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**Fatigue, its causes and effects on HR performance**

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# 1. Introduction

Human Resources Management is one of the accepted forms in both of academic and commercial organization since the middle of 1980's till today. Human resources management is complex managing model which associates theory and ideas for itself in different areas such as psychology, management, sociology, and economy.

Main researching object maximum usage of humans' potential abilities that is Human Resources Management includes different issues among employee, association, and community. Human Resources Management which can combine functions such as finding adequate employee group for managing strategy determined by enterprises and organizations, evaluating labor market, evaluating opportunities of employees' career progress, measuring quality of work done by workers and labor income is sum of different worker groups and works carried out within the framework of certain methods, principles.

HR management has encountered problems such as labor organization, strategic functions of enterprises, election of motivation criteria, improving management model, upgrading quality and increasing general efficiency of work that is done by employees.

In general, it is necessary to maintain and purposefully orientate well-planned, selected and specialized people in the enterprise to achieve the objectives of enterprises and organizations.

It is impossible to analyzing management relationships without preparing to work some methodology issues of management. Method is cognition and research way, also, acting style, theoretical and practitioner activity ability of collectives, and different humans for understanding object.

Management of labor group includes social, psychological, legal, organizational issues by itself. For this reason, it must be approached to human resources and

work done by human resources by the scope of psychological and moral values, also, social status, because, employees can often encounter with social and psychological problems.

Nowadays, existed intensive working environment in enterprises, responsibility of given work to employees, long and heavy work hours, unstable work regimes, unequal breaks in work hours can create psychological and social problems to workers during their activities.

The organization's work is not possible without the protection of the health of the staff through its security and the protection of staff from various risks. The organization's security is understood as creating conditions for its continuous work by ensuring that financial, material and human resources are protected and used efficiently in the event of a negative impact on negative events.

The employees have right to work in secure and healthy atmosphere. In the past, the hiring side regularly exploited workers with the desire of obtaining many products. As a result of this, the health of employees was hurt, accidents were happened cause of not implementing some security proceedings.

Fatigue problem is one of the encountered problems during the workers' activities that this is related to effects of working sphere, also, related to effects of household.

During the managing HR fatigue problem can negatively effect employees and their work and as a result this impacts employee's attitude to work. Some certain proceedings must be fulfilled for eliminating tiredness situation and not to encounter with this problem during the employees' action.

So how struggle with emerging fatigue problem in HR management? Fatigue situation can emerge in which cases, can be resulted from what, what are the effects to workers and their action and finding out results?

We will try to learn only the answer of this in this investigation. We will reach our ultimate goal by explaining how fatigue affects the performance of employees through certain surveys and the effects of fatigue experienced.

## **2. FATIGUE AND ITS CAUSES**

### **2.1. Fatigue and its causes**

Modern management requires that changes in management system affect the enterprise environment. These changes vary for reasons that are not dependent on employees. In today's companies, human resources activities are influenced by some situations where employees are exposed or not. These kinds of employees show themselves in their work performance. At present, there are cases in the workplace that can affect their mechanical and mental movements, which are concentrated under the so-called "fatigue" of worker-employee relationships, and employers' approach to work. It is normal for everyone to feel fatigable at times, but this is a mechanical hazard for individuals who are unstable for an indefinite duration. Chronic fatigue in workers can create potential job accidents that affect individuals in their work and private lives. This, in turn, has a optimal affect on human resources performance. Workplace safety and productivity are directly linked to employee health. There may be physical, biological and psychological factors that can affect the worker at work. The main issue is how to manage these effects. The presence of healthier working group promises more reliable workplace and higher productivity. A well-rested healthy workforce has an important place for more productive activities.

Although the concept of "fatigue" is scientifically-psychologically different, there are no definitions of its standard. The word "fatigue" is the first occurrence of a problem that arises as a problem for tired, sleepless civilian worker, who for a long time has been subjected to mental or physical work, harsh effects of work or living conditions. Today's tiredness of employees is one of the major problems facing human resources management in modern company operations. Fatigue is a serious threat to the workplace and may be related to the health of employees, which can negatively affect both employee. The term "fatigue" is a common concept that can be derived from a variety of factors, based on widespread belief in labor medicine.

Therefore, this term can be accepted as standard in the whole world and it is not possible to provide a complex definition that covers every field. Since the term fatigue is a general term, scientific literature can sometimes be replaced by "fatigue" and "sleep state". Although the first may be substitute for fatigue, the latter is also considered to be one of the factors causing fatigue. One of the first steps in understanding the concept of "fatigue" is the correct understanding of "fatigue" and "sleep state" factors. Even experts in the field have difficulty allocating these parameters.<sup>1</sup> It is difficult to distinguish these concepts because both of the concepts of "fatigue" and "sleep cycle" are situations in which the person experiencing sleep deficit is facing a problem. "Sleep cycle" is the physical and mental reflection of the need for neurobiological sleep in a person's sleeping habits from sleep hormones. The long hours employees spend on work cause sleep patterns to change. Employees who fit into this situation can not sleep comfortably during the day after the fatigue caused by severe physical work during normal working hours. "Fatigue" generally indicates disruptions in job performance. In addition, there are also psychological aspects of fatigue, which do not have enough energy to do the job and continue to follow a certain instruction, which means reluctance. For this reason, fatigue is a warning for physical or mental activity that ends up in the body. Thus, the ability of a person who is fatigued to reduce mental and physical action decreases.

Fatigue is not the only feeling that a worker does not have enough energy to do the job. Also, fatigue can affect the attitude of the worker to the work done and to the coordination that drives it. Mental activity can weaken, including vigilance, attention and motivation. Dr Cullen,<sup>2</sup> scientist who studies fatigue in the workplace, states that "accidents in the tense working environment surrounding stress and anxiety that lasting mental and physical activity are inevitable."

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<sup>1</sup> Gander p., Purnell H., Garden A., Woodward A., Work patterns and fatigue-related risk among junior doctors, 2007, p-64

<sup>2</sup> Folkard S, Popkin SM., Understanding fatigue in the workplace and how to manage it. 2015, p-9

According to the Canadian Center for Occupational Health and Safety,<sup>3</sup> long-term recruiting and long-term job environments may hamper workers' incidence of fatigue. According to his research, he found out that fatigue was classified as acute or chronic. Acute fatigue stems from short-term sleep patterns or short-term physical and mental illness. The dramatic effect of short-sightedness is manifested in a short time. Energy can be restored by sleeping or resting. Chronic fatigue is a condition of fatigue in a hard-working mode. Symptoms are similar to influenza, overweight for more than 6 months, and interferes with certain activities.

Fatigue is a general concept used to describe the termination of the burn. Energy shortage is a gradual process that emerges as a result of decreased performance and exhaustion. At present, industrial and social security is becoming a major problem for businesses where fatigue is too extreme. As a result of general research, fatigue is a mental or physical exhaustion that reduces the ability to work in a certain business context in a quality, safe and efficient way.

There are many symptoms of fatigue itself. These involve the feeling of fatigue after sleeping, the weakness of hands, eyes reactions, short-term memory problems and unwillingness to work, decreased visual acuity and vision, the need for additional sleep during the work, a feeling of insecurity in the environment, inaccurate work, digestive problems and excessive sensitivity.

Searching for causes of fatigue helps to find solutions to workplace fatigue, reduce work-related accidents, and improve the quality of work. Fatigue can be caused by work-related or out-of-work factors. The most important reason for fatigue is the lack of a properly defined sleep hours. In addition, fatigue can also arise from a combination of different factors that depend on one another. For example, the workload indicates the amount of instruction that the worker must perform. Proper

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<sup>3</sup> Powell J., Otsberg O., Improving Alertnessthrough effective fatigue management, 2005

workload management can create fatigue in the work environment. Workloads are classified in three forms according to the results of general research:<sup>4</sup>

\*physical workload

\*ecological workload

\*mental workload

Physical workload indicates the physical load of the employees and consists of persistent attempts to execute hard work, hesitation in performing any work, static load and recurring movements. The employee's health condition plays a role in his sense of fatigue. The physical problems that the body faces can make fatigue. Vitamin deficiency, heart disease, arthritis, diabetes, thyroid, cancer, and other diseases can increase fatigue in the human body.

The environmental burden of the workplace is that workers are exposed to environmental degradation and are caused by sudden temperature changes, environmental noise, light in the workplace, sudden vibrations, and humidity. Exposure to sudden changes in the temperature of the air, sitting near the hot or cold ventilation openings, and increasing the feeling of fatigue of the organism while continuing to work in extreme working environments. The weakness of light in the room, the brightness that causes the eyes to become fatigued, the persistent noise or the constant sound may cause fatigue acceleration.

Mental workload expresses mental fatigue and factors that lead to its occurrence are labor hours within the shift, responsibility for the job, work stress, relationships with employees and the nature of decision-making.

Caremark Rx Inc.<sup>5</sup> a study led by Judith Ricci found that fatigue was caused by various factors. It has been learned that most of the work-related settings have long-term working hours, long-term mental and physical activity, inadequate interruptions between activities, inadequate relaxation, over-stress and overall

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<sup>4</sup> Pasupathy KS., Barker LM., Impact of fatigue on performance., 2012, p 22-30

<sup>5</sup> Healthier Workplace, <https://www.alsco.com.au/2015/09/understanding-fatigue-in-the-workplace-and-how-to-manage-it/>, 29 September 2015

combination. they begin to feel fatigued. The body's natural energy is diminished, and they have to spend more effort to see what's going on. Long-term working hours, inadequate work breaks, physical or mental-guided instructions make the body become fatigued. There are five factors causing fatigue, which are the most common cause of fatigue in the work experience:

- \*Increased sleep loss

- \*Night life is not properly set up

- \*Problems with the regulation of human inner hours

- \*Increased physical activity in the workplace

- \*Focusing on nutrition and body illnesses with careless

The human body has a built-in clock and a natural-time clock mechanism. These hours create a difference between night and day. The task of the nature-adjusted watch sends signals to sleep, wake up, eating. It was calculated that an adult should sleep an average of 8 hours a day. If this does not happen, the rhythm of the organism is disturbed, which shows the decrease in human sleep quality. The violation of the sleep hour destroys the personality balance. The body rests at night, determined for sleep, and restores its energy for a new day. Long-term work, night-time work, inter-continental travel and more. so it can cause fatigue to the organism's natural sleep system and the internal body clock.

Workload and employee-level inequality cause problems with turn-by-turn activities. Both planned and frequently changed working hours make matters worse in the night or day mode.

Changes in workloads, merging of different departments, and increasing the demand for work reduce the way out of the problem. Study of employee levels plays a major role in determining the following criteria:<sup>6</sup>

\*average working hours per employee

\*average time between consecutive business modes

\*average time between common business modes

\*total work hours within the employees' weekly

\*total work hours of employees on consecutive working days

\*length of work hours in night or day mode

In January 2011, the Maine-based Round-The-Clock Resources Inc. website, HCI<sup>7</sup> (Human Capital Institute) the founder and CEO of the organization, Susan L. Cohen. He stated that "When the performance of employees is measured, the quality of the employees should be taken into account in order to obtain the correct financial results. Some administrators do not take into account factors such as the proportion of errors, quality problems, or dismissals as a result of additional work hours when evaluating performance. All of these are directly influenced by the amount of additional work hours. It is important to pay attention to the working hours of the staff working in the enterprise and its relationship with the financial results.

Sometimes the causes of fatigue can be directly related to the activity of the work. That is, the task of the worker involves the factors that cause fatigue. Examples include pilots, drivers, doctors, police officers, seasonal workers, emergency medical or service personnel, and call center personnel.

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<sup>6</sup>Steven E. MD, MPH; Eskin, Evamaria MD, MPH, Fatigue Risk Management in the Workplace, [https://journals.lww.com/joem/Fulltext/2012/02000/Fatigue\\_Risk\\_Management\\_in\\_the\\_Workplace.17.aspx](https://journals.lww.com/joem/Fulltext/2012/02000/Fatigue_Risk_Management_in_the_Workplace.17.aspx)

<sup>7</sup> Kathy Gurchiek, Employers can control some fatigue factors, , 20 January 2011

Not only that of a person who has a job, but also what he thinks he is responsible for, and the will of the inner person, can also lead to fatigue. For example, it is normal for a person to be a workman, a worthy wife, a caring parent, but to think of how to handle all these situations creates psychological distresses. Thus, we can see that psychological parameters play a major role in the formation of fatigue.

Fatigue affects workers and depends on the strength, durability, motivation of these employees. Employees at different levels are affected differently from fatigue. As a result of the global experiment took by Workforce Mood Tracker and SHRM / Globoforce, five major types of worker psychological fatigue have been identified:

1. Worker without spirit
2. Employees who is waiting to end
3. "Negative" workers
4. "Fortune-teller" workers
5. Group rated low

Worker without spirit - Such workers do not see the meaning of their work. As they do not know how to contribute to the company's strategy, the company's mission does not matter to them either. In general, they continue to work together with a lack of motivation. The lack of motivation, incoherence, and lack of motivation in spiritless workers make them fatigued. There is a need for inspiration from the work they are seeing every day so that they can be fully engaged. According to some workers to given themselves, it is important to show them how to look at a particular issue or issue, so that they can learn what values they can invest in. If we do this without endangering the corporate culture of the enterprise, we will have the belief that the entire working group is valuable to targeted strategies. Nevertheless, research shows that the performance of the working group is assessed in a lack of dissatisfaction with the well-known companies of corporate

culture. By means of certain motivation methods and assessments, employees feel responsive to the work they do and are inspired.

Employees who is waiting to end - Such workers work normally from 9 to 5 hours in standard mode. When it's 5 o'clock, they want to leave their job immediately. These motivated workers go to the endless end of the job. In the same situation, unrelenting workouts create fatigue situations. If they do not need it, they do not need extra working hours, and additional hours of work seem to be a bit tedious for them. Approximately 81% of companies offer jubilee awards for long-term employees such as "Annual Service" or "Long Service". Approximately 15% of the working groups in such companies report that this rewards give them a more serious approach. Approximately 73% of employees are welcomed by colleagues or positive feedback from company management.

"Negative" workers - Such workers, mainly, come into the business environment with bad news and emit negative energy. Unsatisfactory situations in which they live are influenced by other workers at work. Some employees are sometimes liked to Debbie Downer, one of the imaginary heroes of the Saturday Night Live television program in America. So, this image in the program draws on the negative feelings, on the negative views of the debate, and says that everything is a bad idea. This charcater, as well as those in the visual literature, also call such workers who suffer from Debbie Downer syndrome. Their negative thoughts and hopelessness cause psychological fatigue.

"Fortune-teller" workers - Workers from this group are afraid of the outcome of their work. The fear is related to their thoughts "everything will be the same". The reason for this is poor work performance and unreliable activity of the employee's business structure. Improper performance of traditional performance ratings in companies can lead to this conslucion. On survey shown by Salary.com, approximately 51% of the working group believes that 45% of administrators see traditional performance assessments as an unsuccessful mechanism and that their performance is inadequate. Based on the survey conducted at the other stage of the

same survey, approximately 61% of respondents said that traditional performance evaluation is rarely successful or not at all. "Fortune-teller" workers think that their performance is not properly evaluated, and they expect the standard operation to continue. As a result, they are experiencing psychological fatigue.

Group rated low - Employees in this group think that their work is low. They think that any instructions are evaluated only once in a month, and they consider why they spend the next 11 months. Such thoughts create dissatisfaction with the workers, motivation. This, in turn, leads to psychological fatigue in the work environment.

## **2.2. Effects of fatigue and its results**

Workers' experiences of fatigue impact their job. Determination and measurement of fatigue is a very difficult process. It is difficult to measure fatigue because there is no standard accepted in the world that can impress its impact on employee activities. The absence of a standard quantity makes it difficult to measure fatigue. Since it is difficult to measure, it is also difficult to determine the relationship between long-term working hours and the need for sleeping to affect any change in the acceleration of accidents that occur during work activity. Employees are generally reluctant to acknowledge that they are in tiredness. However, fatigue can generally have a negative impact on the workplace. Tiredness reduces the ability of employees to work in a work environment, weakens their complex planning skills, affects the correct communication style, and reduces the quality of work and productivity. Low attention, neglect, memory disturbances, sleeping during work activity tell Human Resources Administrators to have a fatigue signal in the work environment and gradually increase fatigue in the enterprise. According to a study conducted at the University of Monash<sup>8</sup> in Australia, fatigue has 5 warning signs for Human Resources:

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<sup>8</sup> The news site of the Australian HR institute, What are the risks of workplace fatigue?, <http://www.hrmonline.com.au/section/strategic-hr/risks-workplace-fatigue/>, 27 January 2017

1. Unusual feelings - Emotional distress, problems with mental problems or ill-treatment of employees in the work environment
2. Display Delays - Employees may delay the work for a variety of reasons at certain times, but consistent repetition indicates that the balance between work and private life is not properly set.
3. Regular work environment - Although some people prefer to work in a chaotic work environment, they are normally considered as symptoms of fatigue.
4. Annutrition and theoretical inattention - Flexible forgetfulness can affect the entire working group. The team set up for a specific target causes other employees to lose time and performance.
5. Reduced productivity - Fatigue leads to a decrease in productivity, which shows how much the employee works, but less effective. This lengthens the time it takes for employees to determine a specific case.

Employees do not respond to changes in the environment or address them when they are experiencing fatigue, increase their risk, and lose their ability to judge. In this way, unwanted accidents can occur in the work environment, and work health is reduced. Occupational health is an environment in which work-related accidents do not work without the need for sleep full-power energy in certain work environments.

Caremark Rx Inc.<sup>9</sup> In another research led by Professor Judith Ricci, experts examined the correlation between occupational health and productivity. As a result of the experiment, fatigue has a negative impact on the ability to work and work environment. Indeed, those who are fatigued have shown lower performance. In addition, as a result of the study, fatigue disturbed the attention of the employees to the job, and increased the time to follow the instructions. In institutions and organizations with high levels of control, employees are similar to experience

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<sup>9</sup> Healthier Workplace, <https://www.alsco.com.au/2015/09/understanding-fatigue-in-the-workplace-and-how-to-manage-it/>, 29 September 2015

fatigue. This is due to the assumption of error and the increase in accountability. The psychological impact of this situation on employees affects the quality of work, which in turn leads to a decrease in productivity.

Fatigue can cause industrial injuries, work errors, accidents in the work environment. It is harmful to workers' health and can lead to cardiovascular disease. Idle fatigue affects thought, perception, tactics. Dr. Susan L. Cohen<sup>10</sup> notes that fatigue seems to be the result of long-standing alcoholism, which causes people who love to sleep for a long time suddenly sleeping hours. When a person is in a state of fatigue, the brain tries to capture the "micro-dream" periods in a short, unconscious manner that can occur at any given time. The worker can be tired, although the brain is active.

Fatigue in the work environment does not only affect employees' mental and physical health, but also can be a problem for the health and safety of the surrounding people. Fatigue can affect every kind of work environment. Even though there are no obvious signs of fatigue when you deal with it, each employee experiences fatigue. Therefore, fatigue is a factor that should be considered psychologically and socially in Human Resources. Fatigue reduces the ability of a worker to think clearly, to make conscious decisions, reliability and productivity.

In addition to mental fatigue, chronic fatigue can create certain obstacles in the worker's life. In chronic fatigue, workers feel tired all day long. When they want to sleep, they do not feel the need to sleep better, and feel like they have not had enough rest in the morning. Chronic exhaustion continues for a long time, and being under the influence of fatigue for a long time affects workers as they face problems such as misunderstandings or distractions. At the same time, an increase in mistakes and a lack of energy are a bit strained. Instead of an enthusiastic, motivated figure in the workplace, the worker creates a tired and complainant one.

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<sup>10</sup> Kathy Gurchiek, Employers can control some fatigue factors, <https://www.shrm.org/hr-today/news/hr-news/pages/fatiguefactors.aspx>, 20 January 2011

In a particular team, the same spirit of one person also affects other workers, which affects the overall performance.

Fatigue can affect everyone, regardless of knowledge, skill, and education. It can reduce the mental and physical ability of workers who are responsible for simple tasks. In the event of fatigue, a person's sensitivity is rising, a coordination problem and gradual loss of brain function.

Fatigue can cause many accidents in the workplace. Therefore, enterprises should be prepared for industrial safety and take steps to eliminate fatigue that affects employee health. It is important to think about the prevention of various types of fatigue during Human Resources. As the body's internal clock is one of the most crucial reasons for fatigue, it also increases the impact of sleep disorders on the quality, performance and inconsistency of prophylactic strategies.

Long-term night shift, extra working hours, fatigue created in the working environment where the fluid regime has been affected have been repeatedly discovered by academics that can affect the safety and performance of the work. It sometimes depends on individuals themselves on the incompatibility of the organism in the watch mode. Although the sleep time is less than the night shift, it is better than the sleep time of the turnaround employees. The 24-hour sleep deficit has a 0.1%<sup>11</sup> greater effect on neurobiological behaviors compared to the amount of alcohol in the blood. A small amount of sleep loss can affect the ability to act cautiously in some positions. Sleep hours fewer than 2 hours per day for a week can lead to consistent awakening and reduced performance in 24-hour sleep mode.<sup>12</sup>

Some fatigue studies indicate that industrial accidents that occur as a result of fatigue are more common in daylight mode. This is caused by a contradiction between the body's internal clock and the need to wake early. The reason for the inner circle's internal contraction is the lack of proper sleep hours. In a similar way

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<sup>11</sup> Dawson D, Reid K. Fatigue, alcohol and performance impairment. *Nature*. 1997; p 388:235

<sup>12</sup> Belenky G, Wesensten NJ, Thorne DR, et al. Patterns of performance degradation and restoration during sleep restriction and subsequent recovery: a sleep dose response study. *J Sleep Res*. 2003; p 12:1–12.

to other disorders, such as hypoglycaemia and some other drug abuse, workers are vulnerable to the effects of their insomnia with subjective outcomes that are not correlated objectively. Employees working in long-term or night-time mode are not affected by sleep loss equally. It can even be recorded in individual differences between insomnia and work performance. It depends on the workers' immunity, their organism.

One of the areas where fatigue safety has long been recognized is the transport industry.<sup>13</sup> The International Traffic Safety Organization says police say nearly 100,000 machine accidents per year are likely to result from driver fatigue. These accidents result in financial losses of average 1550 deaths, 72,000 injuries and \$ 13 billion. The National Traffic Safety Board has started investigating accidents happened from fatigue or auxiliary role.<sup>14</sup> The cause of the study was the fact that most accidents were caused by fatigue since 1989. Increased number of traffic accidents is more commonly seen in medical staff working in long hours or in night-time mode. It is reported that nurses working in 12.5-hour regimen are at greater risk of injuries, work accidents, or medical exposures. The same cases were observed in doctors. So, when the doctors worked for a long time, the number of errors and injuries has increased. More than 24 hours of duty causes more doubts and 36% more medical errors. This fatigue state can lead to household accidents not only during the execution of any instructions during the task, but also in extracurricular areas.<sup>15</sup>

A 100-person study conducted by National Health Interview's Lombardy study revealed increased safety in work environment by increasing sleep clocks in various industries.<sup>16</sup> Accordingly, risk of injury from sleep fatigues caused by sleep of up to 5 hours was 7.89%, 5.21% for 6 hours of sleep, 3.62% for a 7-hour sleep,

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<sup>13</sup> Philip P, Akerstedt T. Transport and industrial safety, how are they affected by sleepiness and sleep restriction? *Sleep Med Rev.* 2006;10:347–356.

<sup>14</sup> National Transportation Safety Board. Factors that affect fatigue in heavy truck accidents. PB95-917001, NTSB/SS-95/01. Washington, DC: National Transportation Safety Board; 1995.

<sup>15</sup> Lockley SW, Barger LK, Ayas NT, Rothschild JM, Czeisler CA, Landrigan CP Harvard Work Hours, Health and Safety Group Effects of health care provider work hours and sleep deprivation on safety and performance. *Jt Comm J Qual Patient Saf.* 2007;33(suppl):7–18.

<sup>16</sup> Lombardi DA, Folkard S, Willetts JL, Smith GS. Daily sleep, weekly working hours, and risk of work-related injury: US National Health Interview Survey (2004–2008). *Chronobiol Int.* 2010;27:1013–1030

2.27% for 8 hours of sleep and 2.22% for a 9-hour sleep. Low sleep times, such as industry, specialty, income, sex, age, weight increased working hours increase industrial accidents.

It is reported that increase in working hours in other industries also has impact on work accidents. According to study conducted by Vegas, 64 hours week employees are 88% more risk than 40 hours of work. Of course, factors such as gender, age, and qualification are taken into account.<sup>17</sup>

Research shows that one of the main factors causing industrial accidents and injuries in different types of work is fatigue, which can result in long-term working hours, night-time work, extra working hours and poor sleep management. In business environment improper administration of some parameters leads to some undesirable consequences. There are some tasks that employees must do to fight fatigue. At the same time, managers and administrators, in addition to employees in particular enterprise, must also take responsibility for the management of fatigue factors in the work environment.

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<sup>17</sup> Vegso S, Cantley L, Slade M, et al. Extended work hours and risk of acute occupational injury: a case-crossover study of workers in manufacturing. *Am J Ind Med.* 2007;50:597–603.

## **3. RESEARCH ABOUT EFFECTS OF FATIGUE ON HR PERFORMANCE**

### **3.1. Fatigue management**

As reported in the previous pages, fatigue can cause various accidents in workplace. In order to eliminate this, there is no standard system for tiredness. Work strategies should be considered to study different types, causes and consequences of fatigue. There are several plans for practical purposes that do not lead to fatigue of employees' activities.<sup>18</sup> In one of these, fatigue precautions are divided into two parts:

1. Precautionary measures before work and interruptions

2. Operating strategies used during business activity

As the worker's sleep pattern is major factor in causing fatigue, preventive measures are planned to reduce the impact of sleep loss on employee performance.<sup>19,20</sup> These measures combine different methods. Most of these methods eliminate effects of fatigue as soon as possible, and then can provide workers with efficient and safe conditions. Some of these methods are:

\*sleep loss reduction

\*short-term sleep at night

\*training employees the right sleep habits

\*remedies (stimulants)

Sleep loss reduction - Promoting quality sleep in work environment is important factor for maximum performance. Generally, people need 8-hour sleep that balances the necessary awakening throughout the day. A small number of employees can see their activity at optimal level with less than 8 hours of sleep.

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<sup>18</sup> Dawson D, Chapman J, Thomas MJ, Fatigue-proofing: A new approach to reducing fatigue-related risk using the principles of error management. *Sleep Med Rev*, 2011, p 1–9.

<sup>19</sup> Razmpa E, Sadegh Niat K, Saedi B. Urban bus drivers' sleep problems and crash accidents. *Indian J Otolaryngol Head Neck Surg*. 2011, p 63:269–73.

<sup>20</sup> Ferrara M, De Gennaro L. How much sleep do we need? *Sleep Med Rev*. 2001 p 5:155–79.

Experts advise that before working, workers should rest.<sup>21</sup> The data indicate that fatigue accidents occur more frequently in 12-hour working modes and in very short working modes. Therefore, in 12-hour mode, you need to override extra working hours and pause between the two queues.

Short-term sleep at night - The most effective way to reduce fatigue for retired workers. Many experiments show that short-term interruptions have a positive effect on the mental state and performance. In addition, a 30-minute sleep break at normal nighttime sleep and night restriction improves subjective awakening. Fatigue control studies indicate that workers' performance increases during the short hours after short break. Experts say that it is more beneficial for workers to have a short break.<sup>22</sup> The first sleep cycle varies between 90-120 minutes. REM says that in this case, the eyes of the human being are closed, regardless of the muscles. Human beings are more likely to survive the REM stage after waking up.

Training employees the right sleep habits - There are special actions that can improve every sleep mode, and some of these are the following:<sup>23</sup>

- \*get normal regular sleep to prevent sleep disturbances whenever possible

- \*leaving the bedroom only for sleep, and removing the conditions for the business process to continue

- \*the use of sleeping regimes, such as listening to the radio

- \*if you have sleep problems, avoid using alcohol before bed

- \*bedroom settings: quiet, dark and comfortable as possible (The ideal temperature for the bedroom is 18-24 'C.

Restorative remedies - In situations where fatness can not help to regulate other factors, dosage enhancers can be considered. Which can help keep awake in the

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<sup>21</sup> Folkatd S, Lombardi DA, Tucker PT. Shift work: Safety, sleepiness and sleep. Health. 2005, p 43:20-3.

<sup>22</sup> Caldwell JL, Paul MA, Miller JC, DF. Aerospace Medical Association. Fatigue countermeasures in aviation. Aviat Space Environ Med. 2009; p 80:29-59

<sup>23</sup> Pérez-Chada D, Videla AJ, O'Flaherty ME, Palermo PMI, et al. Sleep habits and accident risk among truck drivers. A cross-sectional study in Argentina. Sleep. 2005; p 28:1103-8.

long run if you do not have enough sleep to stay awake. Replacers, which carry the drug through the effects of fatigue, have been used in many types of work. Large commonly used medication is modafinil and amphetamine.

Preventive measures to alleviate fatigue during exercise are less than those listed above. In particular, high safety requirements are forced limitation of workers' stay within during work hours.<sup>24</sup>

In 2000, James Reason proposed two approaches to human error:<sup>25</sup>

1. Individual approach

2. System approach

Individual approach - It is based on the person's mistakes, for example, forgetfulness, inattention, irresponsibility, indifference.

System Approach<sup>26</sup> - System errors are based on the possibility that people can make mistakes, and they are likely to be able to do so. In this approach, errors are the causes and more attention is paid to the failure of the system. For this reason, this model is based on changing the working environment, rather than shifting people to improve the model. The main reason for this is the concept of "systematic defense" of obstacles and security measures. Based on a systematic approach, investigation of the case is not about why it didn't make mistakes, but how and why the defense system did not work.

High-tech systems provide several levels of protection during operation. Some of these are built-in systems some people and other controlling factors. Ideally, each layer should be solid and complete. However, there are still opportunities for weaknesses and failures. In other words, each floor looks like Swiss cheese with many holes. The nature of control indicates that these holes are constantly opened,

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<sup>24</sup> Searle AK, Paterson JL. Look before you (s)leep: Evaluating the use of fatigue detection technologies within a fatigue risk management system for the road transport industry. *Sleep Med Rev.* 2014; p 52

<sup>25</sup> Reason J. Human error: models and management. *BMJ.* 2000;320:768-770.  
[www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf). Accessed September 19, 2011.

<sup>26</sup> Reason J. Human error: models and management. *BMJ.* 2000;320:768-770.  
[www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf). September 19, 2011.

closed and moved. The holes in one layer may not be problematic, but this can occur in several layers that can lead to problems that can cause serious complications.

The gaps in the defense system are caused by two reasons:<sup>27</sup>

1.Active and persistent failures

2.Hidden and overlooked conditions

Active errors are employees' dangerous actions. They can be, for example, out of shifts, mistakes and procedures. The impact on the integrity of the system is often a short period of time.

The hidden and obscure conditions depend on decisions taken by organizers, developers, and senior executives. Some defenses may cause long-term vulnerabilities. However, these conditions may not be known for many years because of their confidentiality. In general, it is more useful to uncover confidential conditions than easily detect active errors.

A traditional approach to workplace fatigue can't focusing all aspects of fatigue and has only a superficial defense system at work. Effective way to manage fatigue in the work is the newly - developed Fatigue Risk Management System.

Theoretical foundations of the FRMS are based on the knowledge of sleep science that incorporates recovery of cumulative or temporary sleep loss, and regulates the systemic activity and sensitivity of the human body biological clock. Therefore, FRMS is a field that has stronger scientific basis for the management of fatigue in the work environment, including the science of sleep science and the body's biological clock.

FRMS is a multi-layered defense system designed to protect and manage fatigue in the work environment. This multi-layered defense system is designed for fatigue

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<sup>27</sup> Reason J. Human error: models and management. *BMJ*. 2000;320:768-770. [www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/pdf/768.pdf). September 19, 2011.

management in the context of the "SMS - Safety Management System". Any danger that may occur on this system can be traced back to the trajectory after passing through all layers. Strengthening all layers individually can increase the effectiveness of SMS.<sup>28</sup>

Accidents in both systems are considered to be the end point of the random event chain. The activities of the SMS are designed to eliminate all types of risks. FRMS, in particular, is a system of fighting against fatigue and accidents that can cause it in the work environment. The FRMS model was first introduced by Dawson and McCulloch. This system incorporates defense layers that can create a combination of potential hazards at 4 points. It is possible that fatigue-related work accidents are present in each of these four points.<sup>29</sup>

According to this model, 5 protection layers can be used to eliminate accidents or incidents in the workplace:

Level 1 - Give workers the opportunity to have enough sleep

The main question here is, "How much sleep time does a worker spend on working time?" To minimize the likelihood of fatigue, businesses should create sleeping habits that are sufficient for workers. This level is partly the traditional method and has the same features.

Level 2 - Approval of the need for sufficient sleep to find out that employees are eligible for the task.

At this level, there are also dependent workers. Employees should ask themselves: "Have I been able to work fairly and without fear in the last days?" The first level of control is not always enough. An employee with optimal quality can be tired when working safely. For example, because of family or household problems, it

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<sup>28</sup> Dawson D, Chapman J, Thomas MJ. Fatigue-proofing: A new approach to reducing fatigue-related risk using the principles of error management. *Sleep Med Rev.* 2011, p 1-9

<sup>29</sup> Dawson D, Searle AK, Paterson JL. Look before you (s) leep: Evaluating the use of fatigue detection technologies within a fatigue risk management system for the road transport industry. *Sleep Med Rev.* 2014, p 52

can not sleep enough at rest time. For this reason, sleeping at minimum 48 hours and measuring maximum survival is a important analytical factor.

Level 3 - Determine the symptoms of fatigue in workers' behavior

Although the previous 2 levels are appropriate models, cumulative fatigue has the potential to affect the performance of the employees and increase the probable risks. Cumulative fatigue can cause individual dysfunctions, sleep disturbances, idiopathic problems, and other causes. This level helps identify the symptoms of extensive fatigue, from simple simplicity management regimens to mixed physiological tests from employees and organization. Examples of simple symptom management lists are Samn Perelli's "Fatigue Management List"

4th and 5th levels - Evaluation and management of accidents and incidents caused by fatigue<sup>30</sup>

These levels are used to study the effects of previous levels. The information provided by these levels determines where the FRMS is in the event of an accident. Performance testing, workplace observations, and predefined problems are the means of gathering data. These levels are used to continuously update the FRMS to collect data, improve operating conditions, and prevent future events from occurring in ongoing activities.<sup>31</sup>

There are two approaches that can be used to eliminate fatigue and effects after determining the potential risk of fatigue at work. The three levels of FRMS are dependent on fatigue in the workplace and also indicate the presence and survival of the tired worker. On the other hand, the elimination of fatigue implies a strategy of reducing any possible mistakes that may result in an accident or injury to a tired worker working in the workplace. For example, work with lower risk can be set at times when fatigue limit is high, and complicated and high-risk jobs can be set at times when fatigue is low or unusual.

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<sup>30</sup> Gander P, Graeber RC, Belenky G. Fatigue risk management. In: Kryger MH, Roth TR, Dement CD, editors. Principles and Practice of Sleep Medicine. 5th ed. Philadelphia: W.B. Saunders; 2011. p. 8

<sup>31</sup> Dawson D, Chapman J, Thomas MJ. Fatigue-proofing: A new approach to reducing fatigue-related risk using the principles of error management. Sleep Med Rev. 2011 p 1-9

These five levels create a protective layer for the FRMS. For each more effective FRMS model, each defense level must integrate into the common framework. According to Dawson and McCulloch models

Level 1 requires that a worker find a sufficient opportunity to sleep;

At the 2nd level, the worker must be able to really enough sleep;

Level 3 should be avoided if the sleeping person is not experiencing fatigue behavior;

At the 4th level, it should be noted that fatigue-related errors are not causing inconvenience;

At the 5th level, an incident related to fatigue should be investigated and reported as to how and why the FRMS controls have failed. This approach combines the Moore-Ede model<sup>32</sup> with the work environment and ensures that fatigue failures are not present.

Optimal management of fatigue risks, in both cases, fatigue and tiredness strategies should be used as a complementary component of the FRMS.<sup>33</sup>

Fatigue is a major problem in the modern work. It is more common in cases with high demand, long-term works.<sup>34</sup> The hardness of the problem and ways to engage fatigue are different in industry. In order to effectively manage fatigue in the work environment, it is important to establish the employees' biological hours, to provide for the prediction, dynamics and recovery of temporary and cumulative sleep losses.

Fatigue may sometimes be a symptom of a more serious problem. For example, it can be seen that health problems such as diabetes, depression, obstructive sleep obstruction, hypothyroidism, anemia narcolepsy, vitamin D deficiency, and

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<sup>32</sup> Moore-Ede M. Evolution of Fatigue Risk Management Systems: The “Tipping Point” of Employee Fatigue Mitigation. CIRCADIAN® White Papers. [www.circadian.com/pages/157\\_white\\_papers.cfm](http://www.circadian.com/pages/157_white_papers.cfm). 2009 August 3, 2011.

<sup>33</sup> Gander P, Graeber RC, Belenky G. Fatigue risk management. In: Kryger MH, Roth TR, Dement CD, editors. Principles and Practice of Sleep Medicine. 5th ed. Philadelphia: W.B. Saunders; 2011. pp. 760–8

<sup>34</sup> Sadeghniaat-Haghighi Kh, Aminian O, Pouryaghoub Gh, Yazdi Z. Efficacy and hypnotic effects of melatonin in shift-work nurses: Double-blind, placebo-controlled crossover trial. J Circadian Rhythms. 2008; p 6-10

unhealthy heart disease. Certain medicines, including some muscles, antibiotics, sedative-hypnotics, medication, blood pressure medications, antidepressants and antihistamines can also cause fatigue, to reduce tension and sleep.

Historically, enterprise security has been a reactive process. Events have been investigated to avoid duplication, and research has been combined with controls. In recent years, however, security and its management have become more broadly focused on security, cost-effective balancing and productivity.<sup>35</sup>

Establishment of SMS can affect many areas and operational safety of the organization. Therefore, the optimal level of security is the result of a successful management model.<sup>3637</sup>

One of the main principles of SMS is security risk management. In security organization identifies the threats it may have. It assesses the risks associated with these hazards, and applies appropriate strategies to reduce the risks and eliminate the hazards. Other components of the SMS are reporting processes, training and education, incident investigation, and audit. These elements are closest to traditional form of security management. However, every single element of the organization has structure that incorporates human resources to safeguard security.<sup>38</sup> Therefore, the need to expand the structure of SMS to FRMS due to fatigue is a natural requirement. Because fatigue is perceived as increased risk of business, this system is known as fatigue management in enterprises and is assessed by functions such as "measuring, weakening, and managing fatigue" exposed to workers. Therefore, the development of the FRMS in the form of integration with SMS is a very powerful tool to combat fatigue.<sup>39</sup>

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<sup>35</sup> UK Department for Transport. Fatigue risk management systems: a review of the literature. London, UK. Road Safety Research Report No. 110; 2010. <http://assets.dft.gov.uk/publications/fatigue-risk-management-systems-a-review-of-the-literature-road-safety-research-report-110/rsrr110.pdf>. September 21, 2011

<sup>36</sup> Air Line Pilots Association, International. Background and Fundamentals of the Safety Management System (SMS) for Aviation Operations: Training Manual. 2nd ed. Washington, DC: Air Line Pilots Association, International; 2006.

<sup>37</sup> International Civil Aviation Authority. Safety Management Manual (SMM). 2nd ed. Montreal, Quebec, Canada: International Civil Aviation Authority; 2009. [www2.icao.int/en/ism/Guidance%20Materials/DOC\\_9859\\_FULL\\_EN.pdf](http://www2.icao.int/en/ism/Guidance%20Materials/DOC_9859_FULL_EN.pdf). August 3, 2011.

<sup>38</sup> Federal Aviation Administration. Advisory Circular: Introduction to Safety Management Systems for Air Operators. AC No: 120-92; 2006, [http://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgAdvisoryCircular.nsf/0/6485143d5ec81aae8625719b0055c9e5/\\$FILE/AC%20120-92.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/6485143d5ec81aae8625719b0055c9e5/$FILE/AC%20120-92.pdf). September 21, 2011.

<sup>39</sup> Dawson D, McCulloch K. Managing fatigue as an integral part of a safety management system. In: Proceedings of Fatigue Management in Transport Operations Conference; 2005; Seattle, WA.

The FRMS has different characteristics:<sup>40</sup>

- \*Science-based: Supported by scientists.
- \*Liability: The senior management is responsible.
- \*Information provided and objective analysis are made.
- \*Budgeted: Investment is returned in a precise way.
- \*Cooperative: All stakeholders have prepared together.
- \*Successful development: Reduces risks over time by using feedback, changes, and assessment.
- \*Fully implemented: All panels, systems, policies, procedures bring together a model.
- \*Integration: Security and health management. It has penetrated both areas because it was established by experts in these fields.

This feature can become essential elements of the FRMS. While still some discussions, the following six elements of the SMS are more important:<sup>41</sup>

- \*Security management policy
- \*Investigation of phenomena
- \*Reports
- \*Internal and external audit
- \*Training and education
- \*Risk Management

FRMS includes:

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<sup>40</sup> Civil Aviation Safety Authority. Safety Management Systems: Getting Started. Canberra, Australia: Civil Aviation Safety Authority; 2002.

<sup>41</sup> Railways and Other Guided Transport Systems (Safety) Regulations. London, UK: Stationery Office; 2006.

1. Fatigue management policy
2. Employees fatigue reporting system
3. Fatigue control exercises for workers
4. The activities of internal and external audits that carry out regulatory actions through the processes of sustainable development of RCC
5. Data collection, risk analysis and application of the control system to reduce the risks for managing the risk of livelihood
6. Investigation of the incident
7. Sleep disorders management

Other than just one component, it is a direct contact with the SMS. Sleep disturbance is a component of the FRMS.

The organization of FRMSs requires that senior executives be responsible for this. Anyone here should understand and deal with their obligations. Hence, an appropriate system of work and managers trusting one another and reporting fatigue easily to each other. This has a positive impact on the successful implementation of the FRMS. However, as with all kinds of risk management, there is no FRMS model available to each system as well. FRMS is developed in accordance with the nature of the industry, the business environment and the organization.

FRMS has also spread in other daily activities. The United FRMS model has been relatively new and has been integrated into other types of industries and activities, despite the expansion of the transport sector.

Mining industry - The Tasmanian Minerals Council in Australia published a 2004 booklet titled "Fatigue Risk Management Leader".<sup>42</sup> The New South Wales Mining

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<sup>42</sup> Tasmanian Mineral Council. Fatigue Risk Management Guide; 2004. [www.tasminerals.com.au/fatigue-guideline.pdf](http://www.tasminerals.com.au/fatigue-guideline.pdf). August 3, 2011.

Council, established in 2008, has developed specific standards for fatigue risk management for the mining industry in 2009.<sup>43</sup>

Health - Since the end of the 1990s, the Australian Medical Institute has begun to design a "Safe Hours" project and the project has been approved in 2002.<sup>44</sup> Physicians also supported the project, considering risks associated with changing working hours to help provide a broader understanding of the FRMS. The principles of the project included both risk assessment and proper risk management, as well as joint-stock strategies for working schedules.<sup>45</sup>

Pipeline - The US Department of Pipeline and Hazardous Materials Safety has recently issued statement containing guidelines for control room and human factor. In this report, the FRMS also have a number of tidal reduction principles.<sup>46</sup>

The report by the US Chemical Safety and Hazard Investigation Board on the explosion at the oil refinery in Texas, in 2005, features the American Petroleum Institute, American National Institute of Standards and the United Steelworkers International Union. The report also contained the minimum and maximum working hours for fatigue management, and the points that made the change to work.<sup>47</sup>

Although the United Steel Workers Union wants to stay out of negotiation, in April 2010, the "ANSI / API Recommended Practice RP755" was published in connection with fatigue risk management for oil and petrochemical industry workers in accordance with API standardization requirements. The standards in the notification cover a comprehensive and systematic approach. Companies may also

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<sup>43</sup> New South Wales Mines Safety Advisory Council. Fatigue Management Plan: A Practical Guide to Developing and Implementing a Fatigue Management Plan for the NSW Mining and Extractives Industry. 2009. Available at: [www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0017/302804/Guide-to-the-Development-of-a-Fatigue-Management-Plan-Amended-17-6-10.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0017/302804/Guide-to-the-Development-of-a-Fatigue-Management-Plan-Amended-17-6-10.pdf). August 3, 2011.

<sup>44</sup> Australian Medical Association. Safe Hours Project: Systems of Work for Junior Doctors in Public Hospitals: An Overview of Seven Case Studies. Canberra, Australia: Australian Medical Association; 1998.

<sup>45</sup> Australian Medical Association. National Code of Practice: Hours of Work, Shiftwork and Rostering for Hospital Doctors. Canberra, Australia: Australian Medical Association; 2005.

<sup>46</sup> Pipeline and Hazardous Materials Safety Administration. §195.446 Department of Transportation; 2010. [www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/NPRM.pdf](http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/NPRM.pdf). August 3, 2011.

<sup>47</sup> Chemical Safety and Hazard Investigation Board. Investigation Report Refinery Explosion and Fire. No. 2005-04-I-TX; 2007. [www.csb.gov/assets/document/CSBFinalReportBP.pdf](http://www.csb.gov/assets/document/CSBFinalReportBP.pdf). September 21, 2011.

benefit from this notification, which will help develop the existing FRMS-N system.

FRMS are a type of SMS and have fatigue management in the work environment. Fatigue management in a particular enterprise depends on the level of risk and the aggregate nature of transactions. Additionally, FRMS estimates the causes of fatigue and creates a comprehensive risk protection system. One of the important conditions is the corporate culture of the company and the integration of fatigue management into the daily process for the effective functioning of the FRMS.

The supply chain for the construction of the FRMS:

- 1.Organizations and workers should share responsibility for the elimination of fatigue and accidents that may occur.
- 2.The organization should be responsible for the work of the employees during their work activities.
- 3.At the same time outside the workplace, employees should be responsible for getting enough sleep.

FRMS is based on the following corporate policies:

- 1.Organizational structure
- 2.Applications and procedures
- 3.Preparation and analysis of reports
- 4.Trainings for the development of the applied system

The first policy is that there is an organizational structure to implement the FRMS and its principles. The FRMS does not simply contain pragmatic information about fatigue. FRMS is an active process that is an organizational defense system for continued activity. The size and content of the FRMS depends on the size and composition of the company. For relatively small businesses, one person may be

responsible for this system. For larger companies, the FRMS staff can be company employees, representatives of stakeholders, security guards.

In general, fatigue risk management is a joint responsibility model that reflects the principles of "fair culture" between organization and the worker.<sup>48</sup> The organization should build working hours that provide sufficient facilities for rest, organize training on fatigue management, and develop fatigue control systems inside the organization. Leading employers are responsible for collecting and analyzing fatigue information in order to use the time needed to relax, participate in trainings, comply with the tasks, make recommendations to employees, and select better methods in the future. Thus, employees should at least be involved in the preparation of the FRMS implementation plans at a minimum. Understanding the responsibilities of employees to prepare well for the job is crucial to the organization of programs that provide sufficient leisure opportunities.

Based on the above, it can be concluded that two types of subjects play an important role in the organization of the JRF:

1.Operators(Managers)

2.Work group

Operator(Managers) - This group includes senior executives, local or mid-level administrators, first-rate supervisors and human resources, health planning specialists. Senior management should take on the responsibility of managing fatigue risks as an essential part of overall health. It should demonstrate the sustainability of these resources and continued development of the FRMS administration. Continuous commitment of senior management helps to ensure that the remainder of the enterprise reaches FRMS.

In addition, top-level management should set up an expert team to implement, analyze and direct processes in the FRMS, implement strategies, conduct exercises,

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<sup>48</sup> Reason J. Managing the Risks of Organizational Accidents. Aldershot, UK: Ashgate Publishing Ltd; 1997 p-252.

gain access to information, analyze methods and management activities. This team must be managed on a single line, but must combine different types of professionals. Particular attention should be paid to the participation of third parties, such as counselors in fatigue management, when internal resources are limited.

One of the problems in fatigue management is the risk that administrators can take a reactive approach to fatigue. This means that they can only react to fatigue. A more effective approach is to minimize the effects of tiredness by means of predicting potential fatigue before performing any measure, and take precautionary to eliminate the work mode, software, and environment that may cause fatigue. The strongest model of the impact of the FRMS requires more precautionary measures.

Work Group - Workers play a crucial role in building a successful FRMS model. Because sleep alone is a dream, taking a dream takes on the employee's direct responsibility. Each employee needs sleep in normal mode. Only the worker's self-esteem can determine how much sleep is enough for the maximum level of performance. Although this sleep rate varies between 7 hours and 9 hours, an average person sleeps 8 hours long. Generally, employees' responsibilities are responsive to need for sleep while meeting their fatigue.

Meeting the need for temporary sleep requires planning with consideration of the term of office. For example, if the next task requires early waking up, the worker should have a complete rest for this job and plan ahead of time early. If the next job starts in the evening, the worker must go to lunch and dinner for 8 hours or more to work with fatigue. If the work environment is unable to stay awake, rest, or disrupt the job, the employee is responsible for reporting cases of fatigue caused by work mode, illness. The worker should not accept or comply with the instructions given in the tidy.

There are five types of protection against accidents that arise from fatigue during the application of the FRMS:

1. Workload and balance between employees
2. Preparation of the working schedule
3. Employees' training on fatigue
4. Organization of the business environment
5. Vigilance for fatigue control

Solving the problems of the workgroup in the management of fatigue - Here are three key roles in the list:

1. Disruption of workload and balance between workers may have a negative impact on night or nighttime workers.
2. Permanent and uninterrupted employees may have a negative impact on night-time or fluctuating employees.
3. Changes in workload distribution may also have an adverse effect on night-time or change-over workers.

At present, the number of job positions that are to be filled in for each schedule is 24/7. If the number or level of worker is below the optimal variant, the existing employees are forced to work in extra hours. These additional hours may be added in the following form:<sup>49</sup>

1. Keep workers at work for an extra hour at the end of the working schedule (to increase the time for an average mode or to reduce their resting time after work mode)
2. Keep workers at work hours for extra hours before starting the job mode (to increase the time for an average mode)

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<sup>49</sup> Moore-Ede M, Kerin K. Shiftwork Practices 2002. Circadian Technologies, Inc; 2002.

3. Employers also work weekends or reduce the number of weekly rest days

4. Workers' double or triple shifts (increase working hours and reducing hours)

5. Short-term warnings for execution of missed tasks (involvement of other employees in the execution of job tasks)

As a result, the employees' work hours and the duties they carry are growing. This in turn causes an increase in accidents resulted fatigue.

Additionally, extra work hours are not shared equally with employees. In some cases, 80% of additional work hours are distributed among 20 employees, which requires additional loading.

It is possible that workers receive additional load and work at additional working hours, but there are some reasons why employees may not work in these cases in addition:

1. Holidays

2. Illness

3. Other problems

4. Special tasks

Many 24/7 operating entities do not consider or can not measure the effect of these factors. It employs a smaller number of workers with a longer working schedule. This can affect the quality of the work and the employee's performance. Many companies do not analyze human resources parameters, so they can not even predict inaccuracies.

The reason for the failure of the working group's workload is not just estimates. In the last 20 years, many studies have been conducted to re-regulate the length of

time. As a result of this research, the number of workers has gradually diminished.<sup>50</sup>

Violation of the balance between work load and the working group is important for organizing the FRMS:

1.Until the enterprise understands the concept of cooperation with one another, the enterprise activity continues with equality between worker and workload. Therefore, there should be special exercises.

2.The most cost-effective way to apply corporate FRMS is that the enterprise accepts new employees.

Partnerships, standards, collective bargaining can seem very easy at first glance. However, working together with all these parameters can cause employees to experience severe fatigue. Because the combination of all these parameters requires the collaboration of employees working in different modes.

Before hiring additional employees, it is important to carefully analyze the balance between worker and workload:

1.Reorganization and regulation of the division of labor to reduce the number of jobs to be filled in for each schedule

2.Additional training to develop existing staff

3.Finding a more suitable model to see precautionary measures and distribute workloads

After all these factors have been investigated, certain software analysis is required to ensure that all estimates are properly scrutinized. When the level of the working group is properly organized, the analysis of the program takes place simpler for the model.

Organization of job and job mode - Here are 3 main factors:

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<sup>50</sup> Hammer M, Champy J. Re-engineering the Corporation: A Manifesto for Business Revolution. New York, NY: HarperCollins; 2001.

1.Sleeping mode of the body makes it difficult for the worker to stay awake all day long, but night-time duties do not allow the worker to meet night-time needs.

2.Combinations of strategies can reduce fatigue risks. Here are anti-tuberculosis strategies.

3.Biomathematical models can be used to measure the role of occupational fatigue in the workplace.

One of the main factors causing fatigue is a business mode.<sup>51</sup> According to the schedule, the worker needs to determine the situation where he needs no sleep, and need to meet the sleep needs during non-working schedule. The need for true sleep requires less time than non-working hours. It requires not only sleep but also other needs. In addition, night sleep dreams for human sleep time are restored in the daytime sleep hours. Because the human body is programmed to sleep in the dark of the day.

Sleep problems have been identified in jobs that have a more volatile work schedule, and employees working in the same way often complain about the problem.<sup>52</sup> There is such a belief among people that as it works, it is possible to adapt to sleep patterns. This does not reflect the truth. Work with a variable schedule is not just a connection between sleep and business, but rather a complicated process.

The variable schedule is based on an indefinite schedule, which affects the physiological balance of the worker. In people who work in such a graphic, the natural balance and biological time of the organism is disturbed. Organism regulates sleep synchronized with the work schedule, and does not feel the

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<sup>51</sup> Lavie P. Sleep habits and sleep disturbances in industrial workers in Israel: main findings and some characteristics of workers complaining of excessive daytime sleepiness. *Sleep*. 1981;4:147–158.

<sup>52</sup> US Department of Labor, Bureau of Labor Statistics. Workers on Flexible and Shift Schedules in 2004 [www.bls.gov/news.release/flex.nr0.htm](http://www.bls.gov/news.release/flex.nr0.htm). August 3, 2011.

disruption of balance. Diseases that may later emerge physiologically affect the sleeping system. These sleep problems cause chronic fatigue in workers.<sup>53</sup>

There is no direct solution to the risk of such fatigue. The best way to do this is to combine the following 3 strategies:<sup>54</sup>

1. Creating a system that needs sleep interruptions at nighttime to avoid sleep disturbance
2. Employee training to maximize the benefits of optimal sleep
3. Monitor the work environment and performance of tasks, and take precautionary measures

Employee training and education - Here are 4 key factors involved:

1. Distribution of liability for trafficking risks among employees and administrators.
2. Management is directly responsible for employees, workload, schedule and training.
3. Workers are responsible for correcting the sleep schedule, getting an insomnia.
4. The scientists are investigating this subject and try to put more ideal models

Fatigue risk management is a responsibility that should be shared between employees and managers. Even if fatigue is minimized and employees are in a position to be in a position to work, some important factors are individually controlled by employees.

Employees are responsible for proper rest, work and accountability for the task. However, administrators should also use motivation methods to avoid adverse situations.

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<sup>53</sup> Borbély AA. A two-process model of sleep regulation. *Hum Neurobiol.* 1982;1:195–204.

<sup>54</sup> Folkard S, Lombardi DA, Tucker PT. Shift work, safety and productivity. *Ind Health.* 2005;43:2023, [www.jstage.jst.go.jp/article/indhealth/43/1/20/\\_pdf](http://www.jstage.jst.go.jp/article/indhealth/43/1/20/_pdf). September 27, 2011.

Minor data from administrators may result in problems in the work environment.<sup>55</sup>

In some cases, administrators are required to spend more time in the workplace to solve problems in their work. Motivation by family and work people is also important in this regard. In addition, fatigue management can affect employees' behaviors.

Therefore, the following guidelines should be considered for fatigue management:

- 1.The dangers that may arise during the onset of adulthood and the benefits of resting
- 2.It is impossible to eliminate fatigue, even if it is able to manage it to the lowest level
- 3.The basic principles of sleep psychology and the study of forms of defense against biological sleep
- 4.Learn how to deal with a human problem
- 5.Teach yourself or your inner friends how to resist fatigue
- 6.Assisting employees working in different ways to manage business and personal relationships
- 7.Controlling the use of sleeping means during workplace
- 8.Getting to sleep hygiene, learning how much sleep
- 9.Learning the effects of chronic fatigue in the personal life

Sleep Disorder Management - Here are 4 main factors involved:

- 1.Learning basic and secondary sleep disorders amongst workers
- 2.Examination of sleep problem, analysis of sleep disturbances using various forms of research

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<sup>55</sup> Dinges DF, Maislin G, Brewster RM, Krueger GP, Carroll RJ. Pilot testing of fatigue management technologies. J Transportation Research Board. 2005;1922:175–182.

3.Application of methods used for widespread sleep disturbances

4.Developing the business environment and bringing it to a more relevant form when using the methods of remediation

Fatigue generally affects the ability to work.<sup>56</sup> Employees with fatigue continue to work without their functional capacities. Every year, about 60 billion livelihoods occur due to fatigue caused by sleep disturbances.<sup>57</sup>

Fatigue is a form of notification that affects your work activity, including chronic and depressive disorder that affects work efficiency. It includes various problems, including medical information examined by this subject.<sup>58</sup>

Sleep disturbance is a worker's sleepiness and quality. The amount of sleep disturbances is also a variable factor for every person. As with other forms of treatment, sleep disorders can be treated with medical treatment. These treatment forms are as follows:<sup>5960</sup>

\*Wake up at the same time everyday

\*Avoid bad-habits

\*Doing sport

\*Sleep in dark, cool

\*Keep sleep mode, record time

Business environment - Here are 7 factors:

1.Correcting work environment to keep awake

2.Regulation of moisture, light

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<sup>56</sup> Tucker AM, Whitney P, Belenky G, Hinson JM, Van Dongen HP. Effects of sleep deprivation on dissociated components of executive functioning. *Sleep*. 2010;33:47–57. [www.ncbi.nlm.nih.gov/pmc/articles/PMC2802247/?tool=pubmed](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2802247/?tool=pubmed). September 21, 2011.

<sup>57</sup> National Sleep Foundation. 1997 NSF poll: sleeplessness, pain and the workplace. [www.sleepfoundation.org/article/how-sleep-works/let-sleep-work-you](http://www.sleepfoundation.org/article/how-sleep-works/let-sleep-work-you). November 12, 2010.

<sup>58</sup> Hillman DR, Murphy AS, Antic R, Pezzullo L. The economic cost of sleep disorders. *Sleep*. 2006;29:299–305.

<sup>59</sup> Sampsel S, May J. Assessment and management of obesity and comorbid conditions. *Dis Manag*. 2007;10:252–265.

<sup>60</sup> Rao MN, Blackwell T, Redline S, Stefanick ML, Ancoli-Israel S, Stone KL Association between sleep architecture and measures of body composition for the Osteoporotic Fractures in Men (MrOS) Study Group. *Sleep*. 2009;32:483–490. [www.ncbi.nlm.nih.gov/pmc/articles/PMC2663862/?tool=pubmed](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2663862/?tool=pubmed). September 21, 2011.

3. Provide task time vigilance
4. Daylight illumination for variable shift
5. Training employees to minimize negative impacts of illumination
6. Modification of the recreation according to the assignments
7. Leisure without restriction

Individual risk assessment - Here are 4 factors involved:

1. Tiredness of workers
2. Responsibility of the leading person of fatigue
3. Risks reduction is an emergency recreation
4. Medical examination

### **3.2. Research about fatigue and its effects on HR performance in Azerbaijan work environment**

The research was carried out in two forms, theoretical and practical. First, the theoretical part of the study was developed using the theoretical knowledge, and then the research was continued through a questionnaire established. The study was conducted by 100 people working in Azerbaijan. The questionnaire was prepared with questions about human resources and fatigue. The main part of the survey is the analysis of the factors causing the emergence of titer in the work environment.

The questionnaire used questions about fatigue using different literature and the results of the survey were noted.

According to the study, different results were obtained based on the age, working hours of the people. Questions used in the research:

1. Old:

\*20-30

\*30-40

\*40-50

\*50-60

2. Your work hours:

\*9: 00-13: 00

\*14: 00-18: 00

\*9: 00-18: 00

\*23: 00-7: 00

3. What do you think caused fatigue in the workplace?

\*insomnia

\*stress

\*tension

\*workout diseases

\*nutrition

\*family problems

\*mental fatigue

\*depression

\*additional working hours

\*dissatisfaction in work

4.How many hours do you sleep during the day?

\*6-7

\*8-9

\*10-11

\*Over 11 hours

\*Less than 6 hours

5. What is the cause of the problem of sleep?

\*shifting work schedule

\*insomnia (sleeplessness problem)

\*rest times are not properly distributed

\*sleep times are not properly distributed

How do you feel about the effects of fatigue?

\*unusual feelings

\*scattered work room

\*absent-mindedness

\*inattention

\*decline in job performance

\*violation in coordination balance

As a result of the answers to these questions, the main purpose of this research can be examined and the result can be obtained.

According to 100 individuals, different results were obtained in different age groups. According to the survey, most people aged 40-50, 50-60 and 60-70 are experiencing fatigue. There are 4 major factors that cause fatigue at these ages:

1. Workout diseases (43%)
2. Family Problems (27%)
3. Mental problems (22%)
4. Dissatisfaction in work (8%)

Tiredness in people at the age of 30-40 often gives rise to self-esteem. The reason is mainly three factors:

1. Stress (35%)
2. Family problems (32%)
3. Depression (20%)
4. Additional working hours (13%)

People aged 20-30 are less likely to experience fatigue. That's why the organism has a more resistant system at this age. However, fatigue can occur at this age. There are three factors that cause it:

1. Insomnia (50%)
2. Nutrition (35%)
3. Depression (15%)

According to the survey, employees in Azerbaijan spend 6-7 hours and 8-9 hours. Sleep problems are mainly caused by two reasons:

1. Rest times are not properly distributed (50%)
2. Sleep times are not properly distributed (50%)

According to the research, workers see the consequences of fatigue in forgetfulness:

1. Absent-mindedness (45%)
2. Inattention (18%)
3. Violation of the coordinating balance (15%)
4. Decline in job performance (10%)
5. Scattered work room (8%)
6. Unusual feelings (4%)

## 4. Conclusion

Human resources performance can affect many factors. One of these is the state of fatigue in the work environment. Fatigue is not only the quality of the work, but also the worker's productivity and health.

In addition, there are also psychological aspects of fatigue, which do not have enough energy to do the job and continue to follow a certain instruction, which means reluctance and reluctance. For this reason, fatigue is a warning for physical or mental activity that ends with the body. Thus, the ability of a person suffering from fatigue is reduced to mental and physical action. Therefore, fatigue risk management systems (FRMS) are essential in enterprises.

Theoretical foundations of the FRMS are based on the knowledge of sleep science that incorporates the dynamics and recovery of cumulative or temporary sleep loss, and regulates the systemic activity and sensitivity of the human body biological clock. Therefore, FRMS is a field that has a stronger scientific basis for the management of fatigue in the work environment, including the science of sleep science and the body's biological clock.

The FRMS does not simply contain pragmatic information about fatigue. FRMS is an active process that is an organizational defense system for continued activity.

The best tool for minimizing employee fatigue is to apply FRMS for enterprise. The FRMS model to be built will consider all the factors in the company and reduce fatigue. This system also takes into account not only the employees, but also their working hours, difficulties, and managing the working group. FRMS considers the integration of all the factors in the enterprise and works on the current situation.

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