REVIEW PAPER

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EMERGING OCCUPATIONAL RISKS IN GREEN JOBS: A REVIEW

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Abstract
Green jobs are to be understood as those jobs directly associated with specific sustainability issues and activities related to the efficiency, quality and innovation of goods and services offered, from an eco-sustainability perspective. The objective of the research was to fill knowledge gaps of new and emerging environmental and occupational risks related to sustainable activities and to understand the impact these might have on workers' psychological and physical well-being. A selection of several scientific articles and a critical analysis of the selected articles was carried out from the perspective of defining the concept of "emerging occupational risks in green jobs," using different keywords in the title or abstract as search criteria. Emerging occupational risks, most prevalent in the green sector are those determined by the rapid introduction of new technologies, new materials, new processes and work organizations. In order to be able to improve prevention and protection at work, it is necessary to act on a more careful and adequate risk assessment, the definition of new professional figures expert in green issues, the expansion of research and development of scientific knowledge, and the improvement of ergonomic aspects. Int J Occup Med Environ Health. 2024;37(3):244–56

Key words:
green economy, green jobs, emerging occupational risks, ecological transition, innovative materials and technologies, green ergonomics

INTRODUCTION

Climate change is seriously threatening future environmental and economic sustainability globally, while causing changes in the labor market [1].

In the current global landscape, as society grapples with the challenges posed by climate change, natural resource depletion, and environmental degradation, the demand for a workforce committed to ecological balance and sustainable practices has never been more pronounced. From the intersection of economic development and environmental sustainability, a growing employment sector has emerged, known as "green jobs" [2].

When talking about green jobs, one cannot ignore the concept of the green economy, which, according to the definition given by the European Commission, refers to an economy that focuses on the survival of the planet through the use of sustainable human activities, particularly focusing on a low-carbon economy, efficient use of

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resources and taking the form of a new socio-economic model that pays equal attention to the world of production, economic and social growth [3].

There are many definitions of "green jobs"; the most widely used is the one identified by the United Nations Environment Program (UNEP) in 2008, which defines such jobs as "...agricultural, production, research and development, administrative, and all activities and services that contribute substantially to preserving or restoring environmental quality..." [4].

It should be specified, however, that green jobs are not only those directly associated with specific sustainability issues (protection of ecosystems and biodiversity, etc.), but also those activities related to the efficiency, quality and innovation of the goods and services offered, from an eco-sustainable perspective [5].

Indeed, green jobs encompass a range of occupations and jobs that prioritize environmental responsibility and contribute to the ecological transition. The emergence of this new occupational typology not only responds to pressing environmental concerns, but also represents a significant economic opportunity, recognized by governments, businesses, and individuals, with enormous potential for green sector jobs, innovation, and economic growth. This move toward sustainability underscores the realization that economic prosperity need not come at the expense of the environment; on the contrary, the two can be harmoniously intertwined [6].

In "Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy" [7], the authors divide green jobs into 3 broad categories in relation to the effect they can have on the environment in terms of sustainability:

- direct jobs: first set of job changes due to changing outflows from target industries;
- indirect work: subsequent changes in work due to changes in input flows required to meet the above conditions;
- income-induced work: additional work generated by changes in household income and expenditures resulting from both of the above conditions [7].

In order to achieve smart, sustainable and inclusive growth, meeting the objectives of the EU's Green Transition Strategy, the creation of new jobs must also focus on the importance of anticipating new and emerging risks to workers' health and safety, and re-evaluating so-called "traditional or conventional" risks already regulated under existing workplace safety legislation, with a view to new working conditions associated with the activities envisaged in the ecological transition, with the aim of ensuring adequate, safe and healthy working conditions, offering benefits not only to the environment, but also to the workers involved in these new production processes [8].

In Italy, current occupational health and safety legislation stipulates that the employer must carry out an assessment of all specific occupational risks to which workers are exposed in the performance of all activities involved in specific tasks. Occupational risks taken into account in the mandatory assessment described above are conventionally divided into 3 categories: health risks, safety risks and transversal risks [9].

Specifically, as health risks are understood those from which an alteration of the psycho-physical balance of well-being of workers who are exposed to them can potentially result. These are mainly risks related to exposure to factors harmful to the body that, through chronic exposure, can result in work-related disease states also referred to as occupational diseases. Health risks include all those risks determined by exposure to physical (ionizing radiation, noise, vibration, etc.), chemical, biological and carcinogenic agents.

As far as safety risks are concerned, these include all those of an accidental nature and, consequently, all those working conditions that can determine a traumatic and violent impact with a tool, object, substance or structure present

in the company, such as to determine an event, occurring on the occasion of work, that produces an injury to the body or health of the worker defined as an accident at work. Occupational risks such as: electrical risk, fire risk, risk from explosive atmospheres, risk from falling from height or level (tripping/slipping), cutting risk, etc., are included in this category.

Finally, transversal risks are understood to be those related to the organization of work, that is, related to company dynamics and the set of interpersonal working relationships, which are created within a professional context. To this category of risks has been added the risk of work-related stress, to which are related a number of aspects that concern the emotionality and psychological sphere of the worker. This is a risk that has mainly psycho-social origins and generally arises from the relationship between the worker and the work organization. Generally speaking, work-related stress can cause damage to health that is not always immediately apparent, so it is considered one of the most difficult risks to detect [9].

The exponential growth of the "green" production sector, linked to sustainability and ecological transition, is mostly characterized by a high level of innovation, both in terms of technologies employed and production processes adopted, hence the emergence of new potential critical issues for the protection of workers' safety [10].

For these reasons, the aim of the research was to fill in the knowledge gaps on these new types of emerging occupational risks related to sustainable activities and on understanding the impact they may have on the mental and physical health and well-being of the workers involved.

METHODS

From a methodological point of view, in accordance with the research objective, this narrative review involved the selection of several scientific articles that were compared and summarized on the basis of the authors' experience, theories, and existing models. The analysis involved 2 stages: the identification of recently published studies indexed in the Web of Science Core Collection and Scopus databases, and the selection of the papers deemed most relevant to the authors' research with a critical analysis of the selected articles from the perspective of defining the concept of "emerging occupational risks in green jobs".

In the first stage, articles published since 2008 in the Web of Science Core Collection and Scopus databases were scanned, using the following keywords in the title or abstract as search criteria: emerging occupational risks, green jobs, green economy, environmental sustainability and occupational safety, ecological transition, innovative materials and technologies, green ergonomics.

These 2 databases were used for the literature search because they contain the richest collection of scientific articles that underwent a rigorous review process before being published. While the choice of the research reference period was set from 2008 because the first explicit definition of the concept of "green jobs" was identified in this specific year [4].

Information on the number of articles identified as a result of applying the search criteria in the 2 databases, by publication period, is presented in Table 1.

Once >200 articles were identified, the authors focused the analysis on articles published within 10 years, i.e., after 2015, to ensure that the selected papers are as relevant, current, and easily accessible to the academic community as possible. In addition, as the analysis focuses on defining specific occupational risks in green activities, the search scope was further narrowed to articles that addressed the issue on occupational risks with regard to the health and safety aspect of workers by eliminating duplicate articles, i.e., selected articles with >1 keyword. At the end of the selection, the articles deemed valid for the search were found .

Table 1. Articles published worldwide on green jobs selected in a narrative review conducted from October 2023 – February 2024

Article selection key	Articles [n]
Keywords – published from 2008 onward	
emerging occupational risks	14
green jobs	25
green economy	96
environmental sustainability and occupational safety	45
ecological transition	21
innovative materials and technologies	30
green ergonomics	5
Topic – published after 2015 onward	
emerging occupational risks	5
green jobs	10
green economy	11
environmental sustainability and occupational safety	2
ecological transition	3
innovative materials and technologies	2
green ergonomics	1

RESULTS

At a time when there is an increasing focus on climate change and environmental sustainability, there appears to be a growing demand in the working population, for new skills, referred to as green or "green skills." Green skills are essential for companies aiming at the ecological transition, both for those working directly and indirectly in the sectors involved. In this regard, in different workplaces they are proceeding, not only by adopting sustainable practices, but also by seeking to hire personnel who are increasingly trained and prepared in putting these skills into practice in order to share their aims.

The Report *Analysis of Demand for Green Economy-related Skills in Enterprises, Survey 2023* by Unioncamere and the Italian Ministry of Labour and Social Policies (Soppressione Agenzia nazionale per le politiche attive del lavoro – ANPAL) [11], analyzes the extent of the green jobs phenomenon in Italy. Confirming the hiring trend described above, this survey shows that the green labor market appears to be more resilient than the overall average, and although total hiring slowed down in 2022–2023, workers with green skills were hired for new jobs at a higher rate than those without green skills, and that the majority of open positions involve managerial, artisan, and skilled laborer jobs.

New technologies and work processes related to "green" jobs increasingly require skill combinations among the various professionals involved, who find themselves exposed to emerging and partly unfamiliar occupational risks. This implies that current scientific knowledge of occupational health and safety cannot simply be transferred to these new production sectors, but must be revised, integrated and improved in order to prevent and protect the workers involved. As already partly anticipated in the introduction, this has been brought about by the rapidity at which many production sectors are expanding due to green transition requirements imposed by governments around the world, leading in some cases, to possible skill, safety and prevention gaps, due to inexperienced workers involved in procedures for which they have not been adequately trained, or exposed to risk factors that are still poorly understood.

For "green" jobs to be truly sustainable, it is necessary to ensure that such activities have a greater focus on the safety and health of workers, as well as the environment. Indeed, workers employed in the green sector are often exposed to new so-called emerging occupational risks, not previously identified among those considered traditional and regulated by current legislation, due to the rapid introduction of new technologies, new materials, new processes and work organizations. Therefore, it is necessary to expand knowledge on what are the possible new occupational risks related to these green activities.

For "emerging occupational risks," the European Agency for Safety and Health at Work defines all identified

occupational risks as "new" and "increasing." The term "new" refers to an occupational risk that did not previously exist and therefore not present in the relevant Italian legislation, caused by new processes, new technologies, or social or organizational changes due to a change in social or public perception; or a risk that has emerged as a result of additional new scientific knowledge. Also to be understood as new emerging risks are those conventional occupational risks to which, however, workers are exposed under nontraditional conditions. The other aspect present in the definition of an emerging risk is its trend in terms of the number of exposed workers; a risk for which there is a large number of exposed workers with a high probability that this condition will lead to a hazard should be understood as "increasing"; or that the effect of the hazard on the health of workers is increasing by exposing more and more of them to serious consequences from such exposure [12].

In most cases, green jobs may represent a combination of different types of specific risks between emerging and traditional ones, but carried out under new working conditions.

Specifically, the innovativeness of the materials used and production processes adopted in work activities, the introduction of more modern technologies, and the new forms of employment and work organization involved in the green transition, can certainly result in new risk profiles for the health and safety of workers, which combined with the traditional, and commonly known, specific risks in work environments, such as electrical, chemical, biological, etc., can promote the occurrence of occupational accidents or illnesses.

A key example concerns the use of renewable energy, and in particular the wind energy sector, which combines both traditional safety risks such as electrical risk, the risk of falls from heights or working in confined spaces, and newly arising health risks such as the use of newer, more innovative and resistant materials, such as resins and solvents, to compose wind blades or the manual handling of loads on ropes in unfavorable environmental conditions.

In short, Table 2 shows some of the activities, expanding most in the ecological transition, where all these types of occupational hazards are combined.

The authors' research shows that the scientific literature is poor in what concerns studies on new emerging risks in relation to sustainable work scenarios. Currently, the fastest-growing manufacturing sectors relative to the ecological transition are devoting their attention to improving their environmental impact by focusing on the use of new materials or new technologies, the increased use of renewable energy, and the development of new "zero-emission" production processes.

Exposure to new materials and technologies

Jobs involved in the ecological transition often involve the use of innovative materials and technologies designed to reduce environmental impact. However, limited knowledge about the long-term effects of some of these materials on human health may pose a risk to workers and thus limit their use [13].

Nano-materials (NM) and related nano-technologies, have developed rapidly in recent years, taking advantage of the innovative characteristics of nanoscale (1–100 nm) materials. In 2022, the European Commission updated the definition of NM as: a natural, derived or manufactured material consisting of isolated solid particles or identifiable constituent particles in aggregates or agglomerates, and in which ≥50% of the particles in the number size distribution meet at least one of the following conditions:

- external particle size within the range of 1–100 nm,
- elongated shape particle (such as a stick, fiber, or tube) with 2 outer dimensions <1 nm and the other dimension >100 nm,
- platinized-shaped particle with one of its outer dimensions <1 nm, while the other dimension >100 nm.

Table 2. Labor risks divided into the sectors most involved in the ecological transition in the articles published worldwide on green jobs selected in a narrative review conducted from October 2023 – February 2024

Sector	Labour risks
Wind energy	– safety risks: electrical, falls from height, working in confined spaces – health risks: manual handling of loads, noise, vibration, micro- and macroclimate determined by unfavorable microclimatic conditions, exposure to new, more innovative and resistant materials such as resins, solvents, etc. – cross-cutting risks: organization of work teams and shifts, work-related stress
Waste handling/recycling	– safety hazards: electrical, falls from height, accidental ingestion (contaminated hands) – health risks: manual handling of loads, noise, vibration, inhalation of aerosols, cuts, punctures, contact, exposure to toxic/harmful substances – cross-cutting risks: organization of work teams, night shift, work-related stress
Photovoltaic	– safety risks: electrical, falls from height, working in confined spaces, burns and scalds – health risks: manual handling of loads, noise, vibration, micro and macroclimate determined by unfavorable microclimatic conditions, exposure to solar cell components and semiconductors such as cadmium telluride – cross-cutting risks: organization of work teams, night shift, work-related stress
Biomass	– safety hazards: fire, explosion, electrical – health risks: manual handling of loads, noise, vibration, micro- and macroclimate determined by unfavorable microclimatic conditions, exposure to carcinogens, heavy metals, hazardous gases, volatile organic compounds, dust, mold, endotoxins – cross-cutting risks: organization of work teams, night shift, work-related stress
Solar thermal	– safety hazards: electrical, falls from height, confined spaces, burns – health risks: manual handling of loads, noise, vibration, micro and macroclimate determined by unfavorable microclimatic conditions – cross-cutting risks: organization of work teams, night shift, work-related stress

Regulations spread within the EU state that all chemicals and their use in products for which there is no other specific regulation are subject to EC Regulation No. 1907/2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) [14].

According to the European Chemicals Agency (ECHA), NM are not explicitly mentioned in the REACH framework, but since these requirements apply to chemicals in any form and configuration, they are still considered to be regulated by that regulation. European Chemicals Agency has also published, different guidelines on what are the information requirements and safety risk assessments according to REACH for what concerns NM. Among these criteria specific requirements were also found for the substances covered by the recommendation of the European community, such as data on physicochemical properties, toxicology and toxicokinetics, as well as appropriate assessment measures for safety, including occupational exposure and recommendations on personal protective equipment of personnel to be used in case residual exposure cannot be avoided by the application of other collective preventive and protective measures [15].

Currently, the use of NM and nano-technologies is in high demand. Specifically, these materials are included in the broader group of so-called advanced materials (Table 3), which are extremely versatile materials with new functionalities and increasingly high-performance characteristics. These are either already known and suitably modified materials or entirely new materials designed to have specific characteristics such as: ability to change their physicochemical properties, combinations of ≥2 materials, applied to a biological system or derived from a biological source, or materials obtained

Table 3. Classification of advanced materials in the articles published worldwide on green jobs selected in a narrative review conducted from October 2023 – February 2024

Type	Features	Examples
Active materials: intelligent, multifunctional, adaptive materials	materials capable of changing their properties	electro/photo active materials, with targeted surface properties, modified surface reactivity, self-repairing, inspired by biological systems
Composites: advanced composites, composite materials	materials obtained from combinations of ≥2 materials	fibre and glass, polymers, blends according to REACH, polymer matrix compounds, natural fibre reinforcement, advanced textile and fiber layer construction,
Structured materials: multi-structured, artificially structured materials	structured materials in 2 or 3 dimensions	cellular materials, gels and foams, light alloys, soft materials
Nanomaterials: nanoparticles, nanotechnology products	materials with at least 1 dimension of 1–100 nm	carbon nanotubes, graphene, carbon dots, nanowires, metal nanoparticles
Biomaterials: biopolymers	bio-based materials, applied to a biological system or derived from a biological source	high-performance bio-fiber-reinforced biopolymers based on DNA/RNA, proteins, sugars or fats
Advanced manufacturing: advanced production processes	materials obtained by advanced addition/removal methods through virtual geometry, without the use of pre-forms or moulds	modelling, subtractive, additive technologies

REACH – Registration, Evaluation and Authorisation of Chemicals.

by advanced methods of addition/removal of material through virtual geometry, without the use of pre-forms or molds [16].

These materials are recognized as having great enabling potential in various fields, such as renewable energy, sustainable mobility, efficient use/saving of natural resources, digitalization, Industry 4.0, robotics, and additive manufacturing [14].

Increasing use of nanotechnology is also present in the field of agriculture, as with an ever-growing population, high agricultural yields and more efficient strategies to optimize farming practices are increasingly required [17]. In this area, nanotechnology, has experienced significant growth as these practices have been shown to make agriculture increasingly sustainable, providing innovative solutions to protect and restore water and soil, thereby increasing global food production and quality while respecting the environment, improving seed germination, growth and plant protection through controlled and reduced release of traditional chemicals [18–25].

As a result of such manufacturing success, it is hoped that these solutions can also play a key role in other areas, such as urbanization, energy and resource constraints, sustainable resource use, or pesticide and fertilizer runoff and accumulation in the soil [26,27].

However, the emerging uses of nanotechnology in agriculture, and in many other sectors of the global economy, continue to raise questions and concerns about the possible human and environmental health implications for both the general and working population. In this regard, although organic farming is generally considered to be healthier for both consumers and the environment, it may pose specific risks to agricultural workers [28,29].

From an occupational health and safety perspective, in fact, this seems an even more pressing issue to assess, since the first exposures to these innovative production processes affect workers in the sector who, being intensively and chronically exposed to these xenobiotics, which have not yet been fully explored, could manifest long-term adverse health effects [30].

Exposure to pesticides and organic fertilizers, which are not yet fully understood in terms of their metabolism and effects on humans, despite being less toxic than their synthetic counterparts, may in fact cause health problems on humans if proper prevention and protection measures are not implemented or if all the rules of good practice in the use of chemicals are not followed, such as wearing proper protective clothing and observing practices such as periodic, and increasingly up-to-date, safety training of workers [31].

The potentially large variety of nano-substances used is not yet fully understood from a toxicological point of view, so it should be considered that despite the presence of regulatory and standardization measures in the area of occupational exposure, the major role of NM and the resulting nanotechnologies in industrial production requires adequate analytical capacity for materials characterization, which to date is still under development for some applications.

Specifically, the results of toxicological studies on inhalation of particles from NM, indicate a gradual increase in toxicity rather than completely new nano-specific effects. However, although nano-sized particles as such may not present a toxicological hazard, the large number of new materials, particularly hybrid materials consisting of different compounds, require further attention, so a development of analytical techniques seems indispensable for accurate quantitative characterization of exposure scenarios, and for elaboration of potential adverse effects on humans and for what concerns the environmental fate and ecotoxicity of nanoscale particulate matter [32].

Risk exposure in the renewable energy sector

Among the activities in the renewable energy sector, those related to the use of wind and solar energy represent the most exploited field. Specifically, the field of wind energy seems to count the largest number of workers exposed to newly emerging risks [33].

Wind energy is one of the most abundant forms of renewable energy available in the environment, as it harnesses the energy produced by the wind to generate electricity, using technological facilities that do not release pollutants into the air. Wind turbines represent the basic production units that enable this transformation of energy by means of the turbine consisting of 3 basic elements: the rotor, the cabin, and the tower [34].

Jobs in this field are diverse and mainly involve the construction, operation, and maintenance of wind turbines. Specifically, among the jobs specific to this field those inherent were found in the search for innovations such as engineers who design components, select and authorize sites to operate wind farm installations, and more manual jobs such as machinists, assemblers, welders who manufacture components, to construction workers, including those specializing in concrete and steel foundations [35].

The Occupational Safety and Health Administration (OSHA) describes several occupational hazards specific to wind energy, some of which may be common to other manufacturing sectors in the renewable energy field, as they are traditional but carried out under new and highly hazardous environmental conditions, and others exclusive to this field and considered emerging [36].

The specific risks in wind energy-related activities concern those involved in the production of wind blade components, those who access the inside of the cabin to carry out inspections and maintenance of mechanical parts, and those who work on ropes to install and maintain the blades from the outside.

First, the chemical risk due to exposure to toxic agents in both the production and installation phases is significant. In the course of such procedures, workers may be exposed to epoxy resins, styrene, solvents, vapors and dusts either by inhalation of the same or by dermal exposure. This risk is not limited to the production phases but also involves the in-service phases of the plants. In fact, routine and extraordinary maintenance activities in the cabins, can lead the worker, who works in confined spaces and therefore with poor air changes, to the greatest exposure to

fumes and mists consisting of complex mixtures of airborne substances composed mainly of mineral oils, polycyclic aromatic hydrocarbons, aldehydes, heterocyclic compounds of various kinds (polychlorinated biphenyls, N-nitrosamines, etc.), metals from tools and moving gears. There are also numerous plant parts subject to periodic lubrication and greasing, such as the gearbox, primary shaft bearings, pitch control bearings, etc., which further expose the maintenance worker to a chemical hazard from the use of lubricants, mineral oils, cooling system fluids, greases, solvents, detergents and paints. The toxicological characteristics of these substances are strongly related to their nature and the degree of contamination of the contained additives, as well as, the work process that can lead to thermal degradation and chemical transformations [37].

Another aspect of chemical risk exposure concerns the coating of blades, which increasingly involve the use of nanomaterials, even in this industry, to reduce atmospheric effects on wind turbine components and to enable remote control and monitoring, which as previously exposed poses potential exposure problems for workers involved in both the production and operation and decommissioning phases of the plant [38].

Among the risks specific to these activities is that of carrying out activities in confined spaces within the cabin that houses the rotor and other mechanical components, which during maintenance or inspection can lead to occupational injuries due to the processes of entanglement, crushing and impact with moving parts, as well as an increased risk of intoxication from fumes or mists.

Electrocution is a safety risk present in this sector; workers' access to the turbine cabin for maintenance, as a result of malfunctions or alteration of the insulating components, can in fact cause both electrocution and possible thermal effects related to the presence of electrical energy (such as ignition of fires and burns) leading to health consequences for the workers involved. In fact, it should often be associated the electrical risk with that determined by possible fires; in wind turbines in particular, fires may occur due to electrocution or technical errors and failures. In such cases, the outbreak of fire could be facilitated by the presence of lubricants, oils, live electrical parts or the material of which the cabin enclosure itself is composed. Operators are, therefore, exposed to this risk when mainly when they are inside the cabin.

The risk determined by the performance of work at heights on ropes or basket i.e., at heights >2 m above the ground, as required by law, is always present for those involved in maintenance work of both the internal and external part of the cabin. This conventional work activity in other work areas, in this sector could generate a higher incidence of injuries from falls from heights due to the unfavorable environmental conditions in which it is carried out, if it has been considered that wind farms are often located in places exposed to strong winds, such as at high altitude or sea level.

Finally, possible causes of occupational injury must also include the isolated location of the plant, which could contribute to aggravating the risks associated with the activities carried out inside the wind machines. A wind farm is frequently located in places far from population centers, which can often be reached with difficulty due to lack of adequate roads, with lack of telephone network coverage and often even radio links. All this could exacerbate the consequences of safety hazards capable of leading to work-related injuries with more serious complications dictated by the limited and non-immediate availability of medical and first aid services [39].

Green ergonomics risks

Today, "ergonomic risk" is rightfully among the most evaluated aspects in terms of prevention when designing interventions to improve the safety and well-being of workers in the workplace. These aspects should be considered fundamental in all work sectors to ensure ergonomic workstations that preserve the well-being of employees.

In the context of green jobs, ergonomic aspects, also referred to as "green ergonomics," are considered essential to ensure the development of safe and healthy sustainable jobs [40]. An example of a highly involved work activity in relation to emerging ergonomic risks involves rope work often used in the renewable energy field or in sustainable construction to reduce the use of polluting conventional equipment such as cranes, baskets or other mechanical platforms. This risk is amplified when one considers that the activities performed often involve non-traditional manual handling of loads and prolonged incongruous postures. In fact, it has been shown that there is a high prevalence of cervical spine, scapulohumeral girdle, and upper limb disorders in individuals who perform this type of activity on ropes, caused by these occupational health hazards to which workers are exposed under novel working conditions [41].

Ergonomics in green jobs, therefore, must focus on creating work environments that prioritize workers' health and safety and designing ergonomic workspaces in different activities. In particular, the use of adjustable workstations and equipment to accommodate different body types and individual preferences to reduce the risk of musculoskeletal disorders, along with green jobs-specific training programs on ergonomic practices, could improve risk awareness in workers, reduce the likelihood of workplace accidents, and instill a culture of safety and well-being in all professionals involved. This should be considered not only a benefit to the worker, but more importantly to the employer and the company, fostering an increase in profit, in terms of reducing the number of errors, injuries and sick days, with virtuous growth benefiting the entire company.

CONCLUSIONS

Green jobs involve a variety of occupational sectors with new and different work environments, conditions, processes and work characteristics, which have had a strong socioeconomic and political impact raising quite a few concerns in terms of occupational safety and health.

Considering the limited knowledge of the specific risks emerging in green jobs, the objective was to show an overview of the activities most involved in this sustainable ecological transition and the related health and safety risks for the categories of workers involved by trying to increase knowledge in the area of health and safety in green jobs, seeking to analyze the new specific risks so as to encourage the implementation of effective measures to prevent and protect workers from these risks. The limitation of this study was the inability to consider all job sectors involved in the green transition because of the limited literature sources in the literature that fell within the selection criteria used.

In the authors' opinion, patently from this better knowledge of the risks associated with these rapidly expanding sustainable activities, in order to be able to improve the prevention and protection of possible occupational injuries or the onset of occupational diseases, it is necessary to act on:

- a more careful and adequate risk assessment for green jobs, as well as broader management including specific training on green issues for both workers and all other safety figures in the company;
- the identification and definition of new professional figures who are experts in the green field with different and more defined skills, closely related to the activity carried out by the company and the different stages of development of the new emerging production chains;
- expansion of research and development of scientific knowledge to recognize the risks induced by the new materials used, in order to limit the handling of potentially toxic substances;
- improvement of ergonomic aspects to create work environments that prioritize the health and safety of workers by designing work spaces that reduce physical exertion and prevent accidents even in the presence of hazards assessed as conventional, but whose exposure to workers occurs under new conditions.

Although the challenge of environmental sustainability is cutting-edge and constantly developing, political, tech-

nical and regulatory interventions would be desirable to ensure greater attention to occupational health and safety, with the main objective of being able to anticipate the emergence of new occupational hazards in the future and prevent them by applying increasingly appropriate and effective prevention and protection measures.

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