



TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering

Vol. 64, Issue Special I, January, 2021

ERGONOMICS AND TIME MANAGEMENT IN REMOTE WORKING FROM HOME

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Abstract: *Advances in information technology have led to the extensive use of the Internet of Things (IoT) in all activities. One of these activities is companies' management with lots of associated fields. The companies are considering, among others, aspects regarding time management and ergonomic ones to facilitate obtaining high efficiency in normal working conditions. Nevertheless, in particular situations, such as working away from home, these aspects seem to be neglected. In this context, the paper focuses on the central issues regarding the ergonomic elements and time management when the work carries out at home. We address briefly essential aspects, highlight the advantages and disadvantages of the remote working at home and, we propose a structural framework that is considering specific rules of IoT, ergonomics and time management, as well.*

Key words: *IoT, ergonomics, time management, remote working from home, conceptual model*

1. INTRODUCTION

More and more businesses and activities take place online. Some examples are the following: commerce; advertising; computer, information systems and mathematics industries; science; industrial and architecture design; insurance, banking; accounting and financing; training and education; library, and other services that do not need the face-to-face presence.

However, communication within companies, between companies and the persons, is continuously expanding using the Internet of Things (IoT) and promise to make the world a connected place. Internet of things (IoT) emerged as a concept about 20 years ago and is now making headlines around the world. We are talking about lots and lots of gadgets, machines, buildings, and more, that connect to the web for connectivity and real-time data extraction [1].

The reality shows that IoT facilitates the remote working. For example, more American employees (43% of employed people) are working remotely. They are doing so for more extended periods, according to a Gallup survey of 15,000 adults and 4.3 million U.S. employees

(3.2% of the workforce) now work from home at least half the time [2].

Employees and some employers view the practice as broadly beneficial, saying that remote workers are more productive, and that the additional flexibility can help to close the gender gap [3].

2. PROBLEM DESCRIPTION, APPLICATION AND METHOD

In other situations, than the usual ones, employers accept that some employees (e.g., raising children; locomotor handicap and others such as part-time second jobs) work from home using the Digital technology. Sometimes, employers impose the obligation (when there are travel restrictions in pandemic situations) to work from home. Some entrepreneurs also work from home directly with clients or based on contracts with other companies using IoT.

Often, the flexibility and independence of carrying out work tasks are associated with extreme comfort (working in bed, whole days dressed in pajamas, eating sandwiches or snacks, lack of movement, lack of sleep or too much

sleep and others). This fact harms a person's health and productivity.

Even when using IoT, individuals should not neglect physical health by ignoring some rules of ergonomics or also mental health, working chaotic without a program, neglecting time management. There are many employers and employees that often overlook workplace safety practices, including the use of proper ergonomics [4; 5; 6; 7; 8], increasing the risk of injury or health problems.

In this respect, the paper is aiming to present a brief analysis of the framework that has four components: IoT development, ergonomics, time management, and remote work from home with its advantages and disadvantages. It also offers a conceptual model regarding a structural framework for remote working from home to be useful to anyone. We base our research on bibliographic references and own observations and experiences.

3. LITERATURE REVIEW

3.1 IoT development

Nowadays, information technology is not only evolving in technical terms from Wireless Personal Networks (WPAN), to the next generations, such as Wireless Local Area Networks (WLAN), Low-power Wide Area Networks (LPWAN), Wired, Cellular / M2M, 5G, Wireless Neighborhood Area Networks (WNAN), satellite and unclassified proprietary networks, including edge-to-cloud integration and TSN connectivity [9] bringing new and new user-friendliness but extends from more and more in its use in everyday work. The current market sentiment and short-term outlook is extremely positive. Software and platforms are expected to continue to drive the market as more data is moved to the cloud, new IoT applications get brought to market, and analytics continue to gain in importance.

Some figures reveal the current situation:

- Global IoT Market has been at \$ 151B market in 2018 and is forecast to grow to \$ 1,567B by 2025 [9];
- In 2015 there were 15.41 billion devices connected to the Internet, which will

double in 2020 and reach 75.44 billion in 2025 worldwide;

- The total installed base of IoT connected devices is projected to amount to 75.44 billion worldwide by 2025, a fivefold increase in ten years [10];
- There have been 26.66 billion active IoT devices in 2019 and the number of IoT devices will reach 31 billion in 2020 [1];
- With 1.3 billion projected subscriptions by 2023, IoT is about to experience another boost by the 5G technology and the industry is projected to reach \$1 trillion in 2025 [1].

3.2 About ergonomics

According to the International Ergonomics Association [11], ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design to optimize human well-being and overall system performance. Ergonomics must correlate notions about work organization, psychology, and manufacturing technology to ensure the worker's occupational safety and health [12].

Ergonomics is concerned with three principal elements of work. The first is the workers and their level of skill and effort. Next is the work, the particular task or tasks to be performed, and the level of physical and mental exertion, number of movements or steps, and the amount of time required to complete the job. The last element is the workplace, including space, work surfaces, equipment, tools, and materials needed to complete the task. The objective of ergonomics is to reengineer the work and workplace to reduce or eliminate the worker's physical and mental fatigue [13] by using a variety of empirical analysis tools.

The ergonomics role is to minimize the risk of human error. It aims to create safe, comfortable, and productive workspaces by bringing social abilities and limitations into the design of a workspace, including the individual's body size, strength, skill, speed, sensory abilities (vision, hearing), and even attitudes [14].

Ergonomics has some significant benefits for employers and employees reduces costs, improves productivity and quality by reducing fatigue and frustrations, improves employee engagement because the employees feel safer regarding their health. It also creates a better safety culture because the company shows the commitment to safety and health as a core value [14; 15; 16].

To ensure the health and safety of employees at work, many companies implemented the BS OHSAS 18001: 2007 Occupational and Health and Safety management system. Specific standards and recommendations are provided word wise for different occupations (for example, agriculture, baggage handling, construction, manufacturing etc.). Cal/OSHA [17] offers suggestions for working safely and reducing risks of injury while working at a desktop computer.

Even the companies' system design processes do not integrate ergonomics into companies' system design processes, many authors provide the importance of ergonomics in the company's strategy. In this respect, Dul and Neuman [18] consider that:

- A new direction for ergonomics, using its full potential in organizations, without being exclusively dependent on health and safety considerations is needed, and
- The *strategy* and the *business goals* must be useful connection points to internalize ergonomics in organizations because the strategy is a top management priority. Usually is intended to be broadly communicated and implemented in the organization.

Nevertheless, in the last period, scholars focused mainly on three coordinates of ergonomics: job description redesign, changes occurred using IoT, and ergonomics in sustainable development.

Traditional job design does not consider ergonomics aspects. Still, with time it has been observed that employees and unions are increasingly concerned about ensuring health and safety at work and have called for the redefinition of job descriptions. Therefore, the modern typologies of job design include factors

such: job demands, job control, skill use, task variety, role clarity, use of skills, variety in tasks, support and social contact at work, and even employment security [19, 20, 21, 22].

There is, also, long-standing and continuing interest in psychological well-being and the quality of jobs in work [23; 24]. Daniels et al. [25] argue for the improvement of job design and hence well-being, considering among other characteristics, the ergonomics aspects.

Other authors [26] highlight the progress has occurred in ergonomics regarding:

- The profound change in the use of personal devices;
- The erasure of separation between work and nonwork ("leisure" time);
- Where work is being conducted (at home, in public places, as opposed to designated companies, workplaces, factories, and offices).

Moreover, the ergonomics principle is applied to sustainable development of a company [27; 28]. The authors propose a practical and easily adaptable framework, which integrates ergonomics and sustainability by presenting the relations between fundamental elements of ergonomics and sustainability dimensions.

3.3 About time management

The time management is related to performance increasing and stress decreasing because it enables working smarter instead of harder by organizing and planning the working time using a schedule and prioritizing the tasks.

Apart from working time, time management also takes into account leisure for relaxation, dreaming, or doing nothing. In order to maintain the health of the body and the mind, people must consider an adequate time for themselves (domestic activities, sports, socializing, raising the cultural level etc.).

As projects become more and more used in the activity of companies, it is worth remembering that time management in projects is an essential condition for their efficiency [29].

The literature offers a multitude of opinions about time management, regarding its importance and benefits, necessary skills, tips, behaviours, or strategies [30; 31; 32; 33; 34; 35].

Among the benefits of time management Juneja [36] mentions:

- The right time allocated to the right activity;
- Allows individuals to assign specific time slots to events as per their importance;
- Makes the best use of time as time is always limited.

3.4 Remote work from home

According to the Cambridge dictionary, remote working is a situation in which an employee works mainly from home and communicates with the company by email and telephone. To work remotely means to have a professional activity outside a traditional office environment, whether it is mostly online or not [37; 38].

Remote workers need several tools for effective collaboration with the team and others to be able to track the performance (laptop, mobile smartphone, tablet, team chat, video conference chat, cloud storage, Facebook etc.).

There have been emphasized some advantages and disadvantages in remote work from home.

The main *advantages* regarding working from home statistics on telecommuters in the United States, according to a study realized in 2017 [39] are:

- Employees are more productive because they are devoid of distractions like inefficient meetings, office gossip, or loud office spaces;
- The most telecommuters hold management positions at their companies, as:
 - 16% of all telecommuters identified as managers, highly educated, with high competences and salaries;
 - Office and Administrative Support: 14%;
 - Sales and Related: 13%;
 - Business and Financial Operations: 9%;
 - Computer and Mathematical: 9%.

Working from home statistics suggests that companies that offer a telecommuting option for employees have lower turnover rates of losing employees because they are less stressed. They

make savings by spending less on a variety of costs.

Working from home is a Win-Win for Employees and employers [3] because:

- People who provided flexibility and allowed to work from home can freely control their schedule; they have more time for their family and friends, they have more time for their personal development and more opportunities for growth;
- Those who work from home also seem to be a lot healthier than those who work in regular office environments, as working from home gives them enough time to eat healthier foods and workout when needed. Remote workers do not waste time driving to their workplace; they have more time for their families and socializing;
- Giving them all these benefits often leads to higher employee engagement, loyalty, and retention.

Even the remote work from home has several benefits; it also has some disadvantages [38; 40; 41; 42]:

- Isolation - remote work from home may lower morale due to a lack of face-to-face contact with co-workers;
- Decreased employee visibility - people may feel fear of losing career advancement opportunities;
- Decreased work/life balance - some argue that not having a physical distinction between where an employee works or spends the free time can make it more difficult for him or her to stop focusing on work and enjoy time away from the jobs;
- Lack of relationships among co-workers - working remotely makes more difficult to shared experiences and build camaraderie with each other, even when a company chooses to utilize teleconferencing, online chat systems, and other communication tools;
- Increased distractions - while employees undoubtedly experience day-to-day distractions in an office, they may face even

more distractions at home: children, spouses, pets, the latest Netflix craze etc.;

- Security concerns - working from home may cause data security vulnerabilities (data leaks, employees stealing data, malicious).

4. RESULTS. CONCEPTUAL MODEL

As a result of our research, we propose here a conceptual model regarding a structural framework for remote working from home. The model comprises ten steps, but these are not mandatory to follow precisely (Figure 1).

We consider the activities of one working day related to three factors: ergonomic base (E), time management (TM) and IoT. In this way, the people health and safety are assured, and the injury risk is mitigated.

4.1. Setting the time for working

However, the most effective time for work is from Monday to Friday from 9 to 18, as practiced in the daily activity of a company, with an hour of lunch break. Some people are more productive at other times (in the afternoon, in the evening or even at night).

The advantage of flexible work from home is precisely the possibility for each to choose the working time that he/she considers the most suitable. Sometimes it is not necessary 8 hours of work per day to solve the tasks received, or in other situations, when a task is urgent, it takes more hours. Anyhow, the employer has not to pushes on and to raises targets over time.

4.2. Setting the workplace

If the person working from home has an office in another room, equipped with a desk, PC and library can be isolated from other family members and work in a quiet environment.

In different situations, some prefer to work from a laptop or other IoT (smart phone or tablet) from the bed, the sofa or armchair, or the floor on the carpet.

We do not recommend these situations, because, from the ergonomic point of view, the position at work must be the correct one, to place the laptop/mobile device on a desk or table, and to sit on a comfortable chair, to avoid changes in the spine and to prevent musculoskeletal

disorders and pains. Also, ensuring a pleasant working climate is essential for guaranteeing individual health (ambient temperature, natural light etc.). These aspects belong to ergonomic base.

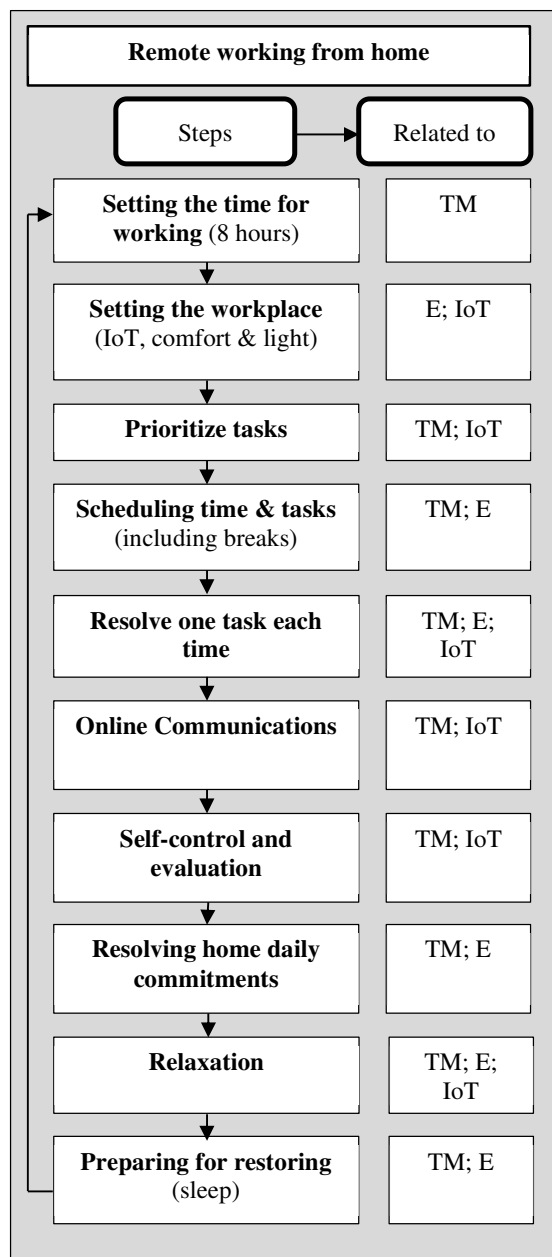


Fig. 1. A structural framework for remote working from home (conceptual model)

4.3. Prioritize tasks

It is necessary to find the balance between work tasks, housework, and those related to socializing with family members, leisure, and

time for oneself. In this sense, the person must prioritize mandatory service tasks, so that those that are urgent or important must be reserved first. The lack of prioritization leads to delays in essential works, personal dissatisfaction, and sometimes financial penalties. Remote from home people may use the Eisenhower's urgent/important principles to prioritize the tasks into four categories [43] (important and urgent; important but not urgent; not important but urgent; and not important and not urgent), considering their priorities or other criteria. These principles help everyone to identify the activities that should focus on, as well as the ones that could be ignored.

4.4. Scheduling time and tasks

The use of a schedule is essential for the management of one's own time, for ensuring the productivity of the work and the efficiency of the use of time.

Many studies that try to find a perfect way for homeworkers to create a schedule, but none is perfect. According to the person's highest potential during the day, one has to create a program and to become productive; it is necessary to keep a routine and discipline. "Having the freedom to create a flexible schedule and a schedule you make yourself is a great thing" [3].

To ensure health, the person must do care rituals, leave the pyjamas, and have breakfast before starting work. Then pause 10 minutes at least every two hours of work for physical exercises (maintenance gymnastics, walking around the house and communicating with family members or performing short-term physical work for house maintenance) to rest the brain and body, and to take the lunch break.

Being in the same posture for long periods is a risk for musculoskeletal disorders and pains. It is also important to break 20 seconds from time to time to look ahead to avoid visual fatigues or headaches.

To facilitate the design of a schedule, one uses a specific software application or build one's plan using excel. It is useful to reserve an extra time in the schedule for unforeseen works. The employer or clients can request an urgent problem that was not in the plan.

4.5. Resolve one task each time

It is vital to approach a single work/paper at a time and focus the effort on its practical completion. The person may achieve fatigue and reduced quality of work if two or more works start at the same time. Some people, especially IT generation, consider themselves multitasking. They are doing in the same time different activities, such as: working to solve a task or more on several folders or files, talking by phone, answering email messages, listening musing or watching TV. There are opinions [44; 45], that all these activities called multitasking are sources for stress that affect the brain health and work productivity. "Those people who think they can split their attention between multiple tasks at once aren't actually getting more done. In fact, they are doing less, getting more stressed out, and performing worse than those who single-task" [46]. It is what Publilius Syrus (a BC Latin writer) said: "to do two things at once is like doing nothing". Some researchers suggest that multitasking can reduce productivity by as much as 40% [47]. So, the reason to do one thing/task in a time is to protect the employees' health and safety.

4.6. Online Communications

Communication is crucial during work from home and IoT is useful. Using online contact, we receive the tasks to be solved, we obtain details and advice, send memos and reports, keep in touch with the employer and or clients, and we can do theoretical and practical research. We also use video chats and chat messages and participate in meetings and conferences in the online group.

As a rule, communication is continuously, but if the person focuses on a job, interrupting the work for discussion can affect productivity. Therefore, it is useful to provide in the schedule adequate time for communication in the interest of service.

4.7. Self-control and evaluation

It is handy to reserve at least 10 minutes a day for restraint and assessment. Getting an image of solving the tasks and the quality of work, the person can reschedule unfinished tasks. Every person can use a progress graph to accumulate

new knowledge about their usefulness and if further professional development is required.

4.8. Resolving home daily commitments

The person reserves this time for home daily commitments. These activities performed at home, usually physical, are necessary not only for the maintenance of cleaning at home or for providing food but also for physical (movement) and mental health (detachment from service problems). It is recommended to change the cloth to feel that the service time is over and from time to time going out for shopping or else.

4.9. Leisure and relaxation

After completing all the tasks assumed daily, it is time for relaxation (rest, entertainment, having fun). A person with a family uses this time to communicate with the family's members, controlling the children's homework and giving advice, playing with children or the whole family, or playing with pets.

Listening to songs and dancing in groups are also recommended. As soon as the children go to bed, the person can spend the time reading or studying to accumulate new knowledge, watching TV and, others. A single person may tailor the time for relaxation to specific conditions.

This time for entertainment provided daily is necessary to ensure and maintain the physical and mental health of each working from home. Specialized advice limits the time spent in the IoT phase to one hour and then a break. Abuses to use IoT is considered a considerable risk for health [48].

4.10. Preparing for restoring through sleep

It is necessary for everyone to sleep 7-8 hours per day, usually at night, between 11 PM and 6 or 7 AM for good health. If the individual biorhythm is different, the process can be adapted.

In the remote working from home, the individuals need to care about themselves, to act towards their self-professional development and to evaluate their progress. The proposed model seems to be a simple one, but it is not easy to be applied because people dislike the frames of mind. Many of us experienced working from

home by using IoT and forgot to break, eating sandwiches while working and so on. Nevertheless, practicing it, one may enter routine, avoiding the risks from not paying attention to ergonomic base and time management, in correlation with IoT [49; 50; 51].

By using the process proposed above, the advantages for the employers and employees, mentioned in section 3.4, may become real facts.

5. CONCLUSIONS

The work from home using IoT is expanding. Many people prefer this way of working, which ensures flexibility, independence, and even financial savings. Many people hardly accept staying at home all the time and suffer, and they are especially demoralized if the employer imposes this working.

However, with all the disadvantages of working from home, this new way of life does not necessarily mean losing comfort in life but opening new opportunities.

The physical distance does not remove the communication, but it can lead to new approaches, and in some cases, it diminishes or removes labour or other conflicts. It also helps to increase responsibility and to develop creativity and technological innovation in many fields of activity. Collaborative education and work are of big interest in teleworking conditions (as supported also by [49;50; 51]).

Working from home can be a leap towards a new socio-economic system. Nevertheless, the ergonomic aspects, although simplified, must be considered to ensure the physical, and the management of the time will lead to the maintenance and development of the mental health of everyone by imposing self-discipline.

The conceptual model of the structural framework for remote working from home, proposed in the paper, can be a useful template for everyone, but, of course, it can be adapted to situations and improved by subsequent contributions. The limitation of the model consists of being inappropriate for jobs that require personal attendance at the workplace.

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Ergonomia și managementul timpului în munca la distanță de acasă

Rezumat: Avansul tehnologiei informației a dus la aplicarea conceptului Internet of Things (IoT) în toate activitățile și domeniile economice, inclusiv în managementul companiilor. Acestea iau în considerare, aspecte ale managementului timpului și ergonomiei pentru a facilita obținerea unei eficiențe ridicate în condiții normale de muncă. Cu toate acestea, în anumite situații, cum ar fi munca de acasă, aceste aspecte par a fi neglijate. În acest context, prezentul articol realizează un inventar al celor mai importante probleme referitoare la ergonomia și managementul timpului atunci când munca se desfășoară de la distanță de acasă. Astfel, sunt abordate pe scurt aspecte esențiale, avantajele și dezavantajele muncii la distanță de acasă și se propune un cadru structural care are în vedere reguli specifice de IoT, ergonomie și managementul timpului.

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