



## Relationship between new technologies and burnout: A systematic literature review

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### Abstract

The rise of digitization in workplaces is transforming how work is managed, presenting both advantages and challenges for safety and health. While new technologies can create safer work environments, they can also contribute to high performance pressure, which negatively affects workers' mental health. This has led to the emergence of psychosocial risks, such as Burnout Syndrome. This study aimed to investigate the link between the introduction of new technologies in workplaces and the development of Burnout Syndrome. A systematic literature review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology, focusing on the Web of Science database. The reviewed studies revealed that the scientific community is increasingly discussing this topic, with 66% of the studies being conducted in the last four years. The health sector was the most extensively researched area in this field. The findings suggest that the increase in Burnout Syndrome is associated with insufficient information and training for workers, as well as their insecurity in using advanced technologies.

**Keywords:** Burnout, digitization, psychosocial risks, workers, mental health

### Introduction

Over the years, the ways of working have changed, leading to innovations. This is due to rapid advancement of technology, with industries having to adapt their processes. It was in the First Industrial Revolution that the term industry emerged and is considered the greatest turning point in the history of world because of the impact it has had on almost every aspect of daily life. Industrialization brought changes in the economy, in the transportation, in health and medicine and led to many inventions and novelties in history (Groumpos, 2021).

The First Industrial Revolution began in the late 18<sup>th</sup> century and is characterized of machines powered by water and steam, replacing manual work (Ciulli, 2019; Min et al., 2019; Vinitha et al., 2020). Due to mechanizations, it was possible to achieve eight times more production compared to conventional methods (Vinitha et al., 2020). The workers went to work in factories and left the work done at home, manually or in cottage industries (Groumpos, 2021). The Second Industrial Revolution started at the end of 19<sup>th</sup> century, characterized by standardization and mass production using electrical energy (Ciulli, 2019; Groumpos, 2021; Min et al., 2019; Vinitha et al., 2020). With advances in technology systems were introduced with electricity, electric lighting, telephones, among others (Groumpos, 2021). The Third Industrial Revolution emerged in the mid-twentieth century and was marked by the beginning of partial automation using programmable memory controls and computers (Ciulli, 2019;

Groumpos, 2021; Min et al., 2019; Vinitha et al., 2020). Since the introduction of these technologies any process became automated without any human assistance, an example are robots. It gave rise to semiconductors, computing and the Internet. That is, what used to be analog has been changed to digital technologies (Groumpos, 2021). The Fourth Industrial revolution started in the 21<sup>st</sup> century and is based on the digitization, optimization and customization of production, automation and adaptation, in human-machine interaction and in exchange of automatic data communication (Lu, 2017). Industry 4.0 is a intelligent network of industrial machines and processes based on new information and communication technologies (Groumpos, 2021; Zhang et al., 2021). The main feature of this industry is the continuous communication between humans, machines and products during the production process (Zhang et al., 2021).

The industry has shown an increased interest in using industrial robots, working as teammates of human operators (Charalambous et al., 2016). Nonetheless, industries by choosing robots are transforming the role of workers and new interactions are being developed between operators and machines (Valentina et al., 2021).

Collaborative robots are one of the enabling technologies of industry 4.0. The main change of these robots is that they are now in direct contact with the operator and carry out the tasks together (Berx et al., 2022). However, contact with robots is affected by the variability of human behavior and its reliability, that will influence their safety, quality and productivity (Valentina et al., 2021).

The worker was and will be influenced by the changes of all the Industrial Revolutions, which may cause impacts on the routine of work, affecting the health of workers. These pass approximately eight hours a day in their work environment, health and safety at work important in the life of worker (Lu, 2017). The worker suffers great pressures in physical and psychological illnesses, such as depression and Burnout Syndrome (Lu, 2017). The burnout syndrome is a psychological syndrome, which manifests itself in response to stress interpersonal factors present at work, being a health problem (Matsuishi et al., 2021). Gil-monte (2009) considers that burnout is a public health problem that has implications for health physical and mental health of the worker, compromising their quality of life. In the mid of 1970s, Freudenberg identified a type of stress associated with work and called it burnout, defining it as a state of mental and physical exhaustion caused by professional life (Marôco et al., 2016). Later, Maslach et al. (2001) defined the syndrome as a multifactorial one that appears in the workers, consisting of emotional exhaustion, depersonalization and reduced accomplishment at work, which can be observed in individuals with professions where interacting/ helping with other people is high. This is still the result of chronic occupational work and prolonged, affecting mainly those professionals who enter their careers with high levels of motivation, personal involvement and ideas and, later, feel frustrated for not being able to reach their goals (Marôco et al., 2016). According to the World Health Organization (WHO), the burnout is a syndrome conceptualized as resulting from chronic stress in the workplace that has not been managed properly (WHO, 2019).

Burnout is defined as a three-dimensional syndrome characterized by three dimensions: emotional exhaustions, depersonalizations and decreased personal fulfillment (Maslach et al., 2001). That is, there is a state of progressive exhaustions (physical, emotional and psychological) caused by psychosocial risk factors at work, leading to a reduction in job satisfaction and the ability to support this workload, accompanying with an attitude of depersonalization or detachment emotional (DGS, 2021; Maslach et al., 2001).

Burnout refers specifically to the occupational context and not should be applied in other areas (DGS, 2021; WHO, 2019). This syndrome presents several factors, namely individual factors (e.g., desmotivation), organizational (e.g., absenteeism) and sociodemographic (e.g., level of schooling). These factors lead to various symptoms in the individual and may include irritability, anger, anxiety and even a decrease in social relationship (Marôco et al., 2016; Murcho & Pacheco, 2021).

They can also cause headaches, dizziness, dyspnea, sleep and appetite disorder, tiredness and irritability, emotional instability and rigidity in social relationships. Nonetheless, may also be related to substance abuse, psychotropic abuse and alcoholism, as well as arterial hypertension and stroke myocardial infarction and, in more severe cases, to suicide (Ma et al., 2021; Marôco et al., 2016; Murcho & Pacheco, 2021).

The introduction of new technologies in the industry are transforming the workplaces, as well as the way the work is organized and managed. As such, workers are increasingly controlled and may reach the point where they will be controlled by themselves, such as robots. These technologies are connected 24/7, requiring a more flexible organization of work, which creates new ways of working. However, it is necessary to consider the psychosocial and organizational risks of work, since that give rise to high work-related stress, resulting in mental health problems.

Robots will become part of the work environment of workers, as they will be able to perform physical and autonomously. The use of these robots will allow withdraw workers from risk situations, to improve quality in the workplace. However, workers can feel a high level of pressure due to the speed and level of a robot. This situation can have a negative impact in workers in relation to their mental health.

With the implementation of these technologies, the worker will be able to have the feeling that you have lost control of nature, rhythm and programming of his work, as well as the way he performs it and that are unable to interact socially or take breaks when want.

Thus, the main objective of this study was to identify whether there is a relationship between the introduction of new technologies in the industry and the appearance of mental health problems, such as burnout, through a systematic literature review. As specific objectives are also defined:

- Identify the tools used for identification and characterizations of burnout syndrome in an industrial context;
- Identify and characterize the feelings and emotions referred by workers when they use more sophisticated technologies in an industrial context;
- Identify the factors that contribute to the appearance of burnout syndrome in an industrial context.

## Method

This systematic review was developed in accordance with the recommendations of Preferred reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), published in 2009 (Page et al., 2021). PRISMA 2020 replaces PRISMA 2009 and includes new guidelines that reflect advances in methods of identifying, selecting, praising and synthesizing studies (Page et al., 2021). It was designed mainly for systematic reviews of studies that assess the effects of health interventions. However, the method is applicable to systematic reviews that assess other topics and many items are applicable to reviews with objectives that do not assess interventions (Page et al., 2021).

This tool includes two instruments (PRISMA, 2020a, 2020b):

- Checklist – comprises 27 items, covering the introduction, methods, results and discussion;
- Flowchart – describes the flow of information through the different phases of a systematic review. It maps the number of identified, included and excluded records, as well as their exclusion reasons.

To carry out the literature review, the Web of Science was consulted, using the keywords and synonyms shown in **Table 1**. The search phrase on the platform was TS =(burnout) AND TS = (industry OR "industry 4.0" OR manufacturing OR factor\* OR production) AND TS = (employee\* OR worker\*) AND TS = (technolog\*).

The eligibility criteria used for the systematic literature review were:

- Studies that identify the tools used to identify the burnout syndrome.

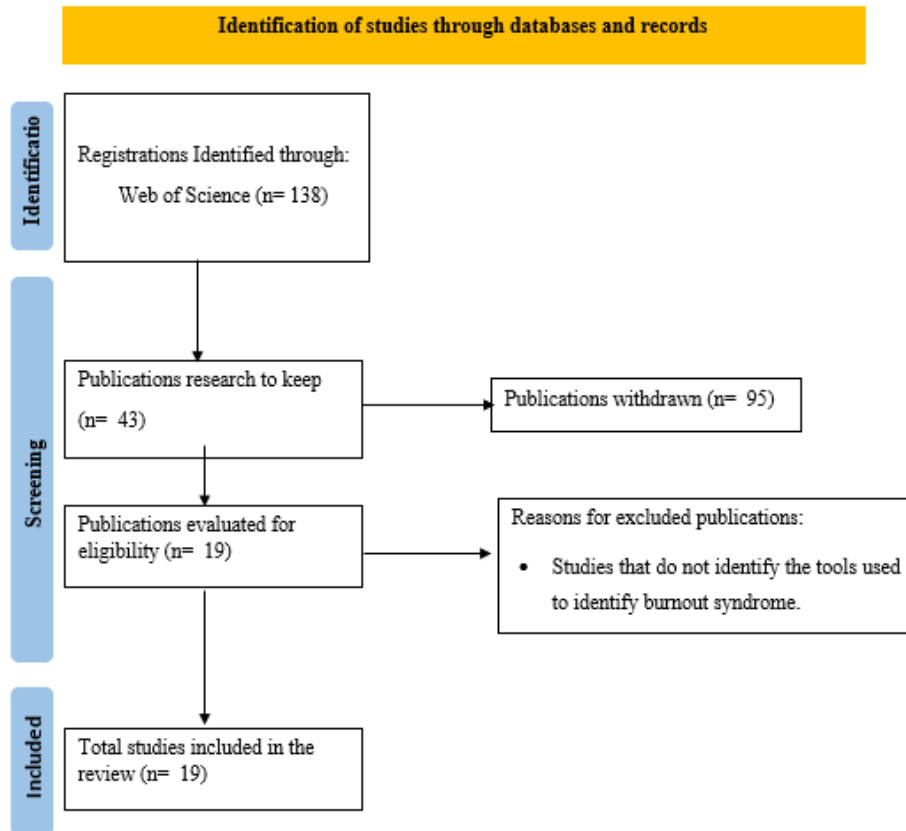
**Table 1** - Keywords and their synonyms

Keywords	Synonyms
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Burnout Industry Worker Technolog*	--- Industry 4.0/ Manufacturing/ Factor*/ Production Employee* ---
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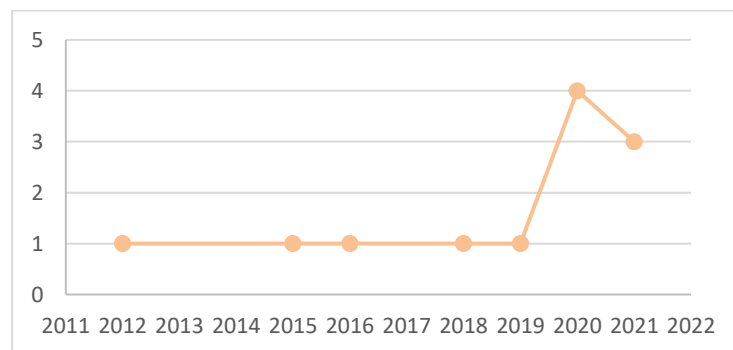
**Results, Conclusions and Recommendations**

Figure 1 shows the PRISMA flowchart, which represents the studies collected from the database and the respective exclusion process, ending with the number of studies analyzed.



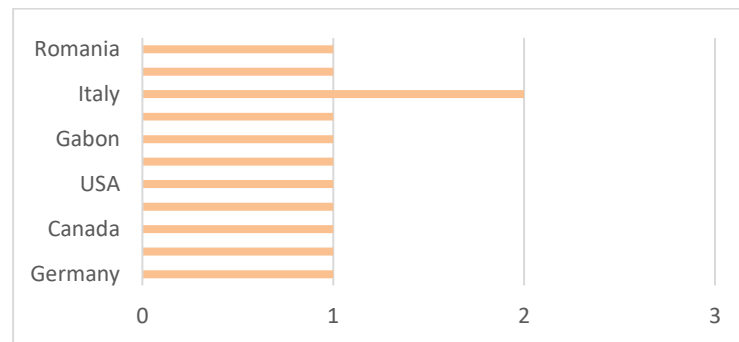
**Figure 1.** Identification of studies through databases and records

Regarding the years of the selected studies, it is possible to verify, according to Figure 2, that 66% of the studies were published between the years 2018 and 2021. These results demonstrate that it is a current topic, but at the same time, it is a theme that has been referred in the bibliography since the first industrial revolution. More recently, burnout has been introduced.



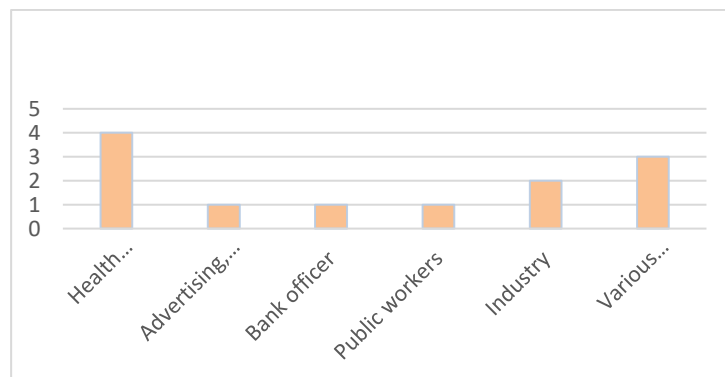
**Figure 2.** Comparison of years of studies and the respective

In Figure 3, the country of the selected studies is presented, and it is possible to conclude that the studies have been carried out all over the world, to try to understand the risks of the entire population, with the objective of implementing measures and helping the workers.



**Figure 3.** Study countries

In Figure 4, the studies are represented by sector/ activity and it is possible to conclude that there is, one again, a variety of sectors where it is possible to develop studies about burnout and technology. In the selected studies, there is a higher prevalence of studies in the activity of health professionals and industry.



**Figure 4.** Sector/ Activity of the studies

According to Sandoval-Reyes et al. (2019), new technologies provide an increase in competitiveness between organizations, which end up influencing their contexts. The modern age requires organizations to be faster, more efficient and more competitive to survive the modern world. However, this leads to an intensification of work, creating greater demands on workers in any sector of activity, as the technology has been adopted by all sectors.

### ***Burnout***

Table 2 and Table 3 show, for each study, its sample, instruments and burnout detection. In studies which burnout is detected on workers, it is identified through different instruments, such as Maslach Burnout Inventory (MBI), the German version of the Shirom-Melamed Burnout Measure and a scale that measures burnout, but also measure other variables, Safety, Communication, Operational Reliability and Engagement (SCORE).

The MBI, introduced by Freudenberg and Maslach, was the most used by the selected studies and is divided into three versions, one for professional, another for the educational context and a more general one, adapted to the entire working population (Marôco et al., 2016).

Regarding the samples where burnout was detected, available in Table 2 and Table 3, it's possible to conclude that only one study has a relatively different sample. This can be explained by the fact that this was the only study which the objective was to evaluate several variables and it was also the only one that did not use an instrument

more focused on burnout.

According to Popescu et al. (2018), some factors that lead to the appearance of burnout are the larger volume of work, fear of unemployment, repetitive and monotonous tasks, insufficient training, inadequate balance between professional and personal life, among other. Varga (2020) identifies another important factor that is present in most sector in

Figure 4, which is direct contact with costumers, which promotes an increase of burnout. Burnout causes consequences such as socioeconomic problems, due to decreased commitment, increased turnover intention, productivity losses, long absences, chronic disability and early retirement.

According to Lennefer et al. (2019), well-being isn't related to burnout. This is due to the activities that help reduce burnout, that is, most interventions capable of reducing burnout, include face-to-face exercises with a professional trainer, because a symptom of burnout is isolation and, in this study, activities were adopted online, with an online professional.

According to Day et al. (2012), the work environment influences the appearance of burnout, as well as Ninaus et al. (2015), who concluded that work environment with greater demands and limited work resources tend to the appearance of burnout on the part of workers and a decrease in commitment to work.

Burnout can be influenced by Communication Technologies and Information (ICT), that, according to Ninaus et al. (2015) and Varga (2020), burnout was identified as a consequence of the use of ICT. Ninaus et al. (2015) states that ICT's can be beneficial and harmful, they bring advantages to the worker, such as being able to access any information at any time and place and making communication processes, exchanging information and accessing information much more efficient, easily, quickly and effectively.

Is also states that the adoption of new technologies allows workers to carry out their activities outside the normal physical environment, being able to work outside their traditional office. This means that the worker can receive any information/ problem in real time and correct any problems that arise quickly. However, the author states that constantly accessing information makes workers unable to organize their work, unable to psychologically detach themselves from work and increase the working day, thus, increasing work demands. Workers, whether accessible on or off the job, means they are always accessible to colleagues, supervisors and customers, which puts additional pressure on workers and increases stress, which in the long term leads to burnout.

According to Torres (2021), ICT's have positive effects on productivity and innovation in organizations, however, they must remember that workers are constantly exposed to updating processes. In addition, workers deal with the problems that updates can cause, as well as the possibility that they can be monitored and accessible anytime and anywhere. However not all professionals consider this issue positive and experience technostress, this is an adaptation problem related to new technologies and that develop when they realize that they aren't able to manage the demands arising from technologies. Technostress is an important phenomenon due to being able to generate exhaustion and, in the long term, burnout.

### ***Job Demands***

Increasing demands imply that workers increase their efforts to achieve their goals. According to Day et al. (2012), ICT requirements influence workers well-being. Sandoval-Reyes et al. (2019), states that the use of technologies, in addition to affecting the psychological state, affects work overload and the work-life relationship, due to always remaining connected to work. On the other side, Navajas-Romero et al. (2020), states that the work-life balance is only affected by the physical demands of work.

According to Medzo-M'engone (2021), psychological demands have a negative influence on workers well-being. These are only affected when the decision-making capacity of the workers is diminished, so you will decrease mood, vitality and general interest and will feel that the work is demanding, feel overloaded, and there is conflict between personal-professional life. According to Sandoval-Reyes et al. (2019), workers must maintain their optimal psychological state, in order to ensure levels of energy, motivation and commitment.

***Frustration and Acceptance of New Technologies***

Frustration with technology is associated with burnout. Tawfik et al. (2021) states that frustration varies with professional and between individuals with the same job. This may have arisen due to the discrepancy between worker's expectations and reality, that is, in the acquisition of new technologies, the supervisor must explain or hire a professional to explain in detail each new technology acquired. Workers feel frustrated that they haven't been warned or resources haven't been explained.

According to the same author, emotional exhaustion is the key for evaluated burnout and reflect a state of burnout due to excessive demands, continuous stress and insufficient resources.

The acceptance of technology also must be considered, as the implementation of new technologies means a sudden change and workers may feel some difficulties.

According to Molino et al. (2020), it is necessary to train and pass on information by a professional to help in the acceptance of technology, thus allowing workers to deal with their doubts and fears, that is, resilience promotes commitment to work in a positive way in regarding change. The acceptance of technology helps to be in constant commitment to the work.

Resilient workers, who can face adversity and overcome them, are committed to their work, which gives rise to their well-being.

According to the same author, communication with the supervisor is very important, as it will allow the worker to ask questions and feel supported, being more motivated to accept the use of new tools.

**Table 2** - Analysis of articles related to burnout

Citation/ Reference	Sample	Instruments	Burnout
Navajas-Romero et al. (2020)	991 nursing professionals from the V European Working Conditions Survey	Copenhagen Psychosocial Questionnaire Job Content Questionnaire	0
Ninaus et al. (2015)	25 participants – 13 from Hong Kong and 12 from Austria and semi-structured interviews were conducted	Interviews with 11 questions, related to requirements and resources at work and the use of ICT at work	0
Varga (2020)	101 women in the banking sector	A self-administered online survey using Google Maslach Burnout Inventory	+
Bardoel & Drago (2016)	11 140 doctors in Australia	JDR model – work life balance MABEL survey	0
Tawfik et al. (2021)	15 505 people reported frustration with technology	Safety, Communication, Operational Reliability, and Engagement (SCORE) survey	+
Lennefer et al. (2019)	121 employees listed	5 online questionnaires included all study variables: Godin Leisure-Time Exercise Questionnaire; German versions of Shirom-Melamed Burnout Measure; German version of Utrecht Work Engagement Scale; Form-36 Health Survey; Time pressure.	+

**Table 3** - Analysis of articles related to burnout (continued)

Citation/ Reference	Sample	Instruments	Burnout
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Medzo-M'engone (2021)	162 civil servants from each of the main public institutions in Gabon	<ul style="list-style-type: none"> <li>• Job demands scale</li> <li>• Scale of Dagenais – Desmarais and Savoie.</li> <li>• Eisenbergr et al (1990) short version scale.</li> </ul>	0
Day et al. (2012)	1st phase – 20 SME's 2nd phase - 258 adults	1st phase - 6 individual interviews and 2 groups (with 6 and 8 participants in each) 2 <sup>nd</sup> phase: ICT Demands Scale; ICT support; Occupational Environment Scales; Job Control Scale; Perceived Stress Scale; Symptom Checklist; Maslach Burnout Inventory.	+
Sandoval-Reyes et al. (2019)	313 healthcare professionals with a full-time contract	<ul style="list-style-type: none"> <li>•Measurement Scale of the Organization's Demands for Detachment</li> <li>•Job Demands Scale</li> <li>•Recovery Experience Questionnaire</li> </ul>	0
Popescu et al. (2018)	360 employees	Maslach Burnout Inventory (MBI)	+
Molino et al. (2021)	Quantitative study that involved 263 employees filling out a questionnaire	<ul style="list-style-type: none"> <li>• Subjective Acceptance Questionnaire</li> <li>• INAIL questionnaire</li> </ul>	0
Molino et al. (2020)	598 workers	<ul style="list-style-type: none"> <li>• Work engagement - Oldenburg Burnout Inventory</li> <li>• Technology acceptance - Subjective Acceptance Questionnaire</li> <li>• Resilience - Connor and Davidson's resilience scale</li> <li>• Goal orientation - Italian Motivational Orientation Test</li> </ul>	0

The main objective of this study was to identify whether there is a relationship between the introduction of new technologies in the industry and the emergence of mental health problems. To answer to the objectives, studies were analyzed following the PRISMA methodology and it was possible to respond them all.

It is important to compare these data, as it is a current topic and technology has been constantly innovated and updated.

It will always be developments and inventions, so it is necessary to check how it affects workers in the modern world of work.

This leads to worker having to adapt their work to new technology adopt by the organization. For this, it is necessary to have communication and information from superiors to workers so that they feel safe and can carry out their work correctly, as well as the implementation of training for each new instrument.

Another important issue to mention is the different sectors to which the selected studies were evaluated. That is, in this review, were analyzed the activity between the different studies, being possible to make comparisons and perceived the presence of burnout due to technology innovation, with burnout being developed in all sectors.

With this study, it was possible to conclude the factors that affect the appearance of burnout and, it will be possible to act on these factors, to improve the work environment and implement some measures to reduce these risk factors, as well as to reduce the burnout in workers.

The limitations of this review were to find studies that compare burnout and new technologies, although more and more studies are being carried out on this topic, it still does not exist n abundance like other topics.

Regarding future work, it is necessary to invest more in the area, so that it is possible to make comparisons between countries, sectors and continue to carry out studies on the psychological and physical problems that affect workers in modern era thar currently lives.

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