H. Marach, M. I. Naydenova, D. O. Novikova, T. Yu. Oharenko, O. I. Pokotilova, O. I. Pushkar, R. A. Rudenskyi, L. N. Serheyeva, H. L. Smolyan, T. A. Taran, T. L. Tomas, A. H. Chkhartishvily, V. M. Shemayev, H. P.Shchedrovytskyi, and others.*

***Uninvestigated parts of general matters defining.*** *Reflexive management of the diffusion of enterprise innovational activity is a rather new direction of scientific research and needs the imperfection of both theoretical basis and practical experience.*

***The research objective.*** *The paper is dedicated to the researching of the notion of reflexive management, structuring and reasoning with the help of matrix games the model of the managerial decisions formulation variants in the reflexive management of the diffusion of the results of enterprise innovational activity and a functional model of reflexive management.*

***The statement of basic materials.*** *The paper considers the advisability of reflexive management of the diffusion of innovational activity results and the structure of the functional model of reflexive management.*

***Conclusions.*** *The method of matrix games can prove the rise of probability of reflexive management insurance of economically reasoned results and define optimal strategies of reflexive management during the interaction with a competitor, consumer (user) of the object of diffusion.*

***Keywords:*** *diffusion of innovations; reflexive management; functional model of reflexive management.*

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# РЕФЛЕКСИВНЕ УПРАВЛІННЯ ДИФУЗІЄЮ РЕЗУЛЬТАТІВ ІННОВАЦІЙНОЇ ДІЯЛЬНОСТІ ПІДПРИЄМСТВ

***Актуальність теми дослідження.*** *Важливість вивчення рефлексивного управління визначається необхідністю враховувати індивідуальні особливості споживання, психологічні аспекти економічних процесів дифузії результатів інноваційної діяльності.*

***Постановка проблеми.*** *Доцільним є проведення теоретичного аналізу еволюції поняття рефлексії, рефлексивного управління і можливості побудови функціональної моделі рефлексивного управління.*

***Аналіз останніх досліджень і публікацій.*** *Наукові праці таких вчених, як О. В. Авілова, А. В. Буракової, В. М. Гурієвської, О. В. Доброзорової, Р. М. Лепи, В. О. Лефевра, В. Є. Лепського, М. В. Мальчик, В. Г. Марача, М. І. Найденова, Д. О. Новікова, Т. Ю. Огаренко, О. І. Покотилової, О. І. Пушкара, Р. А. Руденського, Л. Н. Сєргєєвої, Г. Л. Смоляна, Т. А. Таран, Т. Л. Томаса, А. Г. Чхартішвілі, В. Н. Шемаєва, Г. П. Щедровицького та ін.*

***Виділення недосліджених частин загальної проблеми.*** *Рефлексивне управління дифузією результатів інноваційної діяльності підприємств є новим і не вистачає як теоретичної бази, так і досвіду практичного використання.*

***Постановка завдання.*** *Стаття покликана дослідити поняття рефлексивного управління, побудувати та обґрунтувати за допомогою матричних ігор модель формування варіантів управлінських рішень у рефлексивному управлінні дифузією результатів інноваційної діяльності підприємства і функціональну модель рефлексивного управління.*

***Виклад основного матеріалу.*** *У статті обґрунтовується доцільність використання рефлексивного управління дифузією результатів інноваційної діяльності для побудови функціональної моделі рефлексивного управління.*

***Висновки.*** *Метод матричних ігор може підтвердити зростання ймовірності забезпечення рефлексивним управлінням економічно обґрунтованих результатів, а також визначити оптимальні стратегії рефлексивного управління у взаємодії з конкурентом, споживачем (користувачем) об'єкта дифузії.*

***Ключові слова:*** *дифузія інновацій; рефлексивне управління; функціональна модель рефлексивного управління.*

**The topicality of the research.** The efficiency of innovational activity of enterprise under modern conditions depends on the efficiency of the spreading of the results of this activity under certain market

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conditions. Traditional methods and approaches to the innovations diffusion management do are not always successful and do not account for individualities of consumption, psychological aspects of economic processes [1]. Therefore, the introduction of reflexive management will be appropriate, it will contribute to successful competitiveness, the rise of innovational activity at the stage of innovational goods spreading and innovational potential rise.

To solve particular issues, including functional models of innovations spread, we consider the application of reflexive approach and matrix games a rather appropriate alternative.

**Formulation of the problem.** To reveal the possibility to successfully apply modern social and psychological technologies for diffusion management it is primarily necessary to conduct a theoretical analysis of the notions of reflexion, reflexive management, which possess a great range of both personality features and preconditions of reflexive approach in management application.

**Latest researches and publications analysis.** Among the researches done by prominent scientists who investigated the entity of innovations diffusion the following works are worth attention. These are the works by R. Byers, G. Emrik, G. Colleman, G. Pope, E. Rogers, V. Ruttan, J.-G. Tardo, Y. Shumpeter. The issues of innovations diffusion predictions were investigated by F. Bass, N. Chuhray, H. Shamota. A sociological aspect of diffusion was investigated by S. Baran, Neil. S. Gross, K.Dennis, E. Kats, P. Lazerfeld, B. Ryann. In their turn, Yu. Anisimov, I. Borisenko, Geoffrey A. Moore, R. Peres, V. Mahadgan, E. Muller, P. Maslyak, Ya. Oliynik, V. Otenko, A. Pylypenko considered innovation diffusion from the point of view of communicative and marketing approaches.

The matter of reflexive management is revealed in scientific researches of the founder of the given theory V. O. Lefevra. National and foreign researchers follow. These are O. V. Avilova, A. V. Burakova, V. M. Hurievska, O. V. Dobrozorova, R. M. Lepa, V. Ye. Lepskiy, M. V. Malchyk, V. G. Marach, M. I. Naydenova, D. O. Novikova, T. Yu. Oharenko, O. I. Pokotylova, O. I. Pushkar, R. A. Rudenskiy, L. N. Srgeyeva, H. L. Smolyan, T. A. Taran, T. L. Tomas, A. H. Chkhartishvili, V. N Shemayeva, H. P. Shchedrovytskiy and others.

**The outline of unsearched parts of the main issue.** Despite the amount of scientific papers and the achievements in the theory of reflexive management, there remains a part of problems which are considered to be unsolved and controversial. Concerning the models of reflexive management of the diffusion of the innovational activity results, such application of reflexive management is new and it lacks both theoretical basis and practical experience.

**Setting objectives.** The purpose of the paper is to investigate the notion of reflexive management, build and reason the model of managerial decision formation variants in reflexive management diffusion of the results of innovation activity of an enterprise and a functional model of reflexive management.with the help of matrix games.

**The presentation of the main issues.** Reflexive influence on the competitors and consumers (users), the objects of diffusion has an informational feature. Its use is directed towards the choice of irrational managerial decisions by the subjects which are under reflexive influence. The basis of reflexive management is namely a manipulation of managerial information. H. Smolyan rightly states that a manipulative influence on the personality, one's views and emotional sphere, individual, group and mass awareness is the tool of a psychological pressure with the aim of direct or hidden prompting of individual or social subjects to make decisions and actions as well to their own benefit and of those of separate groups and organizations which influence [2]. In one's turn, the founder of the conception of reflexive management L. Lefevr specifies that there are a few types of reflexive management, including: manipulation with the help of influence( direct influence); manipulation in a way of attitude change( among the individuals in the group); manipulation with the priority order; the influence on subconscious part of subject's being [3]. The scientist claims, as reflexive management has informative feature, then key categories of such management are awareness and subjects' will freedom, who are under reflexive influence [2]. V. Hurievska is convinced that «… reflexion directed to long-term consequences ensures inevitable changes, since it influences deep structures of the personality and the management system…» [4]. For a diffuser (the subject who influences reflexively) to achieve deep structure changes in competitors and consumers' views demands being able to operate the methods of systemic and cognitive analysis, theory of individual choice and perspectives [5].

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Manage subjects make managerial decisions on the basis of intuition and scientifically-reasoned approaches.

Under the conditions of reflexive management diffusers can make conditions under which their competitors, consumers of the objects of diffusion can make two-fold decisions in management and consumption matters. As a result of that it can lead to irrational decisions. Diffusers' manipulative influence can be accompanied by the pressure of the government, disinformation and intrusion into time and content aspects of decision making algorithm. According to S. Komova, there are typical forms of reflexive influence. These are the following: attention distraction, overloading, paralyzing, exhaustion, deceit, split, soothing, threatening, provocation, offer, pressure [6; 7]. As a result of consciousness and the competitors and consumers' will freedom manipulation there arouse alternative trajectories of their market behavior (Pic. 1).
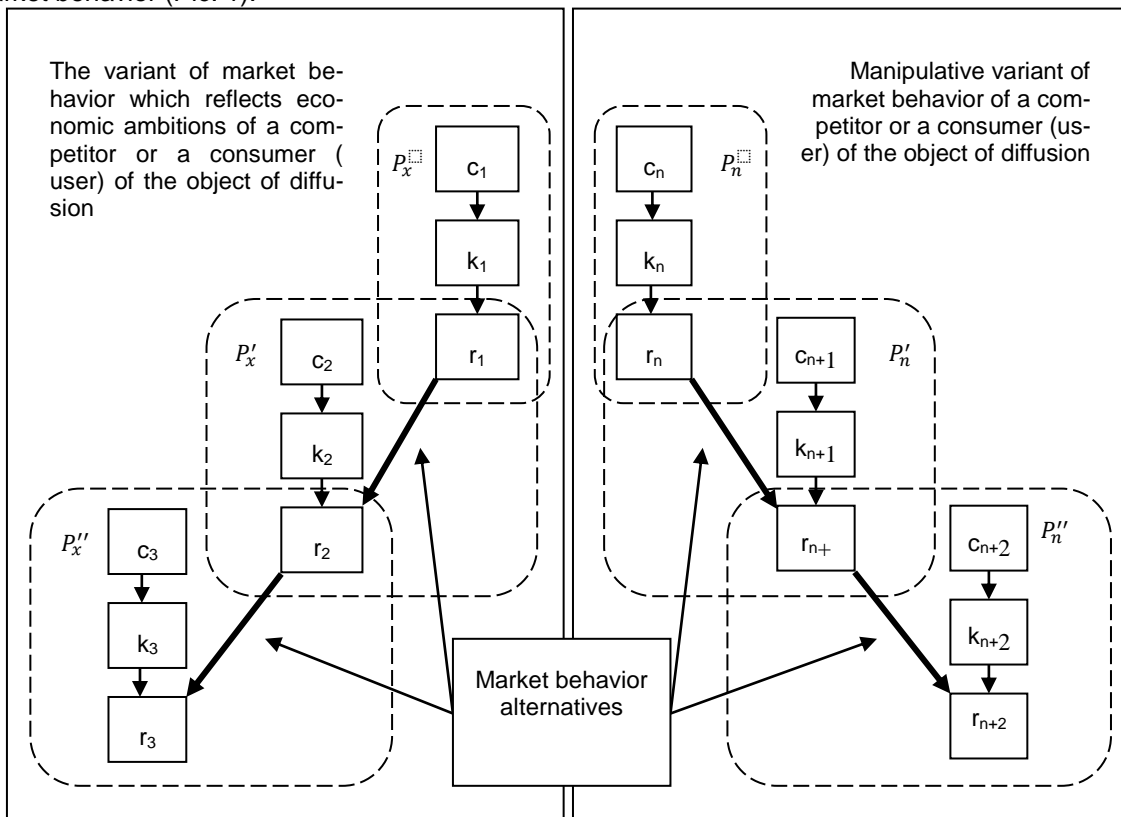


**Pic. 1. Alternative trajectories of market behavior of competitor or consumer( user) of the object of diffusion**

*Resource:* Author's development; $P_x$ ; $P_x'$; $P_x''$; $P_n$ ; $P_n'$; $P_n''$ - the variants of market behavior

Conducted research revealed that reflexive management components are:
1) the formation of the family sets *Fam (P)*;

$$Fam(P) \begin{cases} P_x = f(c_1; k_1; \ r_1) \\ \dots\dots\dots\dots\dots\dots \\ P_y = f(c_3; k_{n3}; \ r_3), \\ \dots\dots\dots\dots\dots\dots\dots \\ P_n = f(c_n; k_n; \ r_n) \end{cases}$$

where $Fam(P)$ – is a family set which include all possible variants of market behavior of the competitor or consumer( user) of diffusion;

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$P_x, P_y$ – elements sets, which represent the variants of market behavior which reflect economic ambitions of competitor or consumer( user) of the object of diffusion;

$P_n$ – elements sets, which represent a manipulative variant of market behavior of competitor or consumer (user) of the object of diffusion;

$c_1$ –the aims, which represent economic ambitions of competitor or consumer(user) of the object of diffusion;

$k_1$ – the criteria of goals realization, which represent economic ambitions of competitor or consumer (user) of the object of diffusion;

$r_1$ – managerial decisions, which represent economic ambitions of competitor or consumer (user) of the object of diffusion;

$c_n$ – the aims of competitor and consumer (user) of the object of diffusion, which arise as a result of diffuser's manipulative influence;

$k_n$ – criteria of realization of the goals of competitor or consumer (user) of the object of diffusion, which arise as a result of diffuser's manipulative influence;

$r_n$ – managerial decisions, made by competitor or consumer (user) of the object of diffusion which are approved as a result of diffuser's manipulative influence.

The logics of formation of *Fam (P)* is the following:

$$\forall P_n(P_n \in Fam(P) \rightarrow P_n \subseteq P) \land \forall P_n(P_n \subseteq P \rightarrow P_n \in Fam(P) \Leftrightarrow$$

$$\Leftrightarrow \forall P_n(P_n \in Fam(P) \Leftrightarrow P_n \subseteq P), \tag{1}$$

where *P* – the variants of market behavior of competitor or consumer (user) of the object of diffusion.

2) Reservation of one or a few variants of behavior in family set of *Fam (P)*;

3) elimination of one or a few variants of behavior in family set of *Fam (P)*;

4) reverse of one or a few variants of behavior in family set of *Fam (P)*.

On Pic. 2 a graphic model of the formation of managerial decisions in reflexive management of diffusion of the results of enterprise innovational activity is depicted.
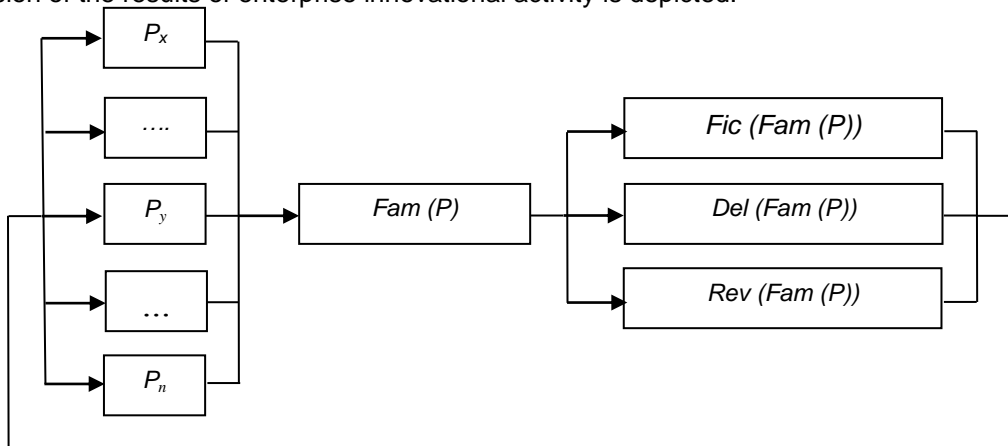


**Pic. 2. The model of the formation of managerial decisions in reflexive management of enterprise innovation activity results**
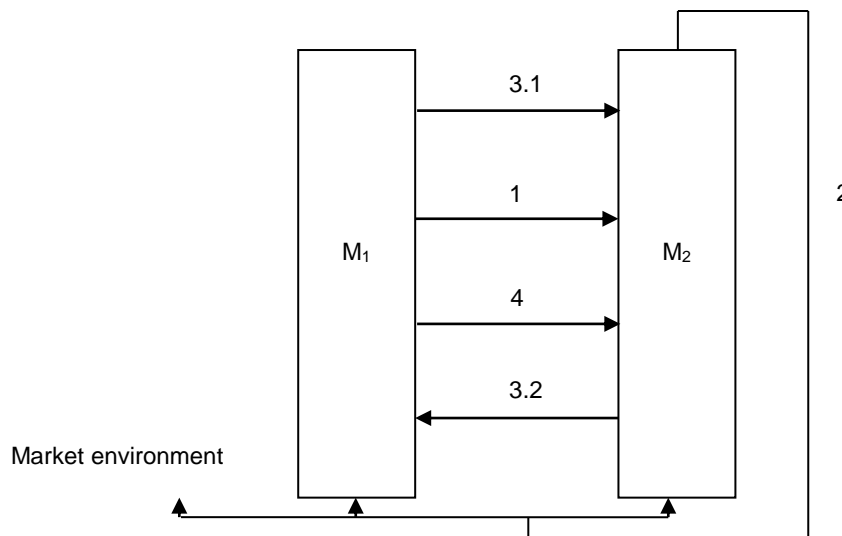*Resource:* Author's development

Logics of model construction, depicted on the pic. 2, is based on the following facts :

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$$\begin{cases} Fic\big(Fam(P)\big) = Fam(P) \Leftrightarrow \forall P_n \Big(P_n \in Fic\big(Fam(P)\big) \Leftrightarrow P_n \in Fam(P)\Big); \\ Del\big(Fam(P)\big) \neq \emptyset \Leftrightarrow \forall P_n(P_n \in Del\big(Fam(P)\big) \Leftrightarrow P_n \in \emptyset; \\ Rev\big(Fam(P)\big) = P \Leftrightarrow \forall P_n(P_n \in Rev\big(Fam(P)\big) \Leftrightarrow P_n \in P. \end{cases} \quad (2)$$

If planning, organizing, motivation, control and regulation traditionally belong to general functions of management, then the functions of reflexive management are information supply, observation and reaction. Apart from these functions, O. Pokotylova differentiates between analytical function, the one of inner reflexive influence, integrated function and also a communicative one [5].

Pic. 3 depicts a functional model of reflexive management.



**Pic. 3. Functional model of reflexive management**
**Resource:** Author's development; $M_1$ – diffuser, the subject who manipulates; $M_2$ – the subject under manipulation; 1– informing; 2 – moves $M_2$ under the influence of optimal information; 3.1 – observations; 3.2 – post- informing feedback; 4 – reaction

Reflexive management aims at achieving a maximal effect out of competitor, consumer's (user) of the object of diffusion free will manipulation. The effects expected out of diffuser's application of reflexive management may be maximal, minimal or medium. As a formulae, maximal effect of ($\cup E$) may be depicted the following way: ($\cup E$)

$$\begin{aligned} P_y \setminus P_x &= \triangle A; \\ P_y' \setminus P_x' &= \triangle A'; \\ P_y'' \setminus P_x'' &= \triangle A''; \\ \triangle A \rightarrow \triangle A' &\rightarrow \triangle A''; \\ \triangle A \cup \triangle A' \cup \triangle A'' &= \cup E. \end{aligned} \quad (3)$$

Minimal effect is possible in the case when as a result of *Fic (Fam (P)), Del (Fam (P)), Rev (Fam (P))* moves there arises at least one $\triangle$, at any level of market behavior decomposition (see pic. 1). In its turn, a medium effect takes place in the case when $\cup E \neq \triangle > 1$.

Functional model of reflexive management of the enterprise innovation activity results diffusion use by the diffusers will strengthen their competitive positions, accelerate innovations and the results of innovational activity at the market which will increase the efficiency of processes of commercialization of innovations in general.

Conducted research allows claiming that the probability of reflexive management receiving the results which are economically reasoned will rise under the conditions of its application together with matrix games models. In the process of formulae of problems solution of matrix games there may be

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applied the peculiarity of mixed optimal strategies. Mixed optimal strategy of the first diffuser guarantees one the lot, which is not less than the game is worth under any strategies of the second diffuser and equal to the price of game under an optimal strategy of the second diffuser. On condition of the given matrix games peculiarity application, the problem of making an optimal decision may be shifted to the problem of lineal developing. We shall exemplify one of the methods of the respective algorithm formation.

We shall apply a matrix game under the familiar matrix definitions of payments $D = \{d_{ij}\}$ $(i = 1,\ 2,...,n; j = 1,\ 2,...,m)$. The first diffuser has clear strategies $X_1, X_2,..., X_n$, the second one – $Y_1, Y_2,..., Y_m$.     It is necessary to define mixed optimal strategies: $S_X = \left(q_1^0, q_2^0,..., q_n^0\right)$, $S_Y = \left(p_1^0, p_2^0,..., p_m^0\right)$, $q_1^0, q_2^0,..., q_n^0$ - probabilities of clear strategies use by the first diffuser, $p_1^0, p_2^0,..., p_m^0$ - probabilities of clear strategies use by the second diffuser.

We may suppose that the first diffuser applies one's optimal strategy $S_X = \left(q_1^0, q_2^0,..., q_n^0\right)$ contrary to any clear strategy $S_Y$, then one can expect a guaranteed gaining equal to mathematical expectancy of the matrix payment significance and the matrix of probabilities:

$$D_j = \sum_{i=1}^{n} q_i^0 d_{ij},\ \ \left(j = 1, 2,..., m\right) \tag{4}$$

It is worth pointing out that the significance of probabilities is unknown. Since under any clear strategy of the second diffuser (consumer( user)) the gaining of the first diffuser will not be less than the cost of the game $V$, the following system of inequalities:

$$\begin{cases} d_{11}q_1^0 + d_{21}q_2^0 + ... + d_{n1}q_n^0 \geq V, \\ d_{12}q_1^0 + d_{22}q_2^0 + ... + d_{n2}q_n^0 \geq V, \\ ... \\ d_{1m}q_1^0 + d_{2m}q_2^0 + ... + d_{nm}q_n^0 \geq V. \end{cases} \tag{5}$$

We will multiply the received system of equations to $1/V$, the following replacements will take place:

$$z_1 = \frac{q_1^0}{V}; z_1 = \frac{q_2^0}{V};...; z_n = \frac{q_n^0}{V}. \tag{6}$$

We shall write the system of inequalities with the use of new variables (4):

$$\begin{cases} d_{11}z_1 + d_{21}z_2 + ... + d_{n1}z_n \geq 1, \\ d_{12}z_1 + d_{22}z_2 + ... + d_{n2}z_n \geq 1, \\ ... \\ d_{1m}z_1 + d_{2m}z_2 + ... + d_{nm}z_n \geq 1. \end{cases} \tag{7}$$

Each diffuser aims at the maximizing of the game $V$, but it minimizes the dimension $1/V$, therefore the solution of the problem of optimal strategy search depends on the range of acquiring of the system of inequalities solutions (7) of those which will minimize the function:

$$Z = z_1 + z_2 + ... + z_n. \tag{8}$$

Therefore we receive the following problem of linear developing :

$$\begin{bmatrix} \begin{cases} d_{11}z_1 + d_{21}z_2 + ... + d_{n1}z_n \geq 1, \\ d_{12}z_1 + d_{22}z_2 + ... + d_{n2}z_n \geq 1, \\ ... \\ d_{1m}z_1 + d_{2m}z_2 + ... + d_{nm}z_n \geq 1. \end{cases} \\ Z = z_1 + z_2 + ... + z_n \rightarrow MIN. \end{bmatrix} \tag{9}$$

The solution to a given problem provides the opportunity to receive the only vector of solutions under which the gaining of the first diffuser will be maximal.

To define mixed optimal strategies of the second diffuser it is necessary to consider the following conditions:

− Medium failure significance which is expected of the second diffuser (consumer (user)) will not exceed the cost of a game, not depending on the strategies the second diffuser will choose;

− The second diffuser (consumer (user)) aims at minimizing one's own expected fail.

Then, an obvious presentation of the problem of linear developing for the second diffuser (consumer (user)) will be the following system:

$$\begin{bmatrix} \begin{cases} d_{11}z_1' + d_{21}z_2' + ... + d_{n1}z_n' \geq 1, \\ d_{12}z_1' + d_{22}z_2' + ... + d_{n2}z_n' \geq 1, \\ ... \\ d_{1m}z_1' + d_{2m}z_2' + ... + d_{nm}z_n' \geq 1. \end{cases} \\ Z' = z_1' + z_2' + ... + z_n' \rightarrow MAX. \end{bmatrix} \tag{10}$$

where $z_1'$, $z_2'$, ..., $z_n'$ - variables, the significance of which coincide with the correlation of the probabilities of the game cost optimal strategy; $Z'$ - sum significance $z_1'$, $z_2'$, ..., $z_n'$, the minimal significance of which is calculated in a way of the solution of the given problem of linear developing.

Since the sum of all probabilities is equal to 1, then the sum of coefficients $z_1'$, $z_2'$, ..., $z_n'$ is to coincide with the following condition:

$$z_1' + z_2' + ... + z_n' = \frac{1}{V}. \tag{11}$$

If one compares the problems of linear developing given in the systems of items (9, 10), we can conclude that the data of the problem are conjugated. One can solve the given problems on the basis of the solution of one of them, the easiest one. Then we will solve the other one on the basis of the use of theorem of conjugation.

**Conclusions.** Accordingly**,** with the help of matrix games it is possible to prove the increase of the probability of reflexive management insuring of economically reasoned results and also define optimal strategies of reflexive management in the interaction with a competitor, consumer (user) of the object of diffusion. Since defined in innovational strategy effects of enterprise innovational activity results dif-

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fusion may be maximal, minimal or medium, then the effects expected from diffuser's application of reflexive management respectively to this strategy are to be achieved by such methods of manipulation influence to be maximal, minimal and medium.

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