

ADDRESSING HUMAN FACTORS IN RISK MANAGEMENT IN DEVELOPING COUNTRIES: REDUCING THREATS TO CHILDREN

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Abstract

Industrial reliability is often studied from a technical perspective. Industries tend to address this issue increasing automation: advanced technology allows designing sophisticated and powerful process control systems. But, if industrial reliability leans on technical savoir-faire, it also strongly depends on human factors because human technology interaction is a key factor of reliability. This paper aims to highlight the link between technological risk and threats to children's life in developing countries. We present the relations, based on a human factors approach, between technological risks and urban dwellers' life conditions in developing countries, in order to promote both better risk management and children's life conditions. We advocate the necessity to increase field studies involving observations as well as interviews and the application and generalization of ergonomics activities analysis method, underlying that the description of human factors phenomenon is necessary to propose powerful material, organizational and social safety solutions.

1. A research program proposal

The purpose of our article is to demonstrate the need for a research program focusing on "Human factors issues in industrial risk management in developing countries". It is based on a proposal made at the UNICEF in December 2002 (Specht, 2002).

In the domain of industrial risk in developing countries, we look into industrial sites and their dangers in urban conditions as outcomes for surrounding dwellers as well as results of surrounding human conditions. On a project-specific basis, addressing human factors issues increases the likelihood of project success. Human factors issues cover the range of impacts (both positive and negative) a project may have on the human environment and vice versa. Issues are linked with reputation, international lenders project funding, obtaining and maintaining a license to operate, but else and much more essential, with sustainable development via risks management and uncertainties reducing (McLaughlin, A. J. & al., 2002). To achieve continuous improvement in safety, health and environmental performance, industries need to consider that there are two intricate sides in the industrial risk phenomenon: one is the technical reliability; its counterpart is the human reliability. Industrial reliability

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needs both technical and human achievements. Industrial reliability is often studied from a technical perspective. Industries tend to address this issue increasing automation as advanced technology allows designing sophisticated and powerful process control systems. But, if industrial reliability leans on technical savoir-faire, it also strongly depends on human factors because human interaction is indeed a key factor of reliability.

Our research in human factors phenomenon in industrial risks leads us to point out that industrial risks provide threats to children in urban settlements of developing countries. In the first part of this paper we develop this thesis on the basis of a first state of the art; in the second part we propose a method to conduct appropriate field studies; and, in the third part we present key research questions.

As we work at a better integration between modern industries and human life conditions in developing countries, linking industries and urban dwellers raises the question of traditional economy as a serious alternative model for industries development. We aim to better secure industries and, ultimately, to create a strong industrial effort to improve children's life in developing countries urban settlements. The purpose of our proposal is, indeed, to face children's life conditions in urban settlements addressing potential lack on industrial safety.

2. Linking industrial risks and children's life in developing countries urban areas

The weight of urban dwellers, the vulnerability of children

During the 20th century, the world's urban population grew more than tenfold and the average size of the 100 largest cities increased more than eightfold. The proportion of people living in urban areas grew from less than 15 per cent in 1900 to an estimated 48 percent by 2002 (Cf. Figure 1.).

Figure 1: Distribution of the world's 3 billion urban dwellers, 2000



likely to continue. It hence appears that urban growth is strongly related with industrial development, making industries and urban settlements geographically more mingled. Urban dwellers are about 80 per cent concentrated in Asia, Africa and South America. In those countries, urban growth in industrial areas usually includes threats to life, economy, society, and environment as a result of technological risk. Unfortunately, children are particularly severely afflicted. In 2002, around a billion of children live in such urban areas. In the absence of ‘good governance’ – and with the lack of investment in infrastructure, basic social services and waste management that this absence implies – an urban concentration of children encounters serious disadvantages.

Economical, Social, Environmental threatening in urban areas

Addressing human issues may, directly and indirectly, generate benefits to both industries’ projects and society. Social, economical and environmental dimensions represent the three pillars of sustainable development. Dos Pais (Dos Païs, 2002) shows that children, more vulnerable than every urban dweller, encounter social, economical and environmental threatening. Poor economical resources increase the reliance on cash incomes for essential goods and therefore a greater vulnerability to price rises or falls. Most of the population lives in illegal and dangerous situations. People are therefore more transient and exposed to natural or industrial disasters and to different ranges of occupational health and safety risks (Cf. Table 1).

Table 1: Threatening in urban vicinities

<p>1/Economical threats</p> <ul style="list-style-type: none"> · Greater reliance on cash income for food, fuel, water, housing (or land on which it can be built), building materials, transport and waste disposal, especially in the larger or more economically successful cities. Less reliance on access to natural resources for subsistence or livelihood. · Greater vulnerability to price rises or falls in income (as more necessities have to be paid for); less possibility of subsistence production or foraging to compensate. · Greater reliance on housing as an economic resource; in terms of location (poor groups often live on dangerous sites because these provide better or cheaper access to employment or income-earning opportunities); as an asset (for owners, even if ownership is uncertain); as an income earner (renting rooms, space for household enterprise). <p>2/ Social threats</p> <ul style="list-style-type: none"> · Greater reliance on illegal solutions; a higher proportion of households live on illegally occupied land, or illegal subdivisions, tapping piped water and electricity networks illegally. Consequently, they run a greater risk of eviction. · More diverse and more transient populations in many cities or particular city districts, which can weaken the basis for co-operative action, especially in areas with cheap rental accommodation. <p>3/ Environmental threats</p> <ul style="list-style-type: none"> · Greater vulnerability to ‘natural’ disasters for many urban dwellers because the only land to which they have access for housing is at high risk from floods, landslides, earthquakes, etc. · A different range of occupational health and safety risks, for example, levels of exposure to industrial chemicals and wastes, dust, dangerous machinery, excessive heat. Specific groups, such as waste-pickers, face particularly high risks.
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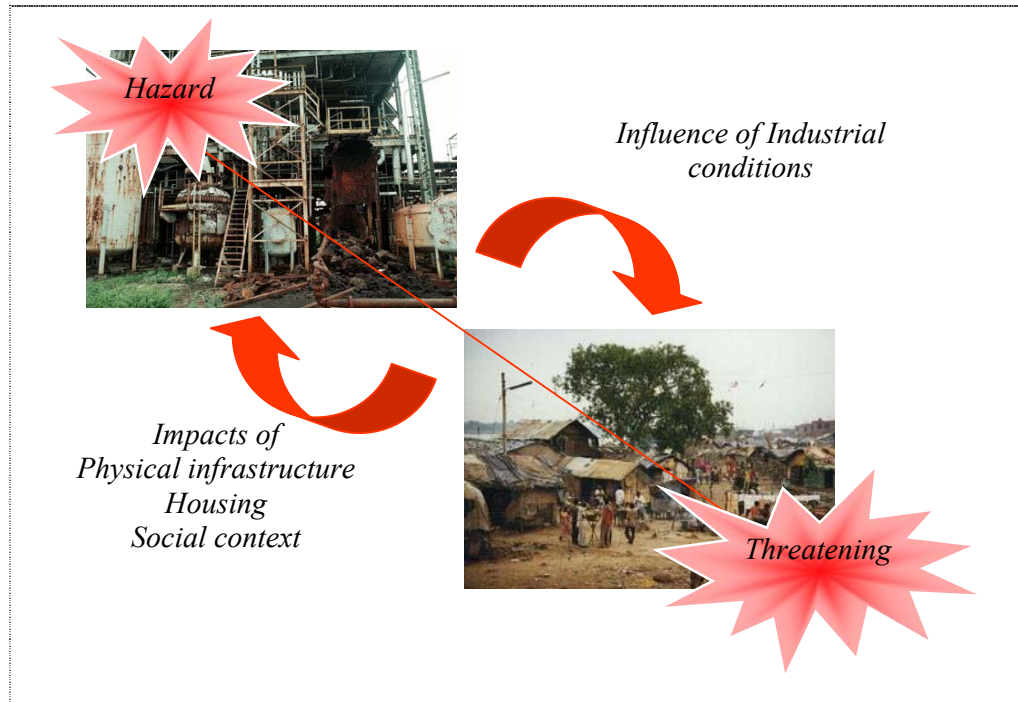
Linking industrial risks and threats to children

Our research project aims to point out industrial sites in developing countries and their dangers regarding surrounding dwellers. It focuses the link between children’s life conditions in urban settlements and industrial risks in this urban context. Industrial risks and threats to children’s life are linked in two ways. In one way, safe industrial processes might be endangered due to failed physical infrastructure, surrounding housing and social context, while, in the other way,



industries' constraints might increase threats to surrounding dwellers (Cf. Figure 2). Physical infrastructure, housing and social context might be counter to the development of best practices in industrial context and the applicability of safety procedures. Industrial context might accentuate the deprivations of physical infrastructure, housing and social context, and endanger children. Thus, children are involved in the phenomenon of risks emergence even as they are the most vulnerable to accidents and disasters.

Figure 2 : Industrial risk phenomenon in urban condition as the result of two processes



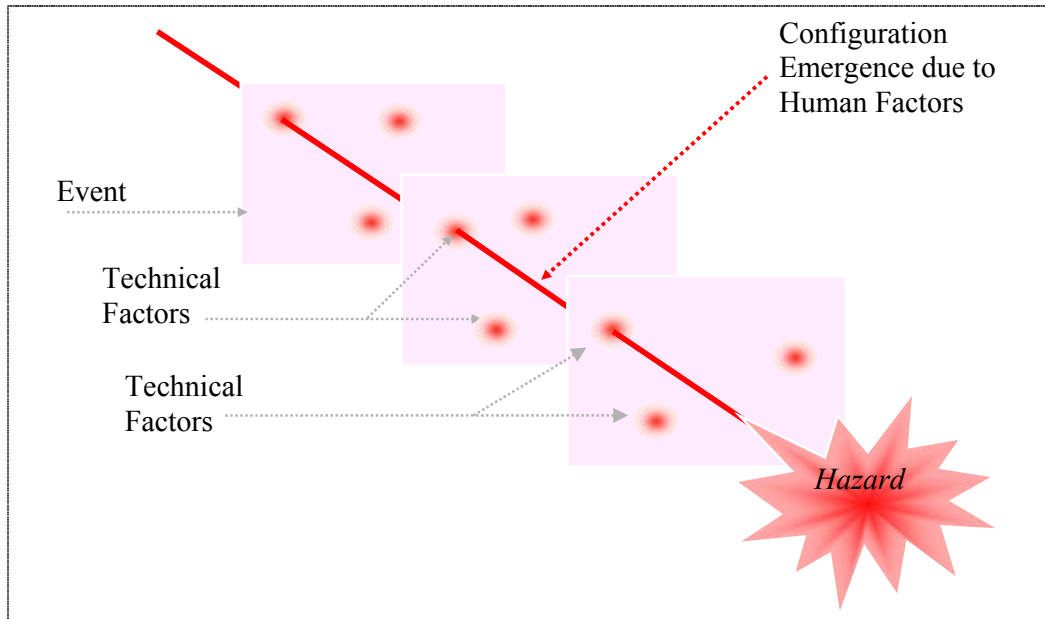
3. Providing human factors investigations in risk management

The human factors approach of industrial risks

It is established by the scientific community that 80 per cent of industrial accidents implies human factors phenomenon (Reason, 1990). Industrial risks appear in two ways. In one way, safety industrial processes might be endangered due to physical infrastructure, housing and social context, while, in the other way, industries' constraints might increase urban threats. This double link implies human factors phenomenon. However, risks, ranging from catastrophic events to injuries to workers, are usually viewed in terms of probability of occurrences and scales of potential consequences of industries malfunctions. Technical sources of risks are analyzed corresponding to infrastructures defaults, processes failures, products toxicity or criminal acts. Although, in its specific way, the human factors approach of risks, points out all activities, in terms of human interactions, which can initiate risks.

Furthermore, human interactions do not operate as automatism and mechanisms. They appear not to be ruled by physic or mathematical models. The way human interactions induce a result is the progressive building of a configuration, which comes out, regardless none unique time scale or space scale. It is only separated events, each one with its own motives, coherence, time scale and space scale, which together lead to a configuration and eventually to accidents (Cf. Figure 3). And, as it is established by the scientific community, this configuration emergence process occurs in 80 per cent of industrial accidents.

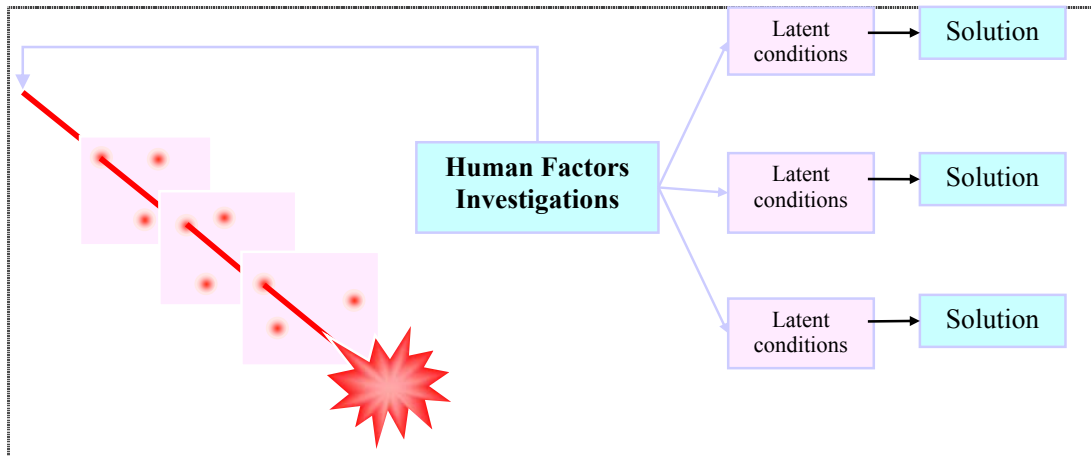
Figure 3: A configuration emergence leading to hazard



The necessity of field studies

In this article, we recommend a scientific methodology based on the application of the ergonomics activity analysis method in order to better highlight human factors processes in industrial risks. Eventually, this method aims to provide material, organizational and social safety solutions responding to these human factors processes. Indeed, field studies appear to be most powerful methods to study human factors processes leading to risks. Ergonomics activity analysis method is based upon a mix between observations and interviews. Their aim is to track human activities (as tasks, behaviors or physical and mental processes). In our case, both should involve industries and urban dwellers. They both have to be conducted respecting scientific criteria. Industrial and cognitive psychology theories, as well as sociology concepts, are essential in human factors studies. Studies analyzing human factors will hence describe latent conditions to potential emergences of dangerous configuration, in terms of human interactions (Cf. Figure 4). When there is no treatment of these latent conditions, they will lead to accidents. Thus, risks phenomenon investigations should always ultimately aim to provide solutions. Face to human interaction issues, social, organizational and material solutions shall be investigated.

Figure 4: Human factors investigations process



4. Highlighting industrial risks and threats to children: research questions

Risks for children versus risks for industries

Based on Dos Pais works (Dos Pais, 2002), we derive hypotheses of risks for children as well as risks for industries:

Risks for children and their families

- Poor housing conditions make the population particularly vulnerable to every industrial disasters and pollutions.
- Evictions and homeless behaviors might be increased enhancing social humiliations, discriminations and harassments.
- Industries might increase the general lack of sanitation.
- Children might suffer from overburdened caregivers in many ways, malnutrition, children labors or multiple hazards for examples.
- Industries might create areas where it is dangerous for children to play or where children might play with dangerous products.

Risks for industries

- Homeless behaviors might generate risk taking behaviors.
- Illiteracy and physical or mental illnesses might endanger industrial work.
- The general lack of sanitation might create a low level of sanitation exigency potentially dangerous for a secure industrial process.

Research questions and scopes of solutions

Questions arise regarding the link between industrial risks and urban dwellers in developing country. Scopes of solutions fortunately appear as well (McLaughlin, A. J. & al., 2002).

1/ How poor housing and living conditions, especially low level of sanitation and dangerous infrastructures, impact people behaviors and activities including working activities?

This intricate issue needs to be assessed as a strong potential of risks taking. In a general lack of good conditions and best practices, it is especially difficult to maintain high exigencies in risks management. Local adviser can be precious to share and support security requirements with the population. But a more powerful solution is the generalization of good standard in working conditions, in terms of employments, salaries and practices. Such a generalization will increase the widespread standard of leaving and facilitate consequently better practices. Reducing general poverty is an effective way of industrial improvements. Many of the key social issues that will eventually be addressed during a project first arise, during initial country entry or during negotiations for project development. Frequently, issues such as development of national infrastructures, employment and business opportunities are described and commitments made at these very early stages. As a result, it is important that company legal and operations staff understand the potential ramifications with risks management of agreements negotiated.

2/ How to adjust or respond to people's psychological and physical states that result from stress due to harassment, discrimination or humiliations, overload, illiteracy, physical and mental illnesses, or malnutrition?

It is particularly important to take into account the physical and mental state of employees dealing with a high risk industrial process. If during daily routines, negative states might be smoothed by the overall working organization, during incidents or emergencies the efficiency of each employee can be decisive. Employment and labor actions, recruitment, hiring, training and management of employees are a significant issue. Traditionally, human resource specialists of the operator and/or sub-contractor manage hiring and training of project workers. Depending upon the project timeline and availability of skilled and semi-skilled labors, intensive training programs can be implemented to ensure that an adequate supply of skilled workers will be



available for selected positions. These types of actions in developing countries provide an excellent opportunity for building capacity. Labor unrest may occur for a number of reasons. These may include perceived discrepancies in pay, lack of contracts, living conditions, working conditions and termination of employment. In some areas issues related to ethnic and religious issues may also contribute to this unrest. Transparent policies for hiring, managing and terminating employment may mitigate some of these issues.

3/ How to reduce the vulnerability of dwellers surrounding industries?

There are possibilities for local participation or governance through consultation and project support. But this issue must be addressed at an early stage of an industrial project. The more it is postponed the more it is likely to go worse. Public consultation and information disclosure is an important component throughout the life cycle of a project. The scope and focus of a consultation effort will vary, largely due to issues such as the education level of the general population. Participants will usually include a wide variety of individuals including Health, Safety and Environment managers, practitioners skilled in the conduct of participatory consultation process, local community contacts, and other community relations specialists.

5. Global trend in industrial risks management: a human factors project

In this paper we have highlighted the poor and marginalized life conditions of most of the children and their families in urban areas in developing countries in relation with industries development and industrial risks. It draws attention to the need of inclusive action to obtain tangible and significant progresses in improving both industrial safety and life conditions in urban settlements. It is rare to encounter industries investing in risk politics including surrounding dwellers, both workers, non – workers and especially children. It is much uncommon to face deeply involved industries in population social issues. Nevertheless, social issues are heavily responsible of industries accidents and disasters and we believe that actions shall be taken. Therefore, a human factors project shall be launched and will indeed lead to great improvements in industrial risks management in developing countries.

In highlighting industrial risks linkage with children and their family's poor life conditions in industries' urban surroundings, we seek to redress an imbalance which has often caused the limited interest of industries into human factors studies in risk assessment method. We encourage investment into ergonomics field studies which aim to describe human factors risks phenomenon in order to develop successful material, organizational and social solutions. Our purpose is to enforce industries to invest in security programs highlighting the risks they encounter, reducing threatening they are linked to and filling the gap between developing and developed country industries' policies and standards. This trend goes forward technical achievements to answer broad industries and executive staff's issues in risk management. Ultimately, addressing human factors in risk management aims to assure sustainable development along with the decline of children threatening.

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