

Human Factor in Occupational Risks Prevention: From Error Theories to Responsibility and Liability Theories

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Abstract The current hegemony of the mechanistic thinking, deeply rooted in the machine image, and the analysis procedure that involves breaking down complex things into simple ones in order to find their existing meaning, together with a great coincidence, have all led to talk about the human being exclusively, as a mere component or casual factor in risk situations. We make the human being responsible for a load that business managers and politicians would share equally. This is all due to an inadequate global security response. The individual is intentionally separated from the environment. Why? In order to make him causal factor and main subject in risk situations, especially in those with political implications. Our work involves understanding human participation in unwanted events from the ethic idea of responsibility and reliability in all organizations, instead of from the individual error thinking.

Keywords Human factors • Responsibility • Paradigm • Mechanistic • Systemic

1 Introduction

It is unavoidable to speak about human factor facts when we try to understand occupational risks prevention. As we see it, people's health is what moves such social practice. However, all human factor issues have been managed through theories that study accidents casualty.

Occupational risks prevention needs to be understood as one cooperative human activity aiming to achieve a goal that societies establish. Therefore, it is a performance that depends of its context of discovery. With all this being said, you will understand that we can't manage occupational risks prevention without taking into account its rational context.

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When we talk about rational context in risks prevention, we are saying [1] that risks prevention, as a certain type of social practice, can't be excluded from a context of intelligibility that is comprised of a way in which we understand Nature, in block capitals; a way of understanding the human being and a way of understanding business. Of course, we are always referring to risks prevention in workplaces.

Different worldviews have various ways to understand these elements. At the moment, there is also a dispute to achieve hegemony between the mechanistic worldview and the systemic worldview, which leads to two different patterns to understand occupational risks prevention and the human being.

2 Paradigm of Mechanism: The Illusion of Control and Security

In the sixteenth and seventeenth centuries, the medieval vision of the world based on the Aristotelian philosophy and Christian theology experimented a radical change. The vision of the world as a machine took over the organic, living and spiritual vision of the universe. The machine metaphor became a dominant principle of modern ages. It tried to explain how the universe, man, and later on the organizations functioned.

Several developments in the sciences of physics, astronomy and mathematics supported this radical change. Movements such as the Scientific Revolution where we find names like Copernicus, Galileo, Descartes, Bacon, and Newton, among others. All these authors were in fact heirs of the eighteenth century Enlightenment and nineteenth and twentieth centuries' empiricist philosophers. They all worked under the theme: "Given a system initial conditions and laws of nature, one can calculate its approximate movement" [2].

Life length for this theme will require a particular understanding of the concepts of Nature, human being and rationality. We cannot forget here the company organization as a must-have context for a productive activity and its risks.

2.1 Nature: One Geometric Space

The vision of Nature has influences on thoughts since it imposes a global vision of the world as a certain transformation in the different areas of knowledge and human action. Nature itself, without previous spiritual elements, or any type of purpose, is identified with the Euclidean geometric space and it is understood within the mathematical reasoning. As a consequence, Nature becomes one uniform space with underlying laws, such as the laws of Mathematics and various Mechanism and Dynamics abstract thinking frames, which will operate universally for all times and places.

The consequence for this Nature approach will be the emergence of the rationalist tradition of prevention.

3 Rationalistic Tradition in Prevention

Our idea is that the mechanistic thinking pictures will be specified in the field of risk prevention in a tradition that has dominated the twentieth century and that it should be put aside in order to achieve higher success levels in risks prevention. Without a doubt, one of this project's goals will be recovering the *res cogitans* that the individual had lost during the Enlightenment.

The main features of this rationalistic tradition in occupational risks prevention will be:

3.1 Risk Is an Objective Thing

From the epistemological point of view, we can say that Logical Empiricism realism would explain the rationality that will prevail in the science of prevention. This will mean to say goodbye to the perceptual in benefit of the conceptual, also the subjective gives way to the objective; which will also reach the risk scope.

In this preventive tradition there are many probabilistic statistics risk definitions based on scientific criteria, that is, positive quantitative science (such as engineering, statistics, physics or chemistry). Risk is an objective property of an event or an activity. It can be measured probabilistically to calculate its adverse effects. From this approach, risk is measured in figures measuring damage.

3.2 Technical Factors that Determine Risk

Occupational hazards are determined by the influence that working conditions has on workers' health. Studying the occupational risks only from the side of natural sciences will mean reducing the risk analysis to the study of the conditions that can be treated with the methods of these sciences (i.e. methods that can be translated into physical or mathematical language). We will leave out other aspects such as all psychosocial risks.

3.3 Quantitative and Analytical Risk Evaluation (One Workplace at a Time)

In this objective tradition, risk evaluation is seen as a highly technical diagnostic phase. There is a quantitative calculation of the human health risks that working

conditions bring about. This approach understands risk as mathematically measurable, so it understands evaluation as a process of estimating magnitudes. Mechanistic epistemology is not only transferred to the quantification of risks but also will establish its analytical rationality to the procedure established for its evaluation. It will refer to a one workplace at a time rather than to global security response.

3.4 Only a Few Technicians Own Expert Knowledge

Objective analysis methods of working conditions that we just mentioned have the following features. Analyses are based on objective data and only experts can put them in practice with the application of scientific methods and techniques. In the analysis phase, such methods do without workers' participation. In this tradition, the concentration of expert knowledge in prevention belongs to small group of specialists who master the procedures and measuring instruments.

The rational tradition in risks prevention that we identify within the framework of a mechanistic paradigm, will add analytical rationality to help us understand risks prevention and accident rates in terms of factors, sources and human error.

4 Mechanistic Human Factor

The current hegemony of the mechanistic thinking, deeply rooted in the machine image, and the analysis procedure that involves breaking down complex things into simple ones in order to find their existing meaning, together with a great coincidence, have all led to talk about the human being exclusively, as a mere component or casual factor in risk situations. We make the human being responsible for a load that business managers and politicians would share equally. This is all due to an inadequate global security response [3].

The individual is intentionally separated from the environment. Why? In order to make him causal factor and main subject in risk situations, especially in those with political implications. It has happened so in railway accidents like in the Valencia Subway accident (2006) or the Ebola spread (2014). Within this mechanistic paradigm of the human being, we can find a long range of accident causation theories (Heinrich theory, H. W. (1950), domino theory, multiple casualty theory, and energy transfer theory). All these make use of an analytical rationality and a great coincidence in explaining how accidents happen. Workers or citizens would just become simple factors in a causal chain. The occurrence of an accident or an unwanted situation can be explained just by them (at least 80 % of the accidents).

From our point of view, this unfortunate management of human participation in the safety field is due to the fact that when we speak of "Human Factor" related to prevention, we speak from the mechanistic language that has been dominating scientific fields like Engineering, interested in quantifying (risk) and calculating

probabilities (human error), Psychology, long dominated by the scheme S-R behaviorism, in its various forms, Ergonomics, focused for a long time in anthropometric figures that represented magnitudes, and Business Science, unable to break free from the classical theory of a bureaucratic and mechanistic organization vision.

This language enabled us to understand the human being as a mechanism whose behavior conforms to a certain structure and programming, developed by safety engineers. Everything that is far from this program becomes noise, deviation or individual error correctable with reprogramming or proper recycling:

«The insistence on human error is suspect of clouding other safety factors, especially design, organization and management limitations. There are “normal” accidents given the structure of the system» [4].

5 Systemic Paradigm

However, systemic thinking wants to address all those encrusted ideas and values, typical of the mechanistic worldview, from another perspective: «The vision of the universe as a mechanical system constructed with parts and governed by the laws of mathematics», «human body as a machine», «life in society as a conglomeration of individuals in a competitive struggle for existence» and «analytic rationality, one knowledge breaker»; that still survive to the consequences we already know in the field of prevention.

The Psychosocial Tradition, which we identify with the systemic paradigm, will add systemic rationality allowing to understanding prevention and accident rates in terms of organization, global security response and systemic reliability. As we see it, this is a better look at exactly what human factors involve. We need to look into the sustainability context where this psychosocial prevention tradition takes place before we study it.

5.1 *Contextual Rationality*

First, you must understand rationality from another point of view. According to the systemic vision, the essential features of an organism are features of all that no part has itself. They emerge from the interactions and relationships between the parts. Although we can discern individual parts in any system, these parts are not isolated. The nature of the whole is always different from the mere sum of the parts. Twentieth-century science has revealed that these parts' features are not intrinsic but can only be understood from a larger context. So it is that the relationship between the parts and the whole become reversed. It is then that we will understand parts can only be understood from the organization of the whole.

Systemic rationality becomes contextual, unlike the analytical nature of the mechanistic paradigm. Systems become the unit of analysis of the new paradigm.

This line of knowledge's keys lead to what we call the line of objectivity in brackets or hermeneutics. Two are the consequences: The existence of a reality constructed by the individual, as opposed to the objective reality of the mechanistic worldview, and the existence of a plural rationality.

In the mechanistic paradigm objectivity is achieved by its adaptation to an external and independent reality the individual knows. In the new paradigm, this external and independent to the individual reality no longer exists. It is constructed by the individual through the way they know reality: Establishing patterns in the relationships network that is reality. At the same time, this will mean that there will be as many realities as ways of existing knowledge.

Ontological and epistemological features of this worldview will bring about different ways of understanding the organizations and humans. In the field of prevention they will be specified in an emerging psychosocial approach.

5.2 The Human Being: Personality System

In psychology, the basic concept of behavior used to be the robot model. We had to explain behavior with the mechanistic stimulus-response scheme (S-R). On the other hand, human behavior will not be understood in the systemic personality theory without considering the pursuit of goals and the individual's intentions. Systemic thinking means that personality has system features where things and the whole itself emerge together, thanks to a slow gathering of learning processes and social, cultural and linguistic factors.

The social relations' system in which the actor is involved is not merely functional but it is constitutive of the personality itself. This systemic dependence will also have consequences for the way we understand action.

5.3 Holistic Theory of Action

The action is to be understood as a system where cultural, social and psychological components live. This systemic scheme extends the mechanistic action scheme. It finds a new source of intelligible individual action in rules provided by the social system or any of its institutions, such as the organization.

Action systems are structured around three focal points: the individual actor, the social system and a system of cultural patterns. The interest of the action must be maintaining the balance of relations between them and the environment in which they find themselves.

From our occupational risks prevention research side, the action that is of our interest is the one that should be explained by the system consisting of a worker

whose personality is built as a result of belonging to a certain social community. This worker performs in a certain company context according to some corporate culture we still do not know. Next point will go over this in detail.

5.4 The Organization

Whether we are aware or not, the vision applied to business organizations today is a direct descendant of seventeenth century Newtonian physics. In the mechanistic paradigm, the machine metaphor and closed systems is the most appropriate figure to understand the company organization. From the systemic point of view, it is the figure of a most appropriate ethical company that will transform a physical space into symbolic that will allow the individual to own identity and it will add intelligibility to action. This company will be the citizen company.

5.5 The Citizen Company

Among the theories that understand the organization as a system, it will be the citizen company [5] model that best reconciles with our interests to understand the occupational risks prevention as opposed to the mechanistic frameworks. Therefore, it has potential to become a guide for individual action also in occupational risks prevention.

A citizen company is a type of organization that is not understood as one machine type, which goal is exclusively obtaining physical products. It is a human group that aims to satisfy the interests of all groups involved in their activity or stakeholders. This concern for all those affected by the productive activity equals to introducing the ethical question in business strategy.

A citizen company does not ignore its social and ecological environment. It is essential for its survival, and it assumes as its own responsibility to meet those demands of social and ecological nature, as well as economic, which its stakeholders make (either internal or external). This implies the assumption of the company as an economic but also social organization which incorporates economic and social balance. Consequently, it is through the theory of responsibility how we connect the company to the systemic thinking and the individual to the social system.

This addition made by companies on a voluntary basis of social and environmental concerns in their business operations and relations with its partners, is what is known as Corporate Social Responsibility. It is only a part of that larger sphere that is social ethics.

As we can see, this social responsibility represents the addition of ethical values to the company management. They will be put next to the traditional economic values of corporate management creating a certain organizational culture identity. Citizen companies are no longer conceived as moneymakers. They are now entities

owning culture. The real backbone of the company is not material but it is now symbolic: one system of sharing meanings and interpretive schemes that create and recreate meanings.

This culture guarantees decision coherence with the key values and beliefs that give identity to the organization. It generates commitment and addresses individual behavior; also in occupational risks prevention. With this symbolic space that comes with business ethics, risk prevention is extended with the psychosocial aspects that it had lost during its mechanistic phase.

6 Psychosocial Tradition in Prevention

For many years, in risks prevention, the world has been written with the same mathematical language that Galileo spoke. Now the reality that risks prevention must work with is no longer perceived mechanistically, as a mere set of elements or risk factors that can be understood in isolation and that can predict their behavior. For instance, the damage caused by the application of a set of universal laws.

We will understand reality as a number of elements or factors that interact with each other and with the environment, resulting in one dynamic and unpredictable reality that cannot be reduced to the sum of its components.

Companies can no longer be understood as indoors, suitably parcelled areas with a perfect stable environment that predicts, with the use of some mathematical calculations, its future behavior in relation to risk. Companies need to be open; they need to count with their environment in order to survive. Preventers will have to deal with uncertain environments. In many cases, it will be impossible to reduce these environments to a small set of measurable and manipulable factors.

The human being cannot be explained with merely chemical and physical criteria anymore either. Their actions will not be understood just through their personal preferences. Now, the human being builds his identity by reference to social organizations that he is part of. He addresses his actions regarding to the values available in the culture where he is integrated.

This means that occupational risks prevention will not only require, in accordance with the traditional way, that limiting rationality that natural sciences bring. Risks prevention will also have a greater scope ethical/social rationality. This is a key feature in citizen companies that have a social risk perception.

6.1 Social and Ethical Risk Perception

When we refer to social risk perception we are referring to a certain level of acceptable risk, or what is the same, certain ethical standards that should work as reference for the citizens' protection and safety. It does not originate in the objective criteria of science but in the confidence, competence, independence, legitimacy,

etc., relations that people are going to keep up with the institutions responsible for managing risk. It can also be associated with all criteria accompanying risks. Risks are so subjective: its catastrophic impact, immediate or retarded risk effects, new or existing risks, voluntary or involuntary exposition to risk, etc.

In our society today, risk has ceased to have clear boundaries and to respect borders. Prevention rationalist conservative approaches focused on limit values and conventionally stable scenarios should be expanded with an ethical responsibility vision. This will create some overall security response (governments, corporations and companies response). A part of a certain responsibility preventive culture will deal with the unpredictable.

Different theoretical approach models to this social perception of risk exist, such as the psychometric perspective, anthropologists and sociologists, cultural theory or social psychology, in general, they understand that the risks are social constructs. Our proposal in this work is the integrative perspective proposed by the psychosocial tradition. We have to understand occupational risks prevention from the broader context of social and organizational relationships in which workers' behavior takes place.

This proposal refers to a tradition that understands that the worker, business and society make some physical but also symbolic system where none of its constituent elements can be understood without referring to the other two. In the prevention and causation of accidents field, this approach will mean understanding human participation in unwanted events from the systemic idea of responsibility and reliability of the organizations and not from the mechanistic idea of individual performance and error. In short, we will understand human error as a result of certain systemic failures, and not as the cause that would explain the production of an accident by itself.

6.2 *Systemic Theories of Accidents*

If from the point of view of the rationalist tradition theories explaining the production of accidents they did from the linear rationality and strong causality, from the point of view of the psychological tradition, the accident to be analyzed from the point of view the reliability of systems. At the same time, the human factor will change its mechanical condition “of cause” by the “consequence” of a number of latent faults in the system. These systemic theories of human error, as proposed by Reason [6], warn us that human intervention, in many cases, is merely the trigger for an evil potion that for many years has been simmering.

7 Conclusions

In this paper we have tried to propose a change in perspective, from the dominant mechanistic thinking to a systemic approach in order to understand human participation in risk situations. This will not be achieved from the individual involvement that can be transformed into a source of disturbance or error, but from the responsibility that entails active participation in certain overall security response. As we see it, adopting the first option, means distorting reality to make it fit into a small number of factors that can be manipulated and controlled, including the human factor.

As we see it, if we take this approach for good, we are making the existence of unwanted events look simple and in an intentional way. We should rather face the responsibility of organizations and society itself. The mechanistic approach that reduces the production of unwanted events to the human factor, understood from the analogy of the human machine, means ignoring some broader reflection that should include organizations and society as a whole.

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