

Efficiency of Human Resource Management in Industrial Automation Enterprises with Prospects of Innovative Susceptibility

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Abstract—In modern conditions of innovative development, the most important resource of production companies and corporations is the innovative susceptibility (IS) of personnel. The key to this is an innovative organization of the personnel management system (HRMS). Accordingly, the task of the study is to analyze the typical HRMS structures of Ukrainian enterprises in comparison with the global ones in order to form an innovative HRMS development strategy and, on this basis, to increase IS of stuff. The goal of this study is to compare the levels of HRMS development in advanced global companies and Ukrainian enterprises in the field of industrial automation. As part of this study, methodological, statistical analysis method of technical and economic characteristics of Ukrainian and world leaders of enterprises in the field of industrial automation are used. As well as, comparative analysis method to characterize the organizational management structures of enterprises; method of expert and analytical assessments of HRMS, including analytical trend analysis to characterize the dynamics of the influence of the HRMS subsystems of industrial automation enterprises on the level of innovative susceptibility of personnel. The result of the study is to obtain an assessment of the impact of HRMS subsystems of industrial automation enterprises on the level of innovation susceptibility of personnel, as well as the formation of the potential field of innovation susceptibility of personnel based on measures to increase the innovation of organizational management systems of an enterprise.

Keywords—Human Resource Management System, HRMS, innovative susceptibility, industrial automation enterprises, comparative structure analysis, homogenizing values diagram

I. INTRODUCTION

It is commonly known that the personnel is the most important resource of innovative development of each company under current conditions. A well-organized Human Resource Management System (HRMS) is considered a key success factor. The aim of this research is the comparison of HRMS development levels in the world's leading companies and Ukrainian enterprises of industrial automation. Consequently, the task of the research is a comparative analysis of typical HRMS structures of both domestic and foreign enterprises with the aim of forming a strategy of HRMS development and the increase of innovative susceptibility (IS) of personnel.

The area of human resource management is one of the basic elements of an effectively managed company. In the era of the knowledge-based economy, its importance becomes strategic as the effectiveness of activity within this scope largely determines the achievement of the company's competitive advantage. Knowledge-based resources can be particularly important to ensure this advantage [1], but they may also play a significant role in the process of creating innovativeness [2], as well as to contribute to the improvement of the organizational performance [3]. It happens so because the area referred to above pertains to the management of an organization's most valuable capital, i.e. the human capital and the knowledge it possesses. However, innovativeness is also needed, and perhaps primarily, as regards the management of these valuable resources. Owing to such an approach, improved effects can be expected [4].

Human resource management professionals view organizational change and their roles in it matters because those perceptions serve as a foundation for how they define their roles and as a boundary for what they see as possible. Despite the importance of understanding these perspectives, few studies have explored human resources professionals' views of organizational change and their roles in it. Data from 547 human resources professionals across a wide range of industries and organizational levels reveal the perception of top-leader involvement in 80 percent of successful changes and numerous roles being held by human resources professionals including "change agent" and "consultant." Additionally, the data revealed that most human resource management professionals tended to view successful organizational change as primarily occurring in a top-down, hierarchical manner. A minority—yet potentially consequential—portion of the respondents viewed their role in organizational change as limited or not very important [5].

In the last century and a half, U.S. industry has seen the emergence of several different management models. Theory of this evolution based on three nested and interacting processes. First, identify several successive waves of technological revolution, each of which prompted a corresponding wave of change in the dominant organizational paradigm. Second, nested within these waves, each of these organizational paradigms emerged through two successive cycles—a primary cycle that generated a new

management model making the prior organizational paradigm obsolete, and a secondary cycle that generated another model that mitigated the dysfunctions of the primary cycle's model. Third, nested within each cycle is a problem-solving process in which each model's development passed through four main phases: identification of a widespread organizational and management problem, creation of innovative managerial concepts that offer various solutions to this problem, emergence and theorization of a new model from among these concepts, and dissemination and diffusion of this model. By linking new models' emergence to specific technological revolutions, we can explain changes in their contents. By integrating a dialectical account of the paired cycles with an account of the waves of paradigm change, we can see how apparently competing models are better understood as complementary pairs in a common paradigm. In addition, by unpacking each model's phases of development, we can identify the roles played by various actors and management concepts in driving change in the models' contents and see the agency behind these structural changes [6]. Study provides new insights into the outcomes of employee voice opportunities as well as the microfoundations of organizational innovative performance [7]. Extending the traditional strategic HRM perspectives by incorporating the micro- and meso-level relational factors that are critical to knowledge development and sharing, joint production efforts, and collective improvement initiatives. In so doing, it addresses the observed lack of multi-level theorizing regarding the links between high performance work practices and the intra-organizational processes and behaviors that lead to the superior organizational outcomes associated with those practices [8]. During the analysis of the role of IS of personnel in the rise of enterprises activity efficiency the conclusion about the growth of the leading firms (of Western Europe, USA and Japan) guidance realization of the role of HRMS management ensuring was drawn. It being understood that it is necessary to strengthen the role of corporate preparation of certain specialists with the aid of the balanced combination of components of management and personnel ensuring subsystems.

Dynamic terms of market development and consequently the tasks on the increase of personnel competitive advantages set the growth of requirements and terms of competitions for substituting of vacant positions as well as the obligatory standards of management ensuring of professional trainings, intellectual resources engagement, their corporate cooperation and social welfare [9,10,11].

As part of the study of the publications dedicated to the HRMS level of domestic enterprises it was found that the current level of development of HRMS is quite low. Normally the working conditions, accounting, training, legal support and motivation of personnel are partly provided, while we can feel the great deficit of subdivisions and specialists of intellectual resources engagement, formation of corporate management style, social labour ensuring and vital functions of personnel [12].

In view of this, the aims and tasks of the following research were formulated.

II. THE SHORT DESCRIPTION OF INDUSTRIAL AUTOMATION

The short description of industrial automation market sub-industry in Ukraine and CIS: an economic crisis brought in some new accents on the market of domestic products. Industrial programmable electronic controllers are produced in Ukraine and in the Russian Federation. While the market vacuum was filled by the imported products of better quality [9]. In Ukraine there is a variety of enterprises specialized on industrial automation: LTD "OVEN", PC "Elektrotermomethriya", PJSC "Manometer", JSC "Terra", LTD. "AS Privod", LTD "Microl", PJSC "Plant "Transformer", NSPF "Regmic", LTD "DS Electronics", PC "Skloprilad".

Summarized data on the Ukrainian industrial automation enterprises are presented in a Table 1.

TABLE I. TECHNICAL AND ECONOMICAL DESCRIPTION OF INDUSTRIAL AUTOMATION ENTERPRISES

#	Enterprises	Distribution	Number of employees	Year of foundation	Delivery to the markets	Positions/naming / modification	Accordance of nomenclatures to the level of world standards
1.	LTD "OVEN"	Ukraine, Kharkiv	1 360	1991	Ukraine, CIS, Europe	16 / 150 / 5000	65%
2.	PC "Elektrotermomethriya"	Ukraine, Lutsk	649	1954	Ukraine	1 / 9 / 108	30%
3.	PC "Manometer"	Ukraine, Kharkiv	137	1997	Ukraine	1 / 15 / 150	45%
4.	PJSC "Terra"	Ukraine, Chernihiv	90	1988	Ukraine, CIS, Europe, Asia,	12 / 120 / 1500	40%
5.	LTD "AS Privod"	Ukraine, Dnepr	100	2006	Ukraine	1 / 3 / 15	30%
6.	LTD "Microl"	Ukraine, Ivano-Frankivsk	200	1997	Ukraine	14 / 25 / 608	35%
7.	PJSC "Plant «Transformer»"	Ukraine, Zaporizhzhya	300	1965	Ukraine	1 / 7 / 150	45%
8.	NSPF "Regmic"	Ukraine, Chernihiv region	35	2002	Ukraine	4 / 7 / 800	30%
9.	PC "Skloprilad"	Ukraine, the Poltava region	690	1959	Ukraine, CIS, Europe Asia	2 / 10 / 400	40%
10.	Ltd «DS Electronics»	Ukraine, Kyiv	71	2003	Ukraine, CIS, Europe	4 / 40 / 70	30%

It is quite difficult for the Ukrainian industrial automation enterprises to conquer the new markets because of the powerful international corporations that produce the same industrial equipment. For example: Danfoss A/S, Schneider Electric, Siemens AG, Asea Brown Boveri Ltd,

Moxa Inc., Allen - Bradley, Delta Electronics Inc., Yokogawa Electric Corporation, OMRON Corporation.

Summarized data on the World companies are presented in a Table 2.

TABLE II. DATA ON THE WORLD COMPANIES

№	Name	Location	Number of employees	Year of foundation	Delivery to the markets	Positions/naming / modification
1.	ABB (Asea Brown Boveri Ltd)	Switzerland, Zurich	150 000	1988	all-world	40/ 150/ 18 000
2.	Schneider Electric	France, Rueil-Malmaison	167 000	1836	all-world	63 /201 /20 000
3.	Siemens AG	Germany, Berlin, Munich	366 000	1847	all-world	70 / 180 / 23 000
4.	Allen-Bradley / Rockwell Automation, Inc.	Milwaukee, USA	22 500	1903	all-world	35 / 50 / 10 000
5.	Yokogawa Electric Corporation	Japan of Tokyo	19 937	1915	all-world	30 / 40 / 8 000
6.	OMRON Corporation	Japan of Kyoto	39 427	1933	all-world	38 / 56 / 6 000
7.	Delta Electronics	Republic Taipei, Chinese Republic	80 000	1971	all-world	40 / 100 / 10 000

III. THE RISE OF INNOVATIVE SUSCEPTIBILITY OF PERSONNEL

In the course of the analysis of the personnel innovative susceptibility role in improving business, performance we can make a conclusion that the management of the leading companies in Western Europe, Japan and the USA has long been aware of the necessity to provide HRMS. All enterprises face two problems. One of them is the rise of

innovative susceptibility of personnel and the second one is enhancing of competitive advantages of these enterprises. That is why it is necessary to consider the structure of organizational administrative subdivisions. Moreover, it is important to consider the corresponding HRMS of the Ukrainian enterprises in order to provide the IS growth. Data on subdivisions that are responsible for the increase of innovative susceptibility of personnel are presented in a Table 3.

TABLE III. SUMMARY TABLE ON ENTERPRISES, SUBDIVISIONS AND SPECIALISTS THAT IMPLEMENT SUBSYSTEMS OF HRMS

Subsystems of HRMS	The enterprises / of subdivision that implement HRMS									
	<i>LTD "OVEN"</i>	<i>PC «Elektronometriya»</i>	<i>PC "Manometer"</i>	<i>PJSC "Terra"</i>	<i>LTD "AS Privod"</i>	<i>LTD "MicroL"</i>	<i>PJSC "Plant «Transformer»</i>	<i>NSPF "Regnic"</i>	<i>PC "Sklopriklad"</i>	<i>LTD «DS Electronics»</i>
I. Terms of labour	HRD, SP, GTS, EL;	SS, EL	HRD, DTE, ELP&AP	GTE, ELP	HRD, ELP	HRD, ELP	HRD, SCFDE, ELP & AP	HRD, ELP	HRD, DE&DP, ELP	HRD, ELP
II. Labour relations	HRD, SP, HRM, EC, CP, BM	SS	HRD, DTE LSCFDE	GTE	HRD	HRD	HRD, SCFDE	HRD	HRD, DE&DP	HRD
III. Management and account of shots	HRD, SP, EC, EL	SS	HRD, LSCFDE	GTE	HRD	HRD	HRD, SCFDE	HRD	HRD, DE&DP	HRD
IV. Planning of prognostication and marketing of personnel	HRD, CP, SP, HRM, LD, BC	SS	HRD, LSCFDE	GTE	HRD	HRD	HRD	HRD	HRD	HRD
V. Development of shots	EC, GTS, SS, HRD, HO	SS	HRD, DTE	GTE	HRD	HRD	HRD, SCFDE	HRD	HRD, DE&DP	HRD
VI. Analysis and development of methods of stimulation of labour	dir., LD, HRD	HRD, PED, BM	HRD, SCFDE, L	dir., L	dir., L	dir., L	dir.	dir.	dir.	dir.
VII. Legal services	outsourcing	L	L	L	L	L	LgD	L	L	L
VIII. Development of social infrastructure	HRD	SS	HRD	GTE	HRD	HRD	HRD	HRD	HRD	HRD
IX. Development of organizational structure of management	BM, CD	BM	dir	BM	dir	BM	dir	dir	BM	dir

Note: human resources department (HRD), service of personnel (SP), group of technical support (GTS), engineer on a labour (EL) protection; skilled service (SS), educational center (EC), technical training department (TED), engineer on a labour protection and accident prevention (ELP & AP), group on the technical educating (GTE), service of the controlled from distance educating (SCfDE), service on a labour protection and accident prevention (SCfDE), director (dir), accountant (A), lawyer (L), legal department (LD), economic planning department (PED), educating and development of personnel department (DT&DP), HR manager (HRM), chief of production (CP), leader of department (LgD), engineer on "Bitrix" (EB), leader of cell (LC), business manager (BM), chief of department (CD) [13].

Performing data analysis from the Table 3, it may be concluded that in different companies there are different structural subdivisions that occupy HRMS. In the company Oven, there are subdivisions that are responsible for development and training of personnel. There are also some similar subdivisions in such companies as Manometer and Megamega. At the factory, "Transformer" there is a remote training service (RTS) and at Skloprilad there is a department of training and development of personnel (DT&DP). However in most cases the main duties on a management and development of personnel belong to the HR service. An expert analytical study of the enterprises was conducted and it can be presented in the following way.

For example in relation to the analytical study of the state of HRMS of enterprise Oven the corresponding HRMS

subsystems were analyzed. An analysis was conducted based on the questionnaire for the interrogation of the leading specialists of enterprise (chiefs of production (2 persons), leaders of productive sectors (6 persons), chiefs of departments (7 persons), leaders of commercially-sale cells (8 persons), HR departments and service of personnel (4 persons), leaders of groups (4 persons). A sample consists of 31 people. Moreover, the analytical data were taken from the enterprise representatives of the industrial automation subindustry during the meetings, general seminars, conferences, exhibitions, associations, based on opinion exchange, and from the open sources based on the empiric estimations.

The results of analysis are presented in a Table 4.

TABLE IV. COMPARATIVE ANALYSIS OF HRMS EFFICIENCY ON THE ENTERPRISES OF INDUSTRIAL AUTOMATION AND CHARACTER OF INFLUENCE ON INNOVATIVE SUSCEPTIBILITY OF HRMS SUBSYSTEMS

Subsystem HRMS	Percent realization of function HRMS to basis complex analysis, % / enterprises									
	LTD "OVEN"	PC "Elektrotermometriya"	PC "Manometer"	PJSC "Terra"	LTD "AS Privod"	LTD "Micro"	PJSC "Plant «Transformer»"	NSPF "Regmic"	PC "Skloprilad"	Ltd «DS Electronics»
I. Terms of labour	23 (E)	23 (E)	19 (E)	16 (E)	23 (E)	21 (E)	18 (E)	21 (E)	21 (E)	21 (E)
II. Labour relations	14 (E)	13 (E)	13 (E)	10 (E)	11 (E)	14 (E)	12 (E)	13 (E)	13 (E)	13 (E)
III. Management and account of shots	83 (F)	74 (F)	74 (F)	78 (F)	73 (F)	71 (F)	68 (WhS)	68 (WhS)	68 (WhS)	68 (WhS)
IV. Planning of prognostication and marketing of personnel	55 (F)	49 (F)	49 (F)	46 (F)	46 (F)	45 (F)	46 (F)	44 (WS)	44 (WS)	44 (WS)
V. Development of shots	58 (F)	48 (F)	46 (F)	44 (WS)	51 (F)	48 (F)	48 (F)	48 (F)	48 (F)	48 (F)
VI. Analysis and development of methods of stimulation of labour	50 (F)	41 (WS)	38 (WS)	37 (WS)	38 (WS)	37 (WS)	38 (WS)	44 (WS)	44 (WS)	44 (WS)
VII. Legal services	30 (WS)	20 (E)	22 (E)	22 (E)	22 (E)	22 (E)	20 (E)	25 (WS)	25 (WS)	25 (WS)
VIII. Development of social infrastructure	43 (WS)	37 (WS)	31 (WS)	29 (WS)	26 (WS)	28 (WS)	29 (WS)	29 (WS)	29 (WS)	29 (WS)
IX. Development of organizational structure of management	65 (WhS)	53 (F)	50 (F)	53 (F)	53 (F)	50 (F)	53 (F)	53 (F)	53 (F)	53 (F)
ALL	47 (F)	40 (WS)	38 (WS)	37 (WS)	38 (WS)	37 (WS)	37 (WS)	38 (WS)	38 (WS)	38 (WS)

Note: Character of functions influence on innovative susceptibility of personnel is estimated on the following intervals of realization: 0% will not be realized (NR), episodically 5-24% (E), without system 25-44% (WS), fragmentary 45-64% (F), on the whole system 65-70% (WhS), system from 71%-100% (SF).

As a result of analysis it is possible to make the following conclusions: almost all of the domestic companies have an unsystematized character of functions influence on innovative susceptibility of personnel that is estimated in 37-40% from the potential of sub-industry enterprises HRMS. Only in the company Oven the potential is about 47% that indicates that it is necessary to adopt experience of leading world companies [14]. To our opinion, during the analysis and systematization of the presented data of HRMS subsystems on IS of personnel. It is necessary to take into account the following features of the nature of functions impact:

Episodically: a function is implemented in unsystematized way, depending on a certain situation and subjective initiative of personnel this character of influence

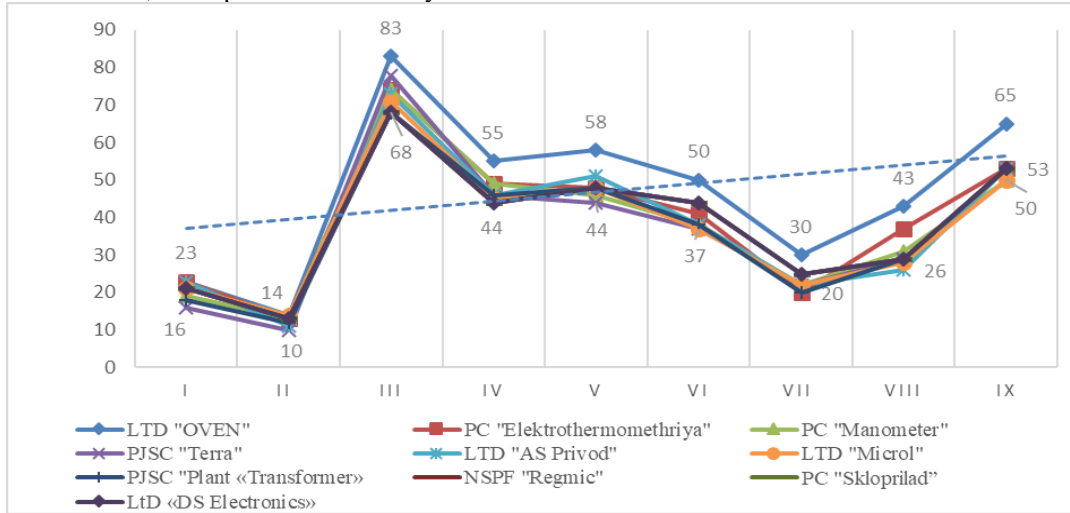
insignificantly influences on the subsystems realization and accordingly on IS of personnel. *Fragmentary system:* a function is partially implemented depending on the level of qualification of specialists on a personnel and subjective opinions of guidance; this character of influence has a slight impact on realization of subsystems and accordingly on IS of personnel. *No system:* a function is implemented unsystematically, depending on the availability of regulatory and guidance documentation and HR specialists with the corresponding level of their qualification, this character of realization has the positive impact on IS of personnel. *The whole system:* a function is implemented by HR specialists in a sufficient measure, in accordance with the current regulatory and guidance documentation of enterprise this level of realization has a significant influence on IS of personnel. *System:* a function is implemented constantly and

sequentially, there is the system of highly skilled specialists on a personnel intercommunication, who creatively use the provided norm-methodical potential and progressive (foreign) experience for HRMS. This character of realization fully influences on IS of personnel.

fragmentary character of influence of functions on IS of personnel, that talks about that is prospect for development HRMS.

It is demonstrated in a Figure 1.

As we see from a summary Table 4, HRMS developed in general from 37 to 47%, here prevails without system or



Note: X-direction - HRMS subsystems I. Terms of labor; II. Labor relations; III. Management and account of shots; IV. Planning of prognostication and marketing of personnel; V. Development of shots; VI. Analysis and development of methods of stimulation of labor; VII. Legal services; VIII. Development of social infrastructure; IX. Development of organizational structure of management. Y-direction - percent of realization of HRMS subsystems.

Fig. 1. Diagram of averaged values of influence of enterprises subsystems of HRMS of industrial automation on the level of innovative susceptibility of personnel

In order to compare the organizational administrative ensuring of IS of personnel of the Ukrainian enterprises of industrial automation we will conduct the comparative

analysis of the typical structures of personnel management services of the world and national companies of industrial automation (Table 5).

TABLE V. COMPARATIVE ANALYSIS OF THE TYPICAL STRUCTURES OF PERSONNEL MANAGEMENT SERVICES IN THE WORLD AND NATIONAL COMPANIES OF INDUSTRIAL AUTOMATION

Multinationals	Ukrainian Inc.
<ul style="list-style-type: none"> -personnel administration department, -personnel management department, -capability department, -social development, -service of corporate administration, -department of corporate development, -executive office, -corporate strategy, -strategy and development of company, -HR recruiting, -supporting center of basically knowledge, training, -experienced resources and legal questions, -financial and social systems of motivation, -health protection, -stimulation of business development, -providing quality and environment protection, -specialist on engaging of intellectual resources. 	<ul style="list-style-type: none"> -personnel department, -personnel service, -training center, -technical training department, -remote training service, -service of labor and environment protection, -legal department, -labor and wages department.
Total the generalized subdivisions:	<p>The potential field of development of management ensuring</p> <p style="text-align: center;">HR (Human resources)</p> <p style="text-align: center;">↓</p> <p>Social and Economic development of personnel of industrial automation enterprises in Ukraine</p>
17	8

Note: In a sample the following enterprises are included: on Ukraine LTD "OVEN ", PC "Elektrotermomethriya", PJSC "Manometer", PJSC " Terra", LTD. "AS Privod ", LTD " Microl", PJSC "Plant "Transformer", NSPF "Regmic", LTD "DS Electronics", PC " Skloprilad ". World companies: Danfoss A/S, Schneider Electric, Siemens AG, Asea Brown Boveri Ltd, Moxa Inc., Allen - Bradley, Delta Electronics Inc., Yokogawa Electric Corporation, OMRON Corporation.

The sample of the world leaders in industrial automation production includes the following companies: Danfoss A/S, Schneider Electric, Siemens AG, Asea Brown Boveri Ltd, Moxa Inc., Allen - Bradley, Delta Electronics Inc.,

Yokogawa Electric Corporation, OMRON Corporation. Information on the generalized structure of HRMS subdivisions is formed on the ground of the specialized sources characterizing the role and engagement of these

companies in the development of world industrial automation market [15]. Apart from this a close organizational and technological collaboration with a company Danfoss was arranged, that is the OEM-partner of an enterprise Oven. As part of this collaboration, an exchange of key specialists and experience is executed. On the results of this cooperation, the seminars and webinars are conducted [16]. In a Table 5 you can see the consolidated data on subdivisions structure of HRMS's departments in both Ukrainian companies of industrial automation and the multinationals. According to the table, Ukrainian enterprises provide the labour conditions, accounting, staff training, legal support and motivation of personnel. At the same time, an analysis of the leading world companies' HRMS departments reveals some differences:

1. It is paid more attention to the personnel development as there are more departments of professional social and intellectual profile.

2. There are some subdivisions dealing with the marketing, attracting and ensuring the personnel corporate development. It means that the administration of company realizes the importance of an appropriate structurizing and integration of personnel in accordance with the changing tasks of subdivisions and the whole company.

3. The level of social labor standards on the Ukrainian enterprises is low. According to the world experience, providing the decrease in influence of negative factors of labor conditions at the workplace, regular maintenance of psychoemotional and physical state, different social packages etc. helps to increase the level of intellectual resources of personnel.

IV. CONCLUSIONS

Ukrainian enterprises experience the lack of innovation oriented skilled personnel called to provide the growth in efficiency of development of the enterprises. During the development of regulatory and guidance documentation of enterprise the experience of leading companies is not used enough. It should be taken into account and modified according with the Ukrainian particularities. Based on the presented material we can make the conclusion about the necessity of development of HRMS with the purpose of coming under the world leading companies standards. It is required to focus on the development of corporate management methods and functioning of personnel corresponding quickly changing market conditions and experience of social security. The goal was set: to analyze the system of factors of HRMS, from that. Vision of influence on the increase in the level of IS of personnel. For this purpose, the system of factors of HRMS that influence the increase in the staff's IS has been improved and presented, it is possible to provide the organizational and managerial component of the work of the staff based on the development of measures that ensure the corresponding organizational and managerial conditions for this increase. From this, it was concluded: a systematic set of factors of HRMS, which affects the increase in personnel, IS, relative to the area of the PA, which allows providing organizational and managerial component of the work of staff based on the development of measures that ensure the appropriate organizational and managerial conditions for this increase.

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