



Factors of specialists' labor motivation at high-tech enterprises in Iran

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Abstract. Human resources are the most important determinants of the success of any organization with a significant effect on achieving organizational objectives; hence, identifying and determining the determinants of their labor motivation plays a very decisive role in increasing their productivity and improving their quality of work. *Purpose.* The present study aimed to determine the determinants of employees' labor motivation at high-tech enterprises based on Herzberg's two-factor motivation theory. *Study design.* In a descriptive-analytical cross-sectional study in 2022 among nine knowledge-based enterprises in Tehran, 144 individuals were selected by the simple random method and the questionnaires were distributed among them, and the necessary data were collected. *Findings.* The research results indicated that from the respondents' perspective, intrinsic (mental) effective factors were more important than extrinsic (hygiene) factors. Recognition and appreciation, job position, and progress and development were the most important intrinsic factors, and job security, salaries and wages, and the way of supervision were the most important extrinsic factors affecting labor motivation. The results indicated a statistically significant and positive relationship between intrinsic and extrinsic factors at the confidence level of 0.01 and a negative relationship between the education level with hygiene factors at a significance level of 0.05 and a positive relationship between the education level and motivational factors. Among the demographic variables, there was a positive and significant relationship only between the two variables, age and job experience, at a 0.01 level.

Keywords: labor motivation, Herzberg's two-factor theory, motivational factors, hygiene factors, high-tech enterprises, knowledge-based enterprises.

Introduction

Today's businesses are searching for solutions to acquire sustainable competitive advantages through increasing production quality, customer satisfaction, and accordingly, their profitability. There is a consensus between research literature and experts that efficient and expert human resources are the most important factors to achieve sustainable competitive advantages (Setiawan, 2020). On this basis, enterprises that put their employees at the center of attention and are aware of the strong relationship between employee motivation and organizational efficiency and try to continuously increase productivity through employee motivation will have higher work performance

of their employees. Increasing motivation means higher productivity, which in turn leads to higher efficient business performance (Nguyen, 2017). Therefore, employers need employees who work with full motivation rather than just being present at their workplace (Mamun, Khan, 2020).

Motivation is an important factor affecting human behavior and performance. It is also an important determinant of human behavior and performance. According to the definition, activation motivation is an intrinsic state that makes people behave in a certain way or stimulates the desire to work (Aslan, Doğan, 2020). Therefore, motivation refers to a process or flow through which we can motivate others. It also exists potentially in humans and stimulates others. Therefore, motivation is considered an important introduction to many positive results such as performance improvement, creativity, commitment, and productivity in organizations, and thus increasing employee motivation has always been an important organizational challenge for managers to focus on and solve (Erhan, Bayrakçı, 2022). Given that motivation is a mental state that may be different from one person to another and may be affected by various factors, it requires that each person or group of employees be motivated in different ways. Since most of today's businesses are managed and produced with new and advanced technologies, providing the necessary motivation to work, identifying the factors, and finally, paying attention to the motivational forces of employees in these activities and industries are significantly important.

Advanced-technology-based industries are very different from industries based on low- and medium-level technologies in terms of products or processes, employees, or the level of research and development, as well as knowledge-based nature. Advanced technology can be identified based on criteria such as the type of product or process, diversity in production along with continuous innovation, the type of employees, or the level of research and development, and finally, their knowledge-based nature (Guo, 2019; Hashai, Zander, 2018; Tobiassen, Pettersen, 2018). Therefore, the present research aimed to determine the determinants of labor motivation of specialists working in high-tech enterprises in Tehran based on Herzberg's two-factor motivation theory (extrinsic or hygiene factors, intrinsic or mental factors) to respond to four questions:

1. What are the effective factors in improving labor motivation and their prioritization for specialists of the high-tech enterprises?
2. Which domain has the most or least labor motivation among extrinsic and intrinsic factors?
3. Which factor is more important in each important domain?
4. What is the relationship between determinants of employees' labor motivation based on variables such as gender, work experience, and age?

Since there is no similar study on this theory in Iran, the present research can be beneficial for clarifying the employees' motivational status in these enterprises and can be used by managers of other similar enterprises.

Literature review

Motivation and motivational models

The term "motivation" was first taken from the Latin word "move" which means movement. Motivation is also called the reason for behavior; hence, it is used to explain "something that moves a person toward a behavior". The main question of this concept, which is defined in different ways in the literature of different disciplines such as management, psychology, and organizational behavior, is "why do people perform what they do" (Pate, 1998; Boamah, 2014). From an organizational perspective and according to another definition, motivation is as follows: "The desire to make a great effort to fulfill the organizational goals in a way that this effort is led towards meeting some

individual needs” (Robbins, 2005). Motivation is like a fuel that guides people to achieve goals and objectives, and without this fuel, people remain inactive, which may lead to inefficiency and even simple mistakes (Okorley, Boohene, 2012).

Motivation is also a chain process that starts with a feeling of need or a lack and deprivation, and then it brings the desire and causes tension and action towards a goal, the product of which is the behavior of achieving the goal. The sequence of this process may lead to the satisfaction of needs. Therefore, motivations encourage and stimulate people to do tasks or behaviors, while motivation reflects a general desire. In all motivation studies, punishment and encouragement are still considered very strong motivations, and money is also mentioned as a tool for awarding, but it is not considered the only motivational factor, and other factors are also involved in this field. The reduction of attendance at the workplace, and the quantity and quality of work are the effects of a lack of motivation. The results of several studies indicate that the long working hours, lack of salary, lack of job security and finally lack of job independence have been mentioned as factors affecting job dissatisfaction and decreasing motivation (Burbeck et al., 2002; Appleton, House, Dowell, 1998). Material incentives and welfare factors such as housing, kindergarten, and incentive leave are also considered important factors in creating motivation (Franco et al., 2004; Raeissi, Mohebbifar, 2006).

According to the existing theoretical literature in this regard, the most appropriate existing definitions for motivation are for the organizational framework that is closely related to work and profession (Pinder, 1998). Motivation is a set of energetic forces that originate both from within individuals and beyond their existence to start work-related behavior and determine its form, direction, intensity, and duration. This expression is defined as “a process that explains the intensity, direction, and continuity of a person’s effort to reach a specific goal” (Can, 1997). Three important elements can be extracted from the authors’ definitions. These elements include intensity, direction, and duration. On this basis, the intensity refers to the level of effort that a person makes to achieve goals that are especially beneficial for the organization. The direction can also be understood by considering the goals that are considered in his motivational energy. The duration also indicates that achieving the goals may be a possible consequence of behavior at work. Accordingly, continuity also measures how long a person can continue this effort. Motivated people stay in their work long enough to achieve their objectives (Setiawan, 2020; Uddin et al., 2014).

Furthermore, motivation is a latent variable that cannot be directly measured or observed, but is considered a psychological process (Pinder, 1998). The employees are motivated when this structure is created, and when the employees are motivated, they show determination, enthusiasm, and a strong desire to perform and achieve the tasks in the workplace (Nguyen, 2017). There are theories that help managers (employers) to understand the employees’ behavior and attitude and increase their motivation in the workplace. These theories are conceptualized in two groups: a) content theories of motivation (which explain motivational factors), and b) process theories of motivation (which explain the process of motivation) (Mitchell, 1982; Küçüközkan, 2015). Maslow’s Hierarchy of Needs Theory, Herzberg’s Theory of Motivation and Hygiene, McGregor’s X and Y Theories, McClelland’s three-factor theory, and finally, Alderfer’s ERG theory are among the important theories that are in the main group of content theories, indicating what factors motivate people. The theories of the second approach to motivation, which explain the motivation process, include Victor Vroom’s expectancy theory, Porter and Lawler’s motivational model, Adams’ equity theory of motivation, organizational justice theory, self-efficacy theory, psychological evaluation theory, and finally, Edwin Locke’s goal setting theory.

In short, we can classify the delivery of management ideas in the field of employee motivation into three relatively different stages. The first group of motivational theories presents a unique model of motivation that is considered applicable to every worker and employee in any situation. These views

are respectively called the traditional model, the human relations model, and the human resources model. The following table presents a summary of their assumptions, policies, and expectations.

Table 1. General models of management attitudes towards motivation

| Traditional model | Human relations model | Human resources model |
|---|---|--|
| Hypotheses | | |
| 1. Work is not pleasant for most people. 2. What they do is less important than what they receive. 3. Few people are willing or able to do work that requires creativity, self-direction, or self-control. | 1. Humans want to appear useful and important. 2. Humans feel a sense of belonging and want to be known as the right individuals. 3. Privilege is more important than money in motivating people to work. | 1. Work is basically unpleasant. Humans want to share efforts to achieve the meaningful goals that they have set. 2. Most people can be more creative, self-directed, and self-controlled than their job requires. |
| Policies | | |
| 1. The managers should closely supervise the employees. 2. They should divide the work into simple and repetitive parts that can be easily learned. 3. They should clearly determine the method of doing work and insist on its implementation. | 1. The managers should make the employees feel important. 2. They should inform their subordinates about the results of work and listen to their words. 3. The managers should allow subordinates to exercise self-direction and self-control in their daily affairs. | 1. The managers should use the maximum capacity of employees. 2. They should create an environment in which the organization members can use their abilities. 3. They should encourage employees to share efforts on important issues and continuously develop self-direction and self-control in employees. |
| Expectations | | |
| 1. People will tolerate work if they receive a sufficient salary. 2. If the tasks are simple enough and the individuals are precisely controlled, they will produce at a standard level. | 1. Exchanging information with subordinates and involving them in daily decisions fulfill their basic needs of belonging and being important. 2. Satisfying such needs improves morale and reduces resistance to the exercise of official authority, and thus subordinates cooperate with consent. | 1. The development of effects of subordinates, self-direction, and self-control improves efficiency. 2. Job satisfaction makes subordinates use their maximum abilities at work. |

Herzberg's two-factor theory, which has attracted great attention in research on employee motivation, is used in this study because this theory deals with issues such as job satisfaction and working conditions, and an approach is used to motivate employees, as explained below (Teck-Hong, Waheed, 2011).

Herzberg's two-factor theory

The two-factor theory presented by F. Herzberg, who was a management theorist and a manager, is the most well-known theory in the theoretical literature of this field after Maslow's theory (Drafke, Stan, 1997; Kayim, 2018). This theory along with Maslow's Hierarchy of Needs theory are the foundations of modern motivational studies (Horton, 2017).

F. Herzberg investigated what techniques managers use to motivate their employees, and he realized that there was a significant difference between the factors that caused widespread dissatisfaction in their absence and increased performance in their presence. F. Herzberg indicated that motivational (intrinsic) factors were the first group of factors, which increased job performance by motivating employees, and hygiene (extrinsic) factors were the second group of factors that did not create great satisfaction. Hygiene factors are minimal conditions that do not create motivation by themselves but create a place for the formation of motivational factors; hence, employees cannot be motivated in their absence. Herzberg stated: Motivational factors, which provide job satisfaction in employees and are expressed as intrinsic factors are related to the job content or the job itself, while hygiene factors, which are interpreted as extrinsic factors, seem to cause employee dissatisfaction, and are related to the job context (Herzberg, 1966; Ajalie, 2017).

In short, job satisfaction factors are different from job dissatisfaction factors. Factors such as salaries and wages, the policy governing the workplace, the way of communication, job security, the conditions of the workplace, and supervision are among the extrinsic factors that prevent dissatisfaction, and factors such as appreciation and recognition, career advancement, work nature, responsibility, and success are considered the job satisfaction factors.

Motivational factors

Herzberg calls the factors, which create job satisfaction, the “motivational factors” that can motivate employees to increase their work performance. According to F. Herzberg, the reason why motivational factors provide job satisfaction is that they are strongly related to the job and task, and they are thus key components for self-development at work. Individuals can take action to fulfill their self-actualization needs (Herzberg, 1966).

Motivational factors, which build the core of work, tend to create initiatives in employees and promote employees to individual and organizational effectiveness levels. Factors such as appreciation, success, recognition, self-work, development opportunities, advancement opportunities, responsibility, and feedback are listed as motivational factors (Alshmemri, Shahwan, Maude, 2017). These motivational factors give employees the opportunity and possibility of personal involvement in difficult tasks, the opportunity to fully use skills, the opportunity to test knowledge, the discretionary control over the behavior, equipment, money, or other employees, clear performance feedback, and the opportunity to interact with senior managers, and encourage them to work harder (Allen, Gilmore, 1993). Therefore, these cases as intrinsic factors can cause job satisfaction.

Hygiene factors

F. Herzberg introduces the factors, which cause dissatisfaction in the absence of them, as hygiene factors. The word hygiene, which is originated from the Latin word “hygiēna”, is defined by F. Herzberg with colleagues. as “medical hygiene” which is a health term (Alshmemri, Shahwan, Maude, 2017). As we can prevent diseases caused by cleaning by observing hygiene and its necessary factors, it is possible to prevent employee dissatisfaction caused by problems in the workplace.

Hygiene factors are related to the workplace that surrounds the work done and thus define the workplace. The presence of these factors eliminates dissatisfaction, but they alone do not provide high job satisfaction and motivation. While these factors have positive effects on the employees’ job attitudes, they primarily act as preventive factors for job dissatisfaction. According to F. Herzberg, it is quite clear why hygiene factors do not provide job satisfaction. These factors do not have the necessary properties to create a sense of growth and development in people. To get a sense of growth and development, a sense of success should be gotten from meaningful work. However, since hygiene factors are not task-related, they cannot provide this meaning to individuals (Herzberg, 1966).

F. Herzberg indicates that there is a few hygiene factors, which are related to the employee’s field of work instead of the job itself and their presence does not create motivation, but their absence can cause job dissatisfaction, and they include issue such as salary (wages); job security, personal life, working conditions, policy, and business management, the status, position, and relationship between employees (with subordinates, superiors, and peers). Therefore, these cases as extrinsic factors can prevent dissatisfaction (Kayim, 2018). In F. Herzberg’s motivational hygiene theory, most contemporary studies have emphasized the study and identification of industrial, personal, and economic factors that cause satisfaction or dissatisfaction reported by employees at work (Lixcel, Lantican, 2021; Mehrad, 2020). Therefore, employees are actually motivated by the same motivational factors suggested by F. Herzberg (Bundtzen, 2021).

Study design

Research background

Numerous studies have been conducted on motivation and job satisfaction using Herzberg's theory. The results of most of these studies indicate that intrinsic and motivational factors are the most important factors, but some studies have considered extrinsic and hygiene factors and their effects more important. The feeling of being valuable, success, communication, job nature, salaries, and working conditions as the most important motivational factors from the police employees' perspective were introduced (Suhartono, 2015). In another study considered on the one hand job progress and success among the motivational factors and working conditions and salary among the hygiene factors as important factors on the other hand (Lakra et al., 2012). The factors such were considered as the feeling of success, recognition, feeling of responsibility, and getting the promotion also the ability to make decisions, competence, participation in work, and a sense of curiosity as factors of intrinsic motivation, and competition environment, evaluation, and forced work were considered as factors of extrinsic motivation affecting the employee motivation (Leat, El-Kot, 2009; Timmreck, 2001). In a study on health workers was indicated that the feeling of pride, effectiveness, honesty in management, and job security were the most important motivational factors (Franco et al., 2004). The work nature, recognition-appreciation, and finally, job success were introduced as the strongest predictors for the perceived job satisfaction of the employees (Mitsakis, Galanakis, 2022).

Research methodology

The present study was cross-sectional and was conducted in the Tehran metropolis in 2022 using a descriptive-analytical and correlational method. The statistical population of the study consisted of all people working in high-tech enterprises (knowledge-based), including nine type-1 knowledge-based enterprises¹ in Tehran. These enterprises operate in nine activity and technology groups such as the agriculture and food industry, drug and advanced products, and advanced machinery and equipment. One enterprise was selected from each main group and a total of nine companies were selected using the simple random method in cooperation with the Center of Knowledge-based enterprises in Iran.

According to the total number of personnel in these companies ($N = 238$), R. V. Krejcie's and D. W. Morgan's table was used to determine the statistical sample size, and finally, 144 individuals (89 males and 55 females) were selected by simple random sampling (Krejcie, Morgan, 1970). The inclusion criterion was full consent to answer the questions, and the exclusion criteria were the non-consent to participate in the research, providing incomplete answers, or defaced answer sheets.

The research data were collected using the 40-question F. Herzberg's questionnaire, which was set in 11 domains of intrinsic and extrinsic effective factors and had validity and reliability confirmed in previous studies (Herzberg, Mausner, Snyderman, 1993). The research questionnaire consisted of three parts. First, demographic information such as age, and gender was questioned. The second part contained 40 factors based on Herzberg's motivation theory in 11 domains (five domains of intrinsic effective factors and six domains of extrinsic effective factors) and it was scored based on a five-point R. Likert scale (from very important to not included). The number of factors in each group of intrinsic (mental) and extrinsic (hygiene) factors were respectively as follows: five factors were related to recognition and appreciation, four factors were related to work progress and development, three factors were related to the work nature, three factors were related to independence and

¹ These enterprises obtain at least 50% of their operating income of the last financial year, reported in their tax returns from the sale of knowledge-based goods or services included in the "Level 1 list of knowledge-based goods and services" and have all the criteria of high-tech enterprises.

responsibility, two factors were related to job success and promotion, three factors were related to salary and wages, three factors were related to the policy governing the workplace, five factors were related to the way of communication with others, four factors were related to job security, three factors were related to the workplace conditions, and five factors were related to officials' supervision. Finally, the third part included an open question "What do you suggest for improving the labor motivation of employees in knowledge-based enterprises?"

After data collection and classification by SPSS, descriptive statistics were provided and the Pearson's correlation coefficient was used to examine the existence of the relationship between quantitative variables, age, gender, work experience and effective intrinsic and extrinsic factors, and also the *t*-test and the one-way analysis of variance (ANOVA) were used for investigating the existence of differences in the mean responses among different groups.

Results and findings

Among 144 statistical samples, 62% were male and 38% were female. About 47% of the employees of the enterprises were under 32 years old, 35% had 32 to 40 years of age, about 17% were over 40 years old, about 59% were married, and 41% were single. The youngest working person was 21 years old and the oldest was 61. Therefore, about 50% of the personnel working in these enterprises were young and just graduated from university and under 30 years of age and were engaged in technological production alongside middle-aged and elderly people. Among the research group, 24% had a diploma or lower, 41% had a master's degree, and 35% had a PhD. According to the employees' educational degrees, a total of 76% of the personnel working in high-tech enterprises had academic degrees. In terms of work experience, about 41% had less than 5 years, 37% had 5 and 10 years, and finally, 12% had more than 10 years of work experience, indicating that a total of about 78% of employees had less than 10 years of work experience in these enterprises, and thus the enterprises were newly established.

To answer the research questions, the K-S test was performed to examine the statistical distribution of the variables, and as $p > 0.05$, the distribution of the data was normal, and the parametric tests could be used. In response to the first question, 92.5% of the employees working in this field considered the effective intrinsic factors the more important factors in labor motivation, and then 84.2% considered the extrinsic factors as the next effective factors in labor motivation (Table 2).

Table 2. Relative frequency distribution of the overall importance of intrinsic and extrinsic factors of labor motivation

| Effective factors of labor motivation | Important | | Not important | | Total | |
|---------------------------------------|-----------|------------|---------------|------------|--------|------------|
| | Number | Percentage | Number | Percentage | Number | Percentage |
| Extrinsic factors (hygiene) | 121 | 84.2 | 15.8 | 23 | 144 | 100 |
| Intrinsic factors (motivational) | 130 | 92.5 | 14 | 7.5 | 144 | 100 |

To examine the statistical accuracy of the results about the intrinsic and extrinsic factors in Table 2, the independent *t*-test and one-way analysis of variance indicated that employees with a diploma or lower ($p \leq 0.05$), those with a master's degree ($p < 0.001$), and those with a PhD degree ($p \leq 0.012$) considered intrinsic factors to be more effective in creating motivation. Similar results were obtained regarding the three groups with work experience of fewer than five years, between 5–10, and more than 10 years, which again proved that intrinsic factors were more effective in promoting motivation. Therefore, both factors were important, but their order of priority was according to the description above.

Tables 3 and 4 present the results of answers to the second and third questions about the importance of domain and effective extrinsic factors in labor motivation. As shown in Table 3, among the extrinsic factors of labor motivation, “job security” was the most important factor (with a mean of 0.83), and “policy, environment, and regulations” domain was the least important factor (with a mean of 0.64). In the field of “job security”, job stability was the most important factor (with a mean of 0.89) and the existence of suitable facilities for using insurance and rest (with a mean of 0.77) was the least important factor. In the “policy, environment and regulations” domain, the proportionality of officials’ expectations was the most important factor (with a mean of 0.70) and the proportionality and clarity of the encouragement and punishment status (with a mean of 0.61) was the least important factor. The most or least important factors can be observed similarly for the rest of the domains.

Table 3. Relative frequency distribution of the importance of factors and domains of effective extrinsic factors of labor motivation

| Effective factors and domains | Mean of factors | Mean of domain |
|---|-----------------|----------------|
| «Salary and wage» domain | | .77 |
| The proportionality of the salary received with life needs | .80 (±3.29) | |
| The proportionality of salary with the rate and type of work | .75 (±3.67) | |
| The proportionality of the benefits received with the level of activity | .76 (±3.10) | |
| «Policy, environment, and regulations» domain | | .64 |
| Clarity of rules and regulations | .63 (±3.02) | |
| Appropriateness of the authorities’ expectations of you | .70 (±3.45) | |
| Appropriateness and clarity of encouragement and punishment | .61 (±3.15) | |
| «Communication with others» domain | | .73 |
| The authorities’ way of communication with you | .88 (±3.39) | |
| Your way of communication with other employees | .62 (±3.02) | |
| The supervisor’s way of communication with you | .78 (±3.65) | |
| Your way of communication with other employees | .65 (±3.21) | |
| The colleagues’ way of communication with each other | .73 (±3.37) | |
| «Job security» domain | | .83 |
| Observance of justice and non-discrimination between employees by officials | .87 (±3.19) | |
| Availability of facilities to prevent job accidents | .80 (±3.34) | |
| Availability of appropriate facilities for the use of insurance and pension | .77 (±3.42) | |
| The level of job stability | .89 (±3.13) | |
| «Workplace conditions» domain | | .70 |
| Physical conditions of the workplace (light, noise, pollution,...) | .78 (±3.29) | |
| Existence of suitable work equipment, facilities, and tools | .72 (±3.61) | |
| Availability of welfare facilities | .62 (±3.13) | |
| «Supervision» domain | | .77 |
| Easy access to officials | .81 (±3.26) | |
| The officials’ way of indirect supervision of your work | .77 (±3.46) | |
| The officials’ way of direct supervision of your work | .88 (±2.93) | |
| The officials’ way of evaluation of your work | .70 (±2.89) | |
| The officials’ way of supervision and administration | .68 (±3.57) | |

According to the results of Table 4, among the intrinsic factors of labor motivation, the “recognition and appreciation” domain with a mean of 0.88 was the most important domain, and the “work nature” with a mean of 0.74 was the least important domain. According to this table in the “recognition and appreciation” domain, the appreciation and providing moral rewards by the authorities was the most important factor with a mean of 0.95 and the appreciation from colleagues was the least important factor with a mean of 0.77.

Table 4. The relative frequency distribution of the importance of factors and domains of the effective intrinsic factors of job motivation

| Effective factors and domains | Mean of factors | Mean of domains |
|--|-----------------|-----------------|
| «Recognition and appreciation» domain | | .88 |
| In the case of providing valuable work, it is appreciated by colleagues. | .77 (±3.32) | |
| In the case of providing valuable work, it is appreciated by customers and buyers. | .86 (±3.45) | |
| In the case of providing valuable work, it is appreciated and morally rewarded by the authorities. | .95 (±2.91) | |
| Officials feel responsible for professional problems. | .92 (±2.81) | |
| Sufficient support from managers and bosses in legal authorities | .90 (±2.85) | |
| “Job advancement and development» domain | | .85 |
| The possibility of job promotion | .90 (±3.04) | |
| The possibility of continuing education | .87 (±3.25) | |
| The possibility of participation in relevant seminars and conferences | .83 (±3.29) | |
| Existence of appropriate research facilities | .81 (±3.49) | |
| “Work nature» domain | | .74 |
| Ability to serve society through profession | .70 (±3.19) | |
| The high value of the profession from the public point of view | .73 (±3.47) | |
| Job interest and satisfaction | .80 (±3.26) | |
| “Job responsibility» domain | | .81 |
| Freedom of expression and giving the responsibility | .80 (±3.11) | |
| Accepting your suggestions and opinions in decisions | .89 (±3.07) | |
| Independence in providing job services | .74 (±3.29) | |
| «Job position» domain | | .86 |
| The possibility of promotion to higher job ranks | .89 (±3.09) | |
| Direct involvement in the process of work or service delivery | .83 (±3.24) | |

The direction and level of the relationship between the variables were determined by calculating the Pearson correlation coefficient between the important variables of the research to answer the fourth question. Table 5 presents the results.

Table 5. The level and direction of correlation between research variables

| Variables | Parameters | Motivational factors | Hygiene factors | Work experience | Education level | Age |
|----------------------|--------------------------|----------------------|-----------------|-----------------|-----------------|--------|
| Motivational factors | Correlation coefficients | 1.00 | .712** | .189 | .412* | .125* |
| | Significance level | .0 | .0 | .129 | .039 | .020 |
| | N | 144 | 144 | 144 | 144 | 144 |
| Hygiene factors | Correlation coefficients | .712** | 1.00 | .13 | -.386* | .189* |
| | Significance level | .0 | 0 | .830 | .021 | .739 |
| | N | 144 | 144 | 144 | 144 | 144 |
| Work experience | Correlation coefficients | .189 | .013 | 1.00 | .279 | .669** |
| | Significance level | .129 | .830 | 0 | .151 | .000 |
| | N | 144 | 144 | 144 | 144 | 144 |
| Education level | Correlation coefficients | .412* | -.386* | .279 | 1.00 | .340 |
| | Significance level | .039 | .021 | .151 | 0 | .071 |
| | N | 144 | 144 | 144 | 144 | 144 |
| Age | Correlation coefficients | .125* | .189* | .669** | .340 | 1.00 |
| | Significance level | .020 | .739 | .000 | .071 | 0 |
| | N | 144 | 144 | 144 | 144 | 144 |

Note: ** Significance coefficient at the level of 0.01. * Significance coefficient at the level of 0.05.

According to Table 5, there was a significant correlation between motivational and hygiene factors at a significance level of 0.01 ($r = 0.747$). In other words, the higher the employees had motivational factors, the higher they would have hygiene factors in the workplace. According to the coefficients, there was also a positive relationship between motivational factors and education

level at a significance level of 0.05 ($r = 0.412$) as an increase in employees' levels of education made their intrinsic motivation more important. Similarly, there was a positive relationship ($r = 0.125$) between age and motivational factors at a significance level of 5%, but only work experience had no statistically significant relationship with motivational factors. Furthermore, there was a negative and significant relationship between hygiene factors and education level at a significance level of 5%; in other words, the lower the individuals' levels of education, the higher their labor motivation and hygiene. Similarly, there was a positive and almost weak relationship ($r = 0.189$) between hygiene factors and age at a significance level of 0.05%. Furthermore, there was a significant correlation at a 0.001 level between employees' age and their work experience, and thus the more their age increased, the more their work experience enhanced. According to the results of this table, there was no correlation between other factors.

The results of the open question of this study, "What do you suggest for improving the labor motivation of employees?" indicated that only 91 cases answered the question. Most of the respondents gave more than two suggestions, which made up about 179 sentences and sometimes similar terms. These suggestions were divided into two main groups in a general classification. The first group included suggestions that referred to labor motivation factors in the second part of the questionnaire, and the second group included suggestions that referred to justice, moral and religious values that did not exist in F. Herzberg's theory of determinants of labor motivation. Therefore, these factors can be taken into consideration in increasing the employees' motivation in high-tech knowledge-based enterprises.

Discussion

According to the research findings, employees in certain enterprises considered effective intrinsic factors as the more important factors in labor motivation and put extrinsic factors in the next rank. This result was consistent with several studies (Suhartono, 2015; Mitsakis, Galanakis, 2022). According to the comparison of the importance and priority of each main domain of the extrinsic factors of labor motivation, the "job security", "salary and wage", and "supervision" domains had the highest importance. These results were also consistent with several studies but they were inconsistent with results of another research which considered the above-mentioned factors the least important factors affecting labor motivation among sports employees (Mohamadi, Fasihi, 1998; Raeissi, Mohebbifar, 2006; Timmreck, 2001; Suhartono, 2015; Appleton et al., 1998). According to the comparison of the importance and priority of each main intrinsic factor of labor motivation, the employees considered "recognition and appreciation", "job position" and "advancement and development" as the most important factors. These results were consistent with several studies (Lakra et al., 2012; Mitsakis, Galanakis, 2022).

The correlation between motivational and hygiene factors indicated that there was a positive relationship at a significance level of 0.01, indicating that the more satisfied employees were with motivational factors, they would be more satisfied with hygiene factors in the workplace. The results of the correlation between work experience and other variables indicated that only age had a positive and significant relationship at a 0.01 level. The studies also indicated that the education level had a negative relationship with hygiene factors and a positive relationship with motivational factors at a significance level of 0.05. Therefore, the older employees' age, the higher the recognition and appreciation, job position, and progress and development became more important. Similarly, the older employees' age, the more job security, salary, and wage, and the way of supervision factors became important in creating motivation to fulfill their financial needs.

Among the demographic variables (age, education level, and work experience), only two variables, age, and work experience, had positive and significant relationships at a 0.01 level. Therefore, as the age became older, work experience also increased, and thus older people would obtain higher work experience in knowledge-based enterprises.

Conclusion

The results of the present study and its comparison with other similar studies on motivation indicated that as Herzberg's two-factor theory stated, psychological and intrinsic factors had a higher potential to create labor motivation and other factors, which were in the group of hygiene and extrinsic factors, were placed in the next rank of importance; hence, the results of the present study were consistent with this theory.

In high-tech knowledge-based enterprises, where there was no previous history of a similar study, intrinsic (motivational) factors, despite their low cost and easier access, were more effective in creating motivation among employees of enterprises where the majority of personnel were educated. In these enterprises, managers paid more attention to these motivational factors that could increase work productivity, production, and costs. Therefore, providing a suitable environment regarding the employees' scientific levels and capabilities, along with job security and maintaining moral values and justice, paying attention to the work nature, and providing salaries and wages based on ability and performance, proper appreciation, and appropriate supervision can create more responsibility and sense of commitment to perform tasks in knowledge-based enterprises and ensure the employees' mental health.

Recommendation for future research

According to the results of F. Herzberg's two-factor model in job motivation, it is suggested that a study be conducted to investigate the commonalities and differences in the views of employees of companies with high technologies and other companies with medium or lower technologies. If possible, conducting a cross-country study and selecting homogeneous companies with advanced technologies in several different countries, the existence of possible differences or similarities between countries should also be investigated.

In addition, due to the limitation of motivational studies in high-tech companies in Iran, it is suggested that studies be conducted using other theories related to employee motivation to enrich the applied studies and enable better planning in the field of high-tech companies. They pave the way for economic development.

Limitation of the study

This study, like many other field and applied studies, has certain limitations, the main of which is the access to the statistics of active companies with advanced technologies, the distribution of the questionnaire among the personnel, and the time it takes to collect the answers provided by the questionnaire.

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Факторы мотивации труда специалистов высокотехнологичных предприятий Ирана

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Аннотация. Человеческие ресурсы являются наиболее важным фактором успеха любой организации, оказывая значительное влияние на достижение организационных целей. Поэтому выявление и определение детерминант трудовой мотивации играет весьма решающую роль в повышении производительности работников и повышении качества их труда. *Цель.* Целью настоящего исследования было определение детерминант трудовой мотивации работников высокотехнологичных предприятий на основе теории двухфакторной мотивации Ф. Герцберга. *Процедура исследования.* В описательно-аналитическом поперечном исследовании 2022 года среди девяти наукоёмких предприятий в Тегеране простым случайным методом было отобрано 144 человека, среди них были розданы анкеты и собраны необходимые первичные данные. Анкета состояла из трёх частей. Во-первых, была собрана демографическая информация, такая как возраст и пол. Вторая часть содержала 40 факторов, основанных на теории мотивации Ф. Герцберга в 11 областях (пять областей внутренних факторов и шесть областей внешних факторов), которые оценивались по пятибалльной шкале Ликерта (от очень важного до безразличного). *Результаты.* Результаты исследования показали, что, с точки зрения респондентов, внутренние (психические) мотивирующие факторы были более важными, чем внешние (гигиенические). Наиболее важными внутренними факторами были признание и оценка, положение на работе, прогресс и развитие, а наиболее важными внешними факторами, влияющими на трудовую мотивацию, были гарантии занятости, заработная плата и способ контроля. Результаты показали статистически значимую и положительную связь между внутренними и внешними факторами при доверительном уровне 0,01 отрицательную связь между уровнем образования и гигиеническими факторами и положительную связь при уровне значимости 0,05 между уровнем образования и мотивационными факторами. Среди демографических переменных была положительная и значимая связь только между двумя переменными — возрастом и опытом работы.

Ключевые слова: мотивация труда, двухфакторная теория Герцберга, мотивационные факторы, гигиенические факторы, высокотехнологичные предприятия, наукоёмкие предприятия.