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What Quality Management Allied to Information Can Do for Occupational Safety and Health

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http://dx.doi.org/10.5772/46103

1. Introduction

What quality management and scientific information can do for an organization will hardly depend on how it is applied in the workplace. Excellence seeking is an inherent practice to most organizations regardless its branch of activity. Loss prevention and market gains are usually presented as a justification for that. In consequence, quality management is closely linked to capital gain, and that is why enterprises apply high investments in this field. What is not explicit in this scenery is that all of this is also linked to scientific information and its correct dissemination. On the other hand, it is not a secret that market share, competitive advantage and profit are directly proportional to how informed one organization's leaders are about their business. In this context, it is pertinent to say that information is money, especially considering its high costs. It is also not a secret that information generates information. It means that the more widespread, more refined information gets, according to the spiral of knowledge that will be discussed ahead. So, the major input that can culminate in findings that may contribute for Science advancement is scientific information. However, two of several potential impediments to accessing and exploiting this vast field are resource scarceness and high costs of information access, and the scenery is the same in occupational safety and health (OSH) field. The barriers faced by OSH professionals during the information retrieval process, especially those derived from scientific experiments, generate the need for reflection on ways of promoting the intellectual capital turnover among professionals and this encourages the development of research instruments that enable the access to scientific information by the OSH community.

On this way, the Internet contributes significantly, whereas the virtual space favors fluidity, agility and possible reduction of communication noise between researchers, due to the possibility of real time communication, and that promotes the knowledge growing and also

the improvement of security practices in the workplace. The significant increase in the volume of publications disseminated in the Internet without any criteria of quality and reliability of data is the result of the internet popularization, which contributed to the appearance of barriers in the selection of relevance information, and in certification of the legitimacy of presented data, particularly in OSH, in which information is scarce in relation to other areas of human knowledge.

An alternative to minimize the impacts caused by noise in information flowing is the creation of specialized virtual environments, called open archives (OA), which enable direction of the information to a target audience, promote break of bureaucratic practices in processes of documents publishing, provide interoperability between systems and communication in the scientific community besides promoting multidimensional ways of accessing studies made available by such routes.

Therein, the utilization of digital repositories of information under the philosophy of information spreading applied to the open archives initiative may be considered as an alternative to promote the intellectual capital turning as well as scientific communication among researchers. The initiative in question is presented as a strategy to support management of health and safety at work, together with quality management tools PDCA and 5S.

2. Knowledge management and scientific information in occupational safety and health

Among the barriers to information access it is important to highlight the linguistic obstacles that may difficult or even make inaccessible the consult to relevant studies, generally published in expressive international journals. These factors justify the promotion of technical and scientific exchange in order to form a professional experiences exchange network, that may assist OSH professionals in achieving satisfactory results on reversing the current degrading situation of working conditions, that are still found in several branches of professional acting.

Information is crucial to the effectiveness of OSH management system, however, in many situations, the information necessary for effective interventions are not available, restricted, for example, by temporal contingency. [...] The evaluation of the OSH management system is a systematic examination of its functionality and effectiveness in order to produce consistent information that may assist in decision making processes for the conception of new strategies to promote the improvement of OSH performance [1].

Engineering, Medicine, Law. All of these and the other fields of human knowledge exist because of information. It is also true that professional acting in any area offer occupational hazards to workers. Some more intense, some less so, but the fact is that occupational safety and health must be the basis of any professional activity, be at the office, or in heavy industry, so that the worker physical and mental integrity is always preserved.

Basically, two kind of information concern to OSH: prevention to accidents and occupational diseases and rehabilitation of occupationally sick or injured workers. The first one has proactive characteristics, while the second one seems to be reactive. An active posture allows the company to preview and prevent negative events, like an occupational accident, for example, and by means of this, save money or decrease spending, considering the expenses that the organization may no longer employ in professional rehabilitation. This means that the costs used in the prevention of occupational accidents and diseases should be treated as investments rather than as expenses.

Once the organization have identified the risks and opportunities in a pro-active way, the manager enables the tools to prevent or mitigate risks, maximize opportunities and reduce or eradicate harmful events to the employee and to the organization as a whole in consequence.

The burden of adopting a reactive posture is to expose the company to a totally vulnerable situation, in which it may not have enough time to any reaction in an emergency situation, staying at the mercy of events.

Scientific and technical activities are the fountain from where flow technical and scientific knowledge that will be transformed, after registered, into technical and scientific information. But, on reverse, these activities only exist, and become real against this information. Information is the Science sap. Without information, Science can not develop and live. Without information research would be useless and there would not be the knowledge [2].

Manage means to carry on business affairs, finance and human resources administration, what also implies to watch out for occupational health and safety. The purpose is common to all: to lead a particular activity or a group of them, to the achievement of one or more targets, which may vary according to the organization goals. Therefore, a range of compliances should be reached, and in case it does not occur, losses certainly will come, in most situations, with dimensions and impacts may vary from case to case. These factors highlight the importance of management and know-how to take advantage of all available resources, always keeping in mind the organization goals to perform tasks with the best coefficient of cost-effectiveness relationship. Management has the function to "build organization that work" [3], and to work, all sectors must maintain a synergy, so, one single action has the strength to move a whole, like a set of gears. By the way, this is the recipe of success which is unknown by so many companies. It is important that workers feel important to the organization and that their work has a real value to the company. As a returning, the worker would receive determination, and motivation, not only merely driven by obligation or interest (or duty) of economic nature. He will feel pleasure to work.

In the industry, machines and equipments receive a special treatment, with periodic reviews and replacement of components. The same way, the employee also requires some care from the organization, like the workplace adjustment and maintenance, for example. After all, the worker is the one who holds the most valuable asset of the organizations: the intellectual

capital. The employee is the "keeper and guardian" of the organizational wealth, which is the knowledge. So, the same way a machine demands periodic reviews, small (or not so small) repairs, and even "vacations", the worker demands satisfactory work conditions as well, so it will be made the most of his potential efficiency. Psychological sphere certainly is very important in an occupational safety and health management plan. Considering that most part of the day of an employee is spent in his professional activities, the manager should also value the maintenance of a healthy work environment, both in physical and mental aspects. Many practices may be adopted in this sense: a good interpersonal relationship, relaxation techniques, profits sharing, regular meetings with the teamwork to identify their needs, and also the encouragement of reading and sports practicing are some valid measures for achieving a healthy work environment.

The adoption of such measures, linked do scientific communication may assist OSH professionals in developing management tools that support the employee in a large-scale way, providing better working conditions and health, both physically and mentally. In this case, information has the role to complement the knowledge of professionals who are responsible for zealous for workers' health and safety, besides giving wide publicity to the good practices adopted in this regard. Trainings, technical visits, lectures, simulations and other forms of professional improvement are also widely successfully applied. Added to appropriate information flowing, and also the valorization and respect for the worker, which may be made visible even in supplying adequate individual and collective protection equipments, the workplace may become a place that provides pleasant and well-being that may also contribute to occupational accidents and diseases prevention.

Occupational accidents, as well as any other accidents are unwanted events, unforeseen and which are generally accompanied by physical and / or material damages. Avoiding accidents and occupational diseases is the major concern of OSH professionals, and also a duty for any citizen. Appearing of occupational diseases, due to noise, high temperatures, radiation, exposure to chemical substances, and so on, is one of the greatest concern to hygienists [4]. An effective prevention program results in declining of occupational accidents and diseases rates and also declining of repair and consequence(s) of a possible accident [5].

This way, information sharing is crucial. A seemingly routine situation for one organization may be considered a risk task for one company which may already have had the unpleasant experience of an occupational accident as a result of that activity. Information like this should be as most widespread as possible (even though the company's name is preserved) to prevent other similar accidents from happening in other plants, or other organizations. However, the fear of intellectual overcoming, the organizational culture or even the fear of exposing thoughts to academic criticism sometimes keep the OSH professionals from starting an occupational hazards prevention discussion with other professionals.

Generating wealth and improvements from intangible assets is precisely the task of knowledge management, which is defined as a "new way of working, a new organizational culture, in which the environment and values allow to generate the necessary motivation for

learning, sharing or transfer and application of knowledge [6]." In proportion to the knowledge becomes an essential and strategic asset, organizational success depends more and more on increasing the company's ability to produce, gather, store and disseminating knowledge [7]. Thus, it falls to the company to promote knowledge sharing among the work team, and consequently the intellectual capital turning within the limits of their own plant. This point by itself is already a plausible justification for building an institutional repository of scientific information. Managing knowledge in organizations is to provide conditions for this knowledge to be constantly produced, codified and shared across the enterprise. Facilitate the interactive knowledge flowing in the organization, adding value to information and distributing them correspond to the role of knowledge management, transforming knowledge into competitive advantage [8].

However, for knowledge to be effectively converted into competitive advantage, it must be subject to application and transmission in the company. This conversion takes place through the transformation of tacit knowledge into explicit knowledge and tacit knowledge again and so successively until the results are tangible enough to satisfy, or preferably exceed the organization needs and expectations.

Tacit knowledge is acquired individually by each person, through courses, readings, lectures, or even the professional experience. The access to this knowledge depends on some factors, including the potential ability of explanation of the person who holds it. Another factor is the "ways of doing things": each person develops their own way of working, aiming to make it easier and more comfortable. However, such procedures and techniques generally are not found in books, journals, films, or any other type of informational support, because this kind of knowledge only can be acquired through professional practice and experience.

On the other hand, explicit knowledge is available everywhere, to whom it may concern. So, explicit knowledge is more perceptible than tacit knowledge in an organizational environment. That is the case of books, journals, newspapers, magazines and so on. Explicit knowledge is what one can transmit in a formal and systematic language. It is the knowledge that can be registered in books, guides, or be transmitted by electronic mail or hardcopy [9]. In fact, information in general corresponds to explicit knowledge. Implicit knowledge is a more recent knowledge that serves to describe a knowledge that, though it has not been documented, it is likely to be. It is the knowledge one keeps, and is able of transmitting be in a more or less assisted way. Indeed this is the knowledge that can be made explicit, but has not been yet. For example: the way between one's home and his workplace is registered anywhere, but this person can draw a map or explain someone how to get there. This knowledge is implicit: it is not registered, but it can be, if there is one's will to do so. On counterpart, tacit knowledge the one that everyone keep, and have no conscience of that. It is personal, acquired through practice, experience, mistakes and successes, it is difficult to be formulated and transmitted in a formal way. A cake recipe (explicit knowledge), for example, can generate totally different results, depending on the experience and sensibility of the person who makes it. That happens because of the act of making a cake also involves a tacit knowledge, which is personal.

The conversion of tacit knowledge into explicit and vice versa, as in a cycle, promotes besides the human capital circulation and socialization, also the opportunity of renewal, acquisition of new knowledge, and promotes the improvement of the whole set of information already gathered. This information exchange cycle provides an intellectual capital spin, which encourage the socialization of generated knowledge, as well as the investigation and the reflection towards new knowledge creation [10]. The authors propose a model of knowledge conversion, what became known as knowledge spiral.
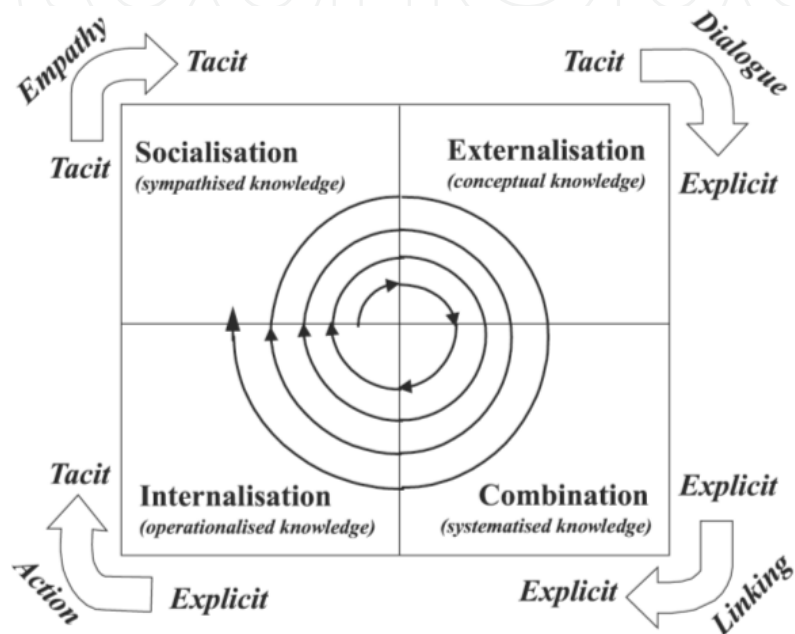

Figure 1. The knowledge spiral [10]

According to the model proposed by the authors, the process of acquiring knowledge passes through four stages:

- Socialization (tacit knowledge to tacit knowledge):

Observation and also the practice are ways of transmitting knowledge through socialization. In this process, there is much experience exchange, what is the big shot to knowledge acquisition. Trainings, brainstorming, and even one's own professional experience can be mentioned as examples of knowledge socialization.

- Externalization (tacit knowledge to explicit knowledge):

Externalization is the highest point of knowledge transmission. It is when occurs the encoding of tacit knowledge into explicit knowledge, so that other professionals can use such information, and convert them back into tacit knowledge. One of the tacit knowledge characteristics is precisely the verbalization high difficult degree. Scientific papers publicizing is a way to facilitate the transmission of this kind of knowledge.

Combination (explicit knowledge to explicit knowledge):

New ideas, new question and projects are designed in this stage. Explicit knowledge is confronted with another explicit knowledge. The result of that is the development of new information. Combination is very present in meetings, discussions, be in person, or by Internet, phone call, or even during a report, or even any other document reading.

- Internalization (explicit knowledge to tacit knowledge):

The conversion of explicit knowledge again into tacit knowledge occurs during internalization process. This is when acquired information is absorbed and right after, converted into knowledge.

Each time the cycle is completed, it should be restarted. Each restart is a higher degree of information complexity, specificity and consistency. Scope is also amplified as well, and may start with a single person and after expand across boundary of people, departments, sectors, units and companies. And information gets more and more improved and specific, until its holder becomes an expert in such question. To enable creation of organizational knowledge, tacit knowledge accumulated needs to be socialized with other members of the organization, and that gets another spiral of knowledge started again, as in a cycle with no end [8].

knowledge creation is divided in five main phases:

- The sharing of tacit knowledge;
- The creation of concepts;
- The justification of the concepts;
- The construction of an archetype and;
- The spread of interactive knowledge [10].

At the phase of tacit knowledge sharing, occurs the socialization, when information is shared through out the company. The creation of concepts corresponds to the phase in which there is conversion of tacit knowledge into explicit knowledge, as a new concept (externalization). In the third phase, justification of the concepts, the company evaluates and decides whether the new concept proceeds or not, and if there is continuity, archetypes are constructed and may generate new prototypes of products services and so on. The last phase, which corresponds to the interactive dissemination of knowledge, is responsible for systematic sharing of applicable information, in extra organizational sphere. This phase is extremely important for OSH management once this field of study focus is to promote welfare and protect worker's physical and mental integrity, while performing their work tasks. The capital gain and the competitive advantage originated from this process, although are both desired and very well seen, are consequences of the knowledge spiral cycle completion. The interaction of one company not only with the other ones, but also with the academic community, may bring great benefits in the sense of human capital acquiring, whereas active professionals in the labor market not always have the opportunity to research and publish new knowledge. So, the scientific community which traditionally carries out this task has much to contribute to the dissemination of research results, and by consequence, to the OSH management inside the companies, reaching, this way, until the shop floor, which can be considered the apple of OSH's eyes.

Any shop floor workers' tacit and explicit knowledge that the company makes use is very healthy to the organization as a whole. Even though experts develop great theories, the more accurate knowledge is held by the employee, which is the one who knows each single part of the processes in depth. As time passes by, working activity becomes an automatic process for a person, due to one's high intimacy level with the activity in question, and this relationship creates bonds that only the familiarity and the professional practice can establish. The "best and more efficient way of doing things" only can be indicated by someone who realizes it frequently.

Facing this, the interaction between the company and the employee is indispensable for the organizational learning to put foward tangible and satisfactory results, though it is also required the employee engagement, in order to be open to new experiences, new information and so on.

Relations with other organizations in the ambit of OSH can increase the spin of the spiral of knowledge, what can bring benefits for all involved in this process, because in contradiction to mathematical laws, knowledge gets multiplied when shared, and may become applicable to other areas like management risk, for example. Once there is a failure that may lead to an occupational accident, it is not enough only to fix it, but it is also necessary to warn the whole working team about the occurrence, for it not to be recurrence, avoiding any occupational accident, regardless its proportions. From the moment that there is the transmission of this kind of information, it becomes part of the knowledge of each single person of the working team, and that makes the likelihood of repeating the same incidence decrease. Through knowledge, companies become more effective and efficient in the use of their scarce resources. On the other hand, without knowledge they become less efficient and effective using resources, and fail, at last [7].

One of the factors that may contribute to accident preventions in an industrial plant is adopting a good quality management system. In contrast, quality is not put in practice without access to information. The efficiency is nothing more than the top of a set of information, arising very often from unwanted incidents, which are responsible for the generation of lessons learned, applied to a specific process, providing satisfactory results in order to improve products and processes. Considering these points it is interesting to stimulate investments in quality management and knowledge management, which is responsible for bringing up the tacit knowledge and experience of the workers, who usually hide valuable data for management in general. This fusion, in fact can bring great benefits to the organization in its various aspects.

3. The benefits of the fusion between quality management tools and knowledge management

A quality management tool is a methodology to improve processes using as less financial resources as possible, optimizing the working processes, increasing production, and also profit, by rational use of space, time and material and human resources.

Quality management tools are widely applied in organizational processes, and generally provide positive results. After all, quality is a crucial factor for optimization of processes, resources using, and the entire operation of an organization. The knowledge management benefits may be enhanced through the use of the resources suggested by instruments of quality management.

3.1. Organizational knowledge management and PDCA cycle

Organizational learning is a prerequisite for an organization existence. Or it is an organization that learns, or it will be condemned to failure soon. Considering the specificity of OSH field, the professional responsibility of monitoring the evolution in the industry becomes even greater and must be observed by each one involved in this knowledge area. However, for a company to learn it is necessary its employees learn first. In this sense, it is interesting to create policies to incentive the human capital acquisition aiming the organizational growth and improvement of processes in a larger sphere. The policy to stimulate education and multiply knowledge is important for the organization and in most cases, spending on research and development are usually recovered at short term, through improvements achieved by this process. This justifies high investments that developed countries apply in research development. So, a permanent cycle of knowledge acquirement provides to the organization the potential to achieve better results, exceeding expectations and achieving goals. The tasks improvement and staff expertise are merely consequences in this scenery.

One of the tools applied in this sense is the PDCA cycle, defined as method of managing for processes or systems. That's the way of achieving the goals assigned to the products or enterprise systems [11]. The word goal is the result of a junction between meta + *hodos*, that means a path to the goal. Thus, it is possible to affirm that the PDCA cycle is a way to achieve a goal [11, 12].

As the organization itself, all knowledge in any field of knowledge is like a living organism, constantly in change. Advances in Science and technology has created an scenery in which there is a need to create new ways of doing work, new strategies, new work tools and/or adapt existing ones to the new reality imposed by XXI Century. Each one of these items should function orderly among themselves, like a gear. So, all the processes of the larger organism, the organization as a whole, are able to flow correctly. Therefore, it is necessary to domain of some essential data for the proper functioning of this system. These data are often not found in books, or in the scientific literature, but in each employee's own experience, the tacit knowledge. In this sense, knowledge management assumes the role of contributing for each employee's intellectual qualifications to be always aligned to the mission and vision of the company which must include the promotion of safe work, and therefore, the occupational accident prevention.

Dissociating theory from practice is impossible, whatever is the activity about to be developed. Theory, due to hard studies, is the main responsible for the facilities and conveniences that can be observed specially on factory floor, as the machine protection and

tasks automation, for example. Therefore, as business management, management in OSH knowledge should also be part of a continuous improvement process, like PDCA.

Conceived by Walter A. Shewhart in the 1930s at Bell Laboratories in the United States [12] and applied two decades later by the quality expert W. Edwards Deming (that's why PDCA cycle is also known as Deming Cycle) in statistics and sampling methods using, the PDCA method is recognized as a process of improvement and controlling that should be familiar to the employees of an organization to be effective [13, 14] CENTRO DE TECNOLOGIA DE EDIFICAÇÕES, 1994). Basically the PDCA cycle can be defined as

A method that aims to control and achieve effective and reliable results in the activities of an organization. It is an efficient way to provide processes improvement. It standardizes quality control information, avoids logical errors in its analysis and makes information easier to understand. It also may be used to facilitate the transition to a management style directed to continuous improvement [15].

The procedure proposed by PDCA implies constant evaluation of the entire system, enabling the early detection of possible failures or improvement points. This ideology makes necessary to conduct detailed audits at all stages of work. Each time the proposed cycle (plan, do, check and act) is completed, occurs the continuous improvement and then, improvement of knowledge of those involved with the activity in question, by consequence. In fact, the PDCA cycle is a total quality management method, which may (and should) also include the prevention of occupational accidents and diseases.

Whereas the world is constantly evolving, even activities performed satisfactorily are subject to improvements that must be pursued as incessant searching process for an unreachable perfection. That is called continuous improvement. Whenever it does not occur, the consequences are certain: occupational accidents are potentialized along with their indices of severity, losses and damages.
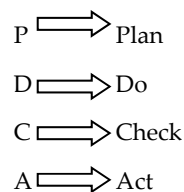
Occupational accidents do not happen by chance. They are just a materialization of a sequence of failures, whether human or not (although machine or mechanical failures also can occur due to human errors) which in most cases could have been avoided.

It is common for us to accept as true when the newspaper disclose, even before the experts report conclusion, that the origin of a fire was a short circuit in electrical installations. It is such an often cause, which examples are innumerable, that not even is necessary to wait a long time for the confirmation that was foreseen by journalists from interviewing experts and testimonials of the users of the hit building. […] What is not always demonstrated for the population is that the referred short circuit was not a surprise occasioned by an uncontrollable phenomenon, but the last breath of an installation that was agonizing. Fires, originated by electrical causes start, general rule, in overloaded circuits, without proper protection and maintenance, and handled by curious laymen covered up by "economic professionals" that seek by "the lowest price" the technical solutions for problems that should have been the cause for specialized diagnosis [16].

Failures, that not always culminate in accidents, but in near-misses, may be product of several factors, among which the lack (or insufficiency) of safety audits and knowledge domain by operators responsible for the activity that has any kind of inconsistency. The set of failures, combined with temporal factors may culminate in industrial accidents. Therefore, improvement must always be pursued by the organization, regardless its maturity level or any other factor.

The cycle proposed by PDCA requires constant evaluation of the whole system, in order to detect any possible failure, in anticipation of the occurrence of inconvenient and undesirable situations. Under this ideology, it is made necessary to conduct accurate audits at each single stage of the work. So, it will always be found new (and better) ways of doing the same things in a more efficient and safety way. Following the cycle Plan, Do, Check and Act (PDCA) is a way of promoting continuous improvement and thus, improves also the knowledge of everyone involved with the activity in question. Moreover, PDCA cycle is a method of total quality management, what also includes occupational safety and health management.

So, PDCA cycle is basically composed by four phases [12]:

P $\Longrightarrow$ Plan

D $\Longrightarrow$ Do

C $\Longrightarrow$ Check

A $\Longrightarrow$ Act

PDCA – P: Plan

The planning phase comprises the step in which all activities are outlined having the company's mission and vision as a point guide, besides other documents that may concern, like standards for example. Planning should point all the parameters of the activity, how it should be executed, financial, material and human needed resources, deadlines and all the information about the characteristics of the planned action, as in a project itself.

It is also in planning phase that are often identified needs hidden by the routine or even by convenience. Goals and methods of reaching them are all defined in this phase. Basically planning phase consists on the development and delineation of the project scope itself. That is why this is the proper moment to identify organizational weaknesses and strengths and develop strategies to convert weaknesses into strengths and strengths into points of excellence.

PDCA – D: Do

To do is to put into practice all that was planned in planning phase (P). It is like preparing a cake (do phase) following the instructions of a recipe (planning phase). This is the moment for training and educating employees, besides implementing all practices according to the project scope. Simultaneously, it can be a pre-audit, when positive and negative points of

the plan should be identified and registered as a way of ensuring that all objectives previously established will be achieved in its fullness. This information also will be useful during the phase of checking the implemented actions.

PDCA – C: Check

Checking is the phase which most involves indicators and performance metrics, and comprises the comparison between planned and achieved results. Audits, processes analysis, evaluations, and satisfaction surveys are very common at this stage of the PDCA cycle. No inconsistency founded means the satisfactory following of the cycle. Otherwise, it is time to start the next phase: Act.

PDCA – A: Act

If the results are as expected, nothing should be done until the moment that any inconsistency is detected, when it is necessary to perform corrective measures to bring the project back to the scope initially established. However, besides implementing corrective actions, acting phase also may be in order to standardize processes that worked well, as a manner of registering information that can be used as stepping stone in similar situations. This phase corresponds to the PDCA cycle completion.
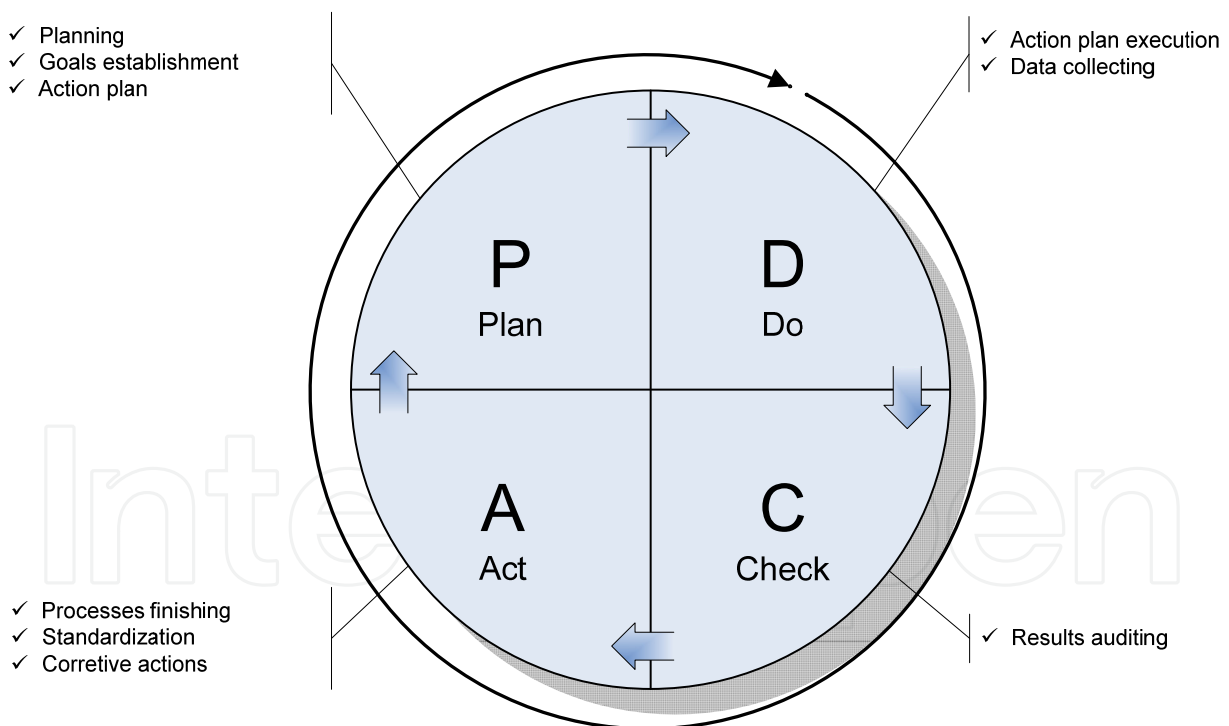

Figure 2. The PDCA cycle [12]

Once all those phases are concluded, PDCA has completed its cycle, which must rotate clockwise, following the sequence of the proposed activities. The most the cycle is completed, the greater the knowledge accumulated by the whole teamwork, in the same way that the rates of quality also will tend to be increasingly towards to excellence.

PDCA cycle is designed to be a dynamic model. The completion of a cycle will flow back in the beginning of the next cycle, and so on. Followed by the spirit of continuous quality improvement, the whole process can always be reviewed and a new process of change can be started [12].

The optimization of processes, reached through the PDCA cycle, promotes a reduction in costs and increasing productivity, what means creating new products, with less use of resources, which yields competitive, once production becomes higher than the competitors'. Likewise, the rate of complexity of information is growing each time the PDCA is fully completed. Each time the process is completed, the involved processes presents indices of improvements, which are represented by the numbers 1, 2, 3 and 4, according to figure 3. The closer to the top of the ramp are the improved processes, the better will be the indexes of maturity of the organization. Andrade (2003) points out that the lessons learned in a PDCA cycle application can be used in a second, third, fourth application (…) that can be more complex and daring, and so on.
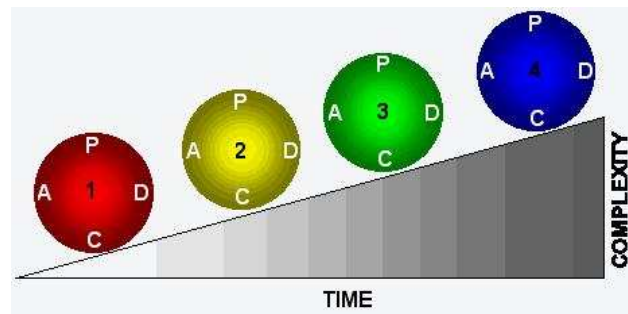

Figure 3. The improvement ramp [17]

The roll of information gathered can be a valuable instrument for the OSH management community, for the moment it is made available for public consultation as a data source of best practices, it may help managers to think globally and act locally. This way, the healthy and safe workplace will not just consolidate into one organization, but in all Brazilian industrial fabric.

There are several instruments for improving the quality of products and processes within an organization. Another instrument that can also be used together with PDCA to optimize the quality of work live is 5S.

3.2. Quality management according to the 5S process

Designed in Japan in 1950 by Kaoru Ishikawa [18], 5S is a method of quality management which aimed to delineate efficient and effective techniques to reach costs reduction, optimization of material, technological and human resources, and also combat waste [19]. It is an educational process, which is often applied as a basis for other management instruments.

The 5S program is a philosophy of work that aims to promote the discipline in the company through awareness and responsibility all to become the workplace a pleasing, safe and productive place.

The Program was named after five Japanese words that synthesize the five steps of the program. They are: Seiri, Seiton, Seisso, Seiketsu, Shitsuke [20].

The goals are to transform the environment of organization and the attitude of people, improving the quality of life of employees, and also reduce costs, waste and raise institutional productivity [18].

The 5S method may imply the improvement of other functions, not directly related in this process, such as production (acquisition of new equipments and adoption of new processes and systems), quality (standards application), human resources (adoption of new organizational policies), as well as hygiene, safety and environment (changes in management process, audits). For this reason, as well as any other innovation within a company, the implementation of 5S requires a detailed analysis on the budget funds to certify that financial aspects will not be an obstacle for the complete implementation of this instrument.

Another point to focus on is the possibility to be applied simultaneously to other quality management tools, such as the Kaizen method of continuous improvement, safety, environment and quality management tools (NBR ISO 9001, NBR ISO 14001 and OHSAS 18001), Six Sigma, as well as PDCA Cycle itself. It demonstrates that 5S method is an extremely flexible tool that can be combined to other management instruments, what potentizes the results that can be reached by this method.

So, 5S acts in three organizational aspects, which are divided into 5 phases: physical aspects (Seiri, Seiton, Seiso), standardization aspects (Seiketsu) and behavioral aspects (Shitsuke). Each one of the five phases of the method is represented by a sense as follows [21]:

3.2.1. Sense of use and disposal (Seiri)

The sense of use and disposal awakens the workers consciousness to keep in the workplace only what is really necessary for the development of their functions. This provides to the worker a clearer, more accessible and easier to clean workplace, and increase visibility to the material actually used. Furthermore, this practice promotes the evacuation of areas previously occupied by unnecessary materials. Thus there may be an increase in productivity, reduction on bureaucracy processes, and prevention of unnecessary purchases.

The methods applied for materials disposal can be diverse: once separated all the unnecessary material, this can be transferred to other sectors, or returned to the warehouse, sold or donated for recycling entities, or even be disposed as trash, that also should be classified as common or toxic.

3.2.2. Sense of ordering and arrangement (seiton)

For each material, its proper place. The ordering sense recommends that once separated all the useless material, the remaining should be sorted in the workplace, preferably in the

closest place to where its use is more frequent, location to which it should be returned as soon as it is not being used anymore. This provides benefits, for example the rationalization of the space designated to material storage, the encouragement of creativity, quickness, and facility in finding documents and objects. This reduces physical efforts and emotional distress in searching for not founded objects, besides preventing occupational accidents that possibly may be caused by a disordered workplace.

3.2.3. Cleaning sense (seisso)

Machine, equipment and any work tool including the workplace itself, must be kept clean and organized. The duty of maintaining hygiene in the workplace is not the sole responsibility of the cleaning crew, but also an obligation of each one of the employees. Cleaning makes the environment becomes more pleasant, and transmits the image of excellence in organization's products. And again, a cleaning workplace is less susceptible to the occurrences of occupational accidents, for example, a fall caused by a slipping way.

3.2.4. Sense of health and hygiene (seiketsu)

Personal hygiene is also essential as well as mental health and life quality in general. The good maintenance of employee's health is like an organizational intangible asset, as a prerequisite for the execution of any task in the company. However, this sense requires an holistic view that permits the manager to extend the meaning of health and hygiene also for the issue of OSS. The ergonomic adequacy of the workplace, the adoption of relaxation techniques, and even the aesthetic and disposal of the workplace are factors that must be considered in this way. As results, it can be achieved higher levels of team motivation, facilities in human relationships, dissemination of the positive image of the sector and also its employees, favorable working conditions to health, and also the occupational accidents and diseases prevention.

3.2.5. Sense of self-discipline (shitsuke)

The last and most individual sense is the sense of self-discipline. This corresponds to the regulator sense, which creates in a company's workers the awareness for the accomplishment of the four previous senses. This provides a natural implementation of all recommendations, the discipline, the moral and ethics, the cultivation of good habits, the promotion of participative management and also the ensuring of the quality of life at work.

The 5S program implementation may provide more efficiency and safety at workplace. The disorganization and lack of asepsis may be considered factors that may culminate in occupational accidents and diseases. The waste generates financial losses. The sense of using and ordering allow a better use of space, and finally, self-discipline, as the name suggests, promotes the discipline among the employees toward a policy of awareness in the use of the company resources. And what is more interesting in this process is that its cost of implementation is considered relatively low.

In fact, 5S may be integrant part of PDCA cycle. Both focus on quality management: 5S, aims to improve the quality of the processes and workplaces, while PDCA focus on strategical and managerial issues, although there is no restrictions for PDCA to cover some areas of 5S.

Both PDCA and 5S are quality management tools which may provide great benefits to an organization. It is also pertinent to point that, the implementation and management of both tools can be much more complex than it seems in this discussion. However, it is also important to consider that discussing these tools in a deeper point of view is not the primary objective of this discussion. These quality management tools were chosen and mentioned because they were considered useful in the sense of promoting the generation of information that may be applied in other workplaces or even other enterprises, through the association with a system of scientific information sharing among all of them. The management of safety and health at work can also be considered a quality management process, once it cares about quality of life at work, quality of safety processes, quality in the workplace, and so on. That does justify the association between quality management and OSH.

4. The fusion between cycle PDCA + 5S = Organizational benefits?

Increasing the quality and productivity while promoting quality of life, simultaneously with competitiveness: that is the great challenge of the manager / entrepreneur of the XXI Century. Whatever are the tools used to improve the quality of the work process within industries, there will be tangible benefits for OSH management.

An OSH quality management process may improve the systems applied in the worker safety and health:

As the organization adopts the audit protocol over time, it has the opportunity to experience the evolution of the performance of the OSH management system as well as the opportunities for improvement.

As it knows the opportunities of improvement, it becomes possible to develop an action plan focused on more expressive and efficient results, continuously improving the performance of the OSH management system [22].

Whatever are the instruments used to improve the quality of the work process within the industries, there will be tangible benefits to the OSH management. Equally, information systems also have their importance in this issue, since they are responsible for storage and make available case studies, which may be useful in identifying diverse points susceptible to improvements in organizational processes as a whole. Case studies, in particular, play a fundamental role in order to disseminate best practices applied by one organization, so other organizations also may be inspired in these cases to promote process improvement and quality of life at the workplace. Nevertheless, they have the potential to get the OSH professionals together, and promote the ongoing discussion about emerging issues in order to promote the prevention of occupational accidents and diseases.

The knowledge is available, the techniques, methods and tools exist and their use has proven results. At the same time, those who study the accident issue in a deeper way probably concluded that the best results only can be obtained from the holistic vision, both of the issue, and specially of the man. Innovating is a need! Dare to actually move toward a more efficient accident prevention which, at last, means to save lives, suffering, reduce costs, increase quality and productivity [23].

Information systems also have their importance in this regard, once several case studies are deposited and published there. These papers are valid to assist in identifying issues for the further improvements in organizational processes as a whole. Information management also is associated to knowledge to management quality [24].

In times when the quality, competitiveness and transparency are considered on determining an organization market share, there is too much to be explored about knowledge management inside the organizations, once explicit knowledge represents a very small portion of what the organization knowledge worth actually. It is also important to invest in capital for the intellectual training of employees in managing occupational safety and health at work. The worker is the most value asset of any organization because it is him who holds the most needed resource to maintain the business "health and force": the human knowledge.

Information, quality, organizational management, OSH, financial returns. Isolated, each one has its particularity, but applied together, these instruments converge to the establishment of organizational improvement programs, which benefit not only the client, but mainly the worker, who is responsible for the final product existence. The value of a worker for an organization is incalculable. Each time a life is lost, it is not only a worker who is not part of the staff of an organization anymore, but also a member of society, whom keeps a range of knowledge, which may still have not been disseminated. In this case, besides the worker, the organization loses a valuable intangible asset: the knowledge.

Effectiveness and efficiency of organizational improvement are linked to innovation to the method applied to available information sources and to the speed and flexibility which they apply, in addition to personal motivation, leadership practiced by the direction of the organization, and the relationship between the organization and stakeholders [25]. That justifies the importance of disseminating knowledge at most. The proposal is that the OSH and knowledge management are convergent in order to ensure that the quality management as a whole, not just the final product, may present strengths to provide better working conditions for workers, being subsidized by the provision of technical-scientific data from both tacit knowledge, and other professionals experience.

The availability and use of scientific information in an organization environment are fundamental to the process natural and safe flowing. And this safety may be built jointly by several professionals, through scientific dialogue, exchange of experiences and joint reflection. Accidents will always happen but if at least one live is saved by something that has been read somewhere, every effort will have been valid [26].

The principle proposed by Maguire seals the proposed link between scientific information and OSH management, and emphasizes the need to reflect on the creation of tools that enable scientific exchange among peers. The Open Archives Initiative (OAI) philosophy adds up this cause, in making available as much information as possible, specially the gray literature (thesis and dissertations, reports and other documents) which usually hold the results of observations, experiments and empirical reflections that may contribute to the OSH management.

5. The Internet as a source of data in occupational safety and health

Among the many emerging communication forms, the one which excels at terms of enabling the information transferring is the Internet, which is defined as a set of academic, scientific, commercial, and military interconnected networks, which communicate with each other through the use of a common protocol Transmission Control Protocol / Internet Protocol (TCP/IP) [27]. The authors highlight the facilities offered by the Internet to the scientific community like its globalization power, the immediacy of production, release, update and access to published information, the hypermedia capability (hypertext and multimedia), that makes it easy to search and access information as well as the volume of data gathered at relatively low cost, in addition to the possibility of interconnecting users, to eliminate barriers in the geographical, temporal, political, social spheres among other barriers to information transferring.

From the moment information has its value recognized, in the sense of being able to aggregate power to its holders, it became essential to generate resources to facilitate the information flowing among scientific community. The Internet has emerged in this scenery as a tool to add value for produced work, and increase visibility not only for presented results, but also to their respective authors and institutions. The creation of research groups besides the facilities offered by the virtual space, such as discussion groups and even electronic mail, narrowed the relations and facilitated access to the author of recently published works and this generates and enriches the scientific discussion, favoring the maturation of the collective intellectual thought [28].

The advent of Internet assured conditions for significant changes in ways of communicating among people, both in regard to communication media, and also the speed of data transferring.

The virtual ambient offers to the researcher agility in processes of production, evaluation, publication and validation of the essays. In printed media, the communication flows slowly, since the entire process of developing a new publication, which involves reviewing, formatting, graphics constructions and other activities related to the completion of the research are made prior to its publicizing. On the other hand, in digital environment, the processes of review and validation of works, through scientific proof, may be done jointly with the target audience of the work, accelerating the process of information transferring. Thus, the high levels of formality in contact with authors, give way to interactivity since a

simply electronic mail replaces the content of an official letter, which could take several days to reach the final destination. The Internet enables immediate and direct contact with members of the community to close relations between scientific researchers.

It is true that the Internet being a network of networks with services of electronic mail and thematic discussions in group facilitates the informal communication between researchers in different areas of Science & Technology. And when one think that informal channels are essential to work at levels of great value added to the information, because they are useful in decision making and allow the creation of strategies from unpublished information, one can have an idea of the value of the communication network [28].

It is worth an interesting comparison between the virtual environment, and the typical scenario of scientific events such as symposiums, conferences, and discussions, exchanges of experiences, and other considerations that both enrich and add value to the collective intellectual thought. The scientific dialogue promoted in digital media, is like an extension of the shared moments of reflection, always present in scientific events, round tables, sessions of questions, debates etc... In this sense, the authors refer to the facilitation of informal communication, once at a conference or other event of this nature, there is the establishment of a direct dialogue between authors and the target audience of your statements. The virtual space in a way, also promotes this feature, since once that there are two computers connected to the Internet, the communication between them can be directly established at any time. A dialogue is formed since there is a transmitter who sends a message to a receiver, who decodes and process the sent message, and generates a response for the transmitter, who assumes the position of receiver at this moment, while the receiver, passes to be the transmitter. It is also true that this not always happen be due to the unavailability of the receiver, be due to human or technological failures in the moment of message sending, but this, not necessarily consists a barrier to scientific dialogue.

Even so, the Internet can be considered a way of direct communication between two or more people which may offer great benefits to the scientific community, when applied properly. By using this computer network, the scientific debates which are usually made in scientific events, are able to extend for an indefinite period, rather than being limited to the 15 or 30 minutes generally reserved for complaints in events. With this, the author-reader interaction enables the clarification of one or another aspect addressed in the work that deserves a greater detailing, creating opportunities for the improvement of qualitative indices of the work presented, since any failure or passages that deserve special attention, will certainly be raised by the community members. Thus, a particular work is no longer individual, but will incorporate the collective thought, expressing the opinion of a community on a given topic.

The consensual opinion of the scientific community, which is one of the most fundamental standards of Science, is that the works should be disseminated by their respective authors [27]. The act of publishing enables that a research result be recognized as scientific truth, through validation of theories presented [29].

Interestingly, the publication and dissemination of information are essential to the development of new studies, since previous publications may be considered as inputs for the development of new studies as a way of providing greater credibility, validate, demonstrate and emphasize the new data submitted. Thus it is formed a scientific dialogue among different authors, which is precisely what makes possible the verification of the premises presented, and encourages the generation of new studies, and instigate researchers to explore emerging topics in their respective areas of expertise.

In this context the Internet is presented as the support which receives such a dialogue, which can also be called scientific debate, giving continuity to the information cycle which is responsible for the generation and improvement of human knowledge. Just as in other areas of knowledge, in occupational safety and health the Internet is a powerful tool while helper and source of research in professional forming, or continuing education in OSH, specially in remote, poor and less assisted geographical areas.

Additionally, the option of publishing in electronic format offers various facilities, both to the author of the study, and the information units, that later will incorporate such publication to their collections, with possibility of eliminating decisive processes of production and dissemination of knowledge that includes the best way of providing, acquiring and disclosing information, how much to spend, and so on. The stages of the publishing process is generally lengthy and costly - factor of impediment to the publication of works for many writers - is broken, since the cost of publication in digital format are lower in relation to the printed publication, not to mention validation activities, which in this case are made collectively by the entire scientific community, speeding up the improvement of publication process, and covering topics since from formatting and standardization until wording and content revision.

From the viewpoint of the information user, the greater and most social visible benefits and probably the most relevant ones provided by digital publishing are:

- The possibility of simultaneous access by multiple users to the same document;
- The facilities of handling, transporting and transmitting data;
- The possibility in converting the digital media in a printed document;
- The versatility of the media;
- The possibility of breaking down temporal, geographical and linguistic barriers.

The benefits of electronic communication are numerous and surrender itself a new research. The trend that has been the cause of controversy among scholars is that the volume of information produced in analog format, (paper) decrease significantly. Many publishing companies and other organizations are already producing their journals only in electronic format, which generally corresponds to the CD-ROM or online versions. Besides the benefits discussed, the fact brought the rationalization of physical spaces for storage, cheapening of resources for conservation of material, since the digital media tends to be more resistant to decay in relation to the paper. All this, not considering that traditionally, printed periodical publications only can be accessed inside the information units dependencies, with no

possibility of home loan, which can cause potential complications or even impossibility of consulting the material by the researcher. Such restrictions do not occur with electronic publishing, since its contents can be duplicated for another media, and transported for consultation in another location, without making the original document unavailable for immediate consultation in its unity of origin.

From the moment in which the publications are available exclusively in electronic format, there is an increased risk of excluding many people from the scientific discussion, considering all these people that has no access or are not familiar with the digital environment, and thus the whole purpose of facilitating access knowledge, promote scientific integration, and provide visibility to published researches is inversely reached.

A possible solution to this situation may be to provide equipment connected to the Internet in educational institutions, both public and private, with monitors for guidance on access to information. However, the fact is that even though these facilities are available, they are not sufficient to eradicate the digital exclusion. The reasons are diverse, ranging from disinterest of the public to the lack of available equipment. Considering the global trend, driven by globalization, which initiated the computerization era, it becomes necessary to establish a national policy to encourage the generation and use of electronic information, so that the country can keep up with advances worldwide, regarding to the development of information retrieval systems. On the other hand, although the scientific information does not reach 100% of the public involved, managers often have easy access to these kind of data. It is up to them so, to consult such information and transmit them to their whole staff, so that scientific language is properly converted to the worker understanding, which constitutes the focus on OSH management.

However, the fact that the information is available does not mean that it will be accessed and converted into knowledge for further practical application, when applicable, as a way of promoting the advancement of OSH, and consequently the welfare of the worker. Thus, the OSH class institutions, together with the units and information professionals, play a crucial role in order to highlight and promote the use of this vast material, which stores the inputs to the construction of knowledge, and also provides support to the professionals of the area for such actions to achieve remarkable and satisfactory results. This responsibility increases from the moment that is considered the fact that the OSH institutions are the main producers of information on this subject. So, a new necessity arises, besides an encouragement for computerization, creation and scientific knowledge communication. The investigative spirit must be something inherent to the researcher, so that he must feels the need for seeking information involuntarily, and do not expect something to emerge that bring it to him. Hence the need to develop the instinct of independence in these professionals to have greater autonomy to act in terms of information searching and scientific expression.

In this sense, knowledge management plays a key role considering the need to promote the scientific informational capital turnover allowing the maturation processes of knowledge management within organizations. The benefits offered by the Internet allow the process of

information transfer to increased speed and efficiency to ensure the safety of workers more effectively, reducing the rates of occupational accidents.

According to tables 1 and 2, official statistical data from the Brazilian Ministry of Social Welfare (Ministério da Previdência Social – MPAS) indicates that from 2008 to 2010, Brazil has registered over 700.000 occupational accidents a year, resulting in more than 8.000 deaths. Important to remember that these numbers do not correspond to reality, once that underreporting is still a problem faced in the workplace. Statistics themselves, better than any other data, justify with great skill the necessity of reflecting on the working conditions not only in Brazil, but all around the world, and, above all, the need for developing effective tools in reducing these rates.

Number of occupational accidents registered by Brazilian Ministry of Social Welfare, from 2008 to 2010														
Total number (with and without CAT** registered)			With CAT** registered											
			Total with CAT registered			Cause of the accident								
						Typical accident***			Commuting Accidents****			Occupational diseases		
2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
755.980	733.365	701.496	551.023	534.248	525.206	441.925	424.498	414.824	88.742	90.180	94.789	20.356	19.570	15.593

Table 1. Number of occupational accidents registered by Brazilian Ministry of Social Welfare, from 2008 to 2010 [30]

Number of occupational accidents in Brazil, by consequence, from 2008 to 2010							
Years	Total	Consequence					
		Medical assistance	Temporary disability			Permanent disability	Deaths
			Total	Less than 15 days	More than 15 days		
2008	774.473	105.249	653.311	317.702	335.609	13.096	2.817
2009	752.121	103.029	631.927	306.900	325.027	14.605	2.560
2010	720.128	97.069	606.250	299.928	306.322	14.097	2.712

Table 2. Number of occupational accidents in Brazil, by consequence, from 2008 to 2010 [30]

** CAT (Comunicação de Acidente do Trabalho) is a form that the company must fill in to communicate to the INSS (Instituto Nacional de Seguridade Social / National Institute of Social Security - Brazil) a work accident, which occurred with an employee, with or without removal, until the first working day following the occurrence, or immediately, in case of death, under penalty of fine.
*** A typical accident is the one with happens during the execution of a professional activity.
**** A Commuting accident is an accident occurring on the habitual route, in either direction, between the place of work or work-related training and:
(i) the worker's principal or secondary residence;
(ii) the place where the worker usually takes his or her meals; or
(iii) the place where he or she usually receives his or her remuneration;
which results in death or personal injury (http://stats.oecd.org/glossary/search.asp)

Achieving development is a virtually impossible task if at least the minimum conditions to preserve the physical and mental integrity of the worker are not observed. Therefore, work, health and safety are three components that must walk and advance together. From this perspective, the Internet can be applied as an instrument that enables and facilitate the scientific information flow and also the OSH intellectual capital turning, especially in underdeveloped regions, where the levels of exploitation and misinformation are higher.

So, the Internet can be considered an efficient tool for communication and dissemination of organizational knowledge, which assists in the process of homogenization of knowledge among employees of an organization. Information is essential to any organization, including all its workers, be from top management, be from shop floor, and emphasize the need for rapid access to data to reach the open market, competitiveness and also quality [31]. For this it is necessary to reveal the way in which information technology interact with organizations, since according to the literature, it is by this process that occurs cultural changes what includes the interlocutors behavior, which yet can involves business results, motivation and well-being of employees.

Information technology is a powerful tool to maximize the number of people reached, especially in shop floor, where can be found workers that have all the conditions to opine on a subject, resulting in new ideas, aiming to optimize ways of working and even getting better relationships among the staff. It is up to OSH professionals, to recognize the resources applied by information technology as a tool for OSH management in Brazil, so there will be a really valid and visible contribution the worker point of view.

1. It should be generated by means of empirical thinking;
2. It must be liable of understanding and proof;
3. It must be formerly communicated to scientific community.

The most common form of communicating scientific information is by written communication (publication of books, articles, essays and so on) or by oral communication (informal conversation or oral presentations in events like congresses, seminars, symposiums and so on). Which one is better in OSH field is a hard question, because it depends on several factors, including the nature and complexity of information to be transmitted. However, written media is still the easier way to access scientific information, once participation in scientific events may become unviable due to geographic limitations or even budgetary restraints. So, an alternative to overcome these barriers to information access is to create information systems designed to store, preserve, disseminate, and promote access to intellectual output of the scientific communities around the world, preferably in an open access ambient, to overcome another barrier to scientific information: its costs.

Considering the opportunity of promoting collective thinking on OSH and the conveniences offered by digital age, some reflections emerge in order to build and encourage the use of

instruments that allow scientific communication flowing. Therein, the Open Archives Initiative (OAI), coupled with the proposed mechanisms for quality management, emerges as an instrument with high potential for promoting a healthy and safe work environment for workers, overcoming geographic, temporal, and possibly linguistics barriers, facilitating access and dissemination of information.

So, scientific information reliability and validation is based on three points:

6. Digital information access resources under the open archives philosophy

Success and professional recognition are the targets of any professional, but only can be achieved against great deeds. For that, the main additive is a good quality information made timely accessible. Precisely for this reason, information has been increasingly valued and pursued by all professionals.

The society has watched to an informational explosion along the last few decades, both in qualitative and quantitative aspects. Many facts should have collaborated to it, for example, the need of publishing, to get or to maintain a job [2]. This is a common practice in the academic world. However, regardless of the reason, information is there, everywhere, to whom it may concern. Once available, information has to be communicated, for it to have its worth, and to achieve its objectives. Internet has contributed significantly for that, as an effort to facilitate the access for information, and communication processes among scientists and researchers, that is, the scientific society, defined as a social group formed by of individuals whose profession is scientific and technological research [2].

But how do these scientific communities work? By the same way that did the primitive societies: by donation system. Scientists transfer their knowledge spontaneously and gratuitously to the scientific community, without expectation of receiving any economic compensation in return [2].

However, the existence of use and production of information become useless, if whomever may need it do not know about its existence or can not retrieve it, whatever the reason. Just for this not to happen, any effort towards making information available to as many people as possible is valid. Thus, facing the scenery described, arises the incentive to free access to scientific information that

as already extensively reported in the literature, is both the result: (a) of a reaction of researchers to the business model of scientific journals commercial publishers (and their increasingly high prices for […] signing and (b) increasing awareness of the impact caused by availability of scientific papers free from access barriers. The motto of the worldwide movement in favor of the Open Access search results, therefore, is the wide and unrestricted dissemination of the researches supported by public resources [32].

Considering that information can play the noble task of generating and disseminating knowledge, which through an empirical combination (scientific communication), may culminate in the development of increasingly effective tools for building and maintenance of healthy and safety work environments, any expenses for this purpose, either with job training (input) or with the access and dissemination of information (output) should be considered as an investment.

Facing this, the Open Archives Initiative may be applied as a tool for adding value to quality management in OSH, while providing information, including successful reports, which may be adapted and possibly applied in the workplace, aiming to promote better working conditions for workers.

Open archives (OA), which can also be considered an information quality management tool, are seen as an innovative concept designed to provide the text as quickly as possible, promoting and popularizing free access to electronic publications, so that there is a weakening of the monopoly detained by the publishers upon any scientific publication until then [33]. The OA established a set of standards that enable interoperability between different digital repositories, which [34], are defined as a form of storage for digital objects that have the ability to maintain and manage material for long periods of time and provide proper access. Becoming the main forum for dissemination of scientific results and discussions [35].

Digital repositories of information are information systems which are intended to storage, preserve, disseminate and promote access to the intellectual output of the various scientific communities around the world. The main features are the extensiveness of public access, the variety of documents regarding to form and content, including aspects of interdisciplinary and preservation of digital data stored in there, and also the storage of this kind of informational support, that dispense the formation of the traditional printed collections, that demands above all, physical spaces for the accommodation of the archived material. However, the differentiating feature of open archives is the ability to provide simultaneously, freely accessible documents, using the philosophy of self-archiving, and also more restricted documents, made available only to a select audience, such as researchers engaged in a specific educational institution, for example. This way, digital repositories may present both interfaces: one widely and opened accessible, and another one, more restrict, gathering both the philosophy of free access, and the digital repositories philosophy itself. The policy used in the process of adding new documents collection ever assembled determines the repository as open archive, or digital repository. In the first case, the name refers that the information access is completely open, allowing the authors to remove or alter documents already posted whenever they found it convenient. In digital repositories, instead, access is restricted to a specific community, such as university professors or researchers from an institution.

Since digital repositories are constructed within the philosophy of open access, the final user of this kind of information source is able to search, copy, print, and also send a document to

another researcher besides the possibility of using the full text documents in other discussions, since the source and authorship is indicated. The data reliability is ensured through quality policies that establish minimum standards of quality of the archived information. A way of applying this sense is to have a specific judging commission, which should be responsible for examining the papers submitted for publication before making them available in the network.

The popularization of the Internet contributed to the depreciation of the degree of reliability of the data available in there, since anyone that dominates some basic features of information technology are able to add and/or change data on the network, inserting new documents and information that are not always reliable or truthful. The thematic digital repository under the philosophy of open archives, however, can mitigate such effects, recovering the initial principle of scientific communication in digital format, which is to facilitate the scientific information exchange between professionals.

Usually maintained by renowned institutions, thematic repositories adopting the philosophy of open archives gather in one place plenty of documents on a specific issue. That saves the researcher free time, and eliminates the need of displacement until an information unit or a library to have access to such data. Therefore, rather than the researcher looks for information, the opposite is what happens: the information comes to the table of the researcher, through a computer, bringing with it the backing of the institution responsible for its authorship.

The establishment of the open archives initiative in Brazil, may contribute to the breakdown of the barriers to access to OSH information, and also promote joint reflection between the members of the scientific community. The self-archiving, defined mechanism that allows the authors to submit or deposit their papers in a digital repository [36] besides being a way of democratizing forms of publication and access to scientific information, is also a way of promoting the continuing debate about a subject among scholars. The contribution to the construction and sharing of knowledge in this scenario becomes an automatic process, in order to contribute significantly to the evolution of science and improvement of various forms of labor relations in the OSH context.

7. OSH information management in São Paulo city, Brazil, under the professionals perception

During the year of 2008, Santos realized a study (presented as a master dissertation) in the south area of São Paulo City, in Brazil. The objective of this study was to detect the perception of the OSH professionals regarding to the availability of scientific information in occupational safety and health, and ways of accessing it, in their perception. It was also investigated the perception of the OSH professionals about how OSH scientific information and the maintenance of a healthy working environment could contribute to increase quality indicators, and consequently the organizational profits, that corresponds to the managers and stakeholders main interest.

It was randomly selected 23 organizations of the south area of São Paulo city, which OSH professionals were interviewed. 52% of the studied population consisted of safety technicists, while safety engineers consisted 21% of the total sample. The profile of the selected community was characterized predominantly male (82.6%), ranging in age from 36 to 50 years and over 10 years experience in the area.

The analysis of the answers to the 17 questions questionnaire that was applied to these professionals indicated that there is still a great job to be done to improve OSH information access and application in companies in São Paulo. It was found that the virtual environment for research is not yet fully exploited by the respondents, which is a fact that arises some concern to OSH managers, considering all the benefits of this knowledge transfer resource.

With regard to the worker welfare, the results clearly show that access to information is essential for safety processes improvement. Workers physical and mental health protection depends largely on access to the occupants of senior professionals have to the scientific information in general. According to respondents, cross-check between one and another company is very important in order to improve techniques and processes to assist in decision making or problem solving.

The study results also showed the need to promote the practice of OSH management as a means of protecting workers, and not as an inspection agent with punitive power to those who fail to comply with its recommendations. The worker must have a different view of safety at work, as well as professionals working in the area. Therein, integration and awareness of employees through information once again revealed itself effective. Information by itself is not the key to all problems solving , but it may be a major step in building and maintaining the ideal working environment. Data exchange among companies provides the sharing of experiences, improvement of processes and support in the prediction of harmful events, the accident itself.

The initial premises, which were confirmed at the end of the study, indicate that the philosophy of dissemination of scientific information used by open archives is considered by the interviewed professionals as a support tool for OSH management. Regarding the attitude of these professionals, the acceptance of this new form of dissemination of scientific information is plausible, although the reliability and familiarity of the public with digital instruments of research is relatively low, what creates the need of promoting the scientific culture, which stirs up both production and sharing of information, and above all, the scientific papers publication.

The discussion emphasized that scientific information can be viewed and used as a support tool to OSH management in general, which is considered a pillar to occupational safety and health management. An information resource would help professionals in the area, be in decision making processes, be in technical aspects. Allied to the mechanisms for quality management, benefits are enhanced with the possibility of achieving significant results to organizations.

8. Final considerations

It is important to establish the alignment of the alliance among scientific information, quality management and occupational safety and health. This combination, stands for the interests of OSH professionals, workers (including shop floor), and managers. OSH professionals, through the access of information are able to improve their professionals skills and apply methods of accident preventions never experienced before, or experienced in other organization, while quality management tools, like PDCA and 5S may help them to evaluate the adopted measures, making easier the identification and correction of any fail, and also to provide a clear, organized and healthy work environment, through the 5S recommendations. Workers, may enjoy a better (friendly) work environment, ergonomically correct, cleaned and organized job stations, not to mention the perception of the importance of him and his job to the organization, and also the improvement of occupational hazards management, once a suitable working environment reduces the chances of the occurrence of occupational accidents. For the organizational manager, all of this represents profits increasing. Once the OSH professional has conditions to offer a proper workplace in the organization, the worker is able to produce more, and more efficiently (profit). The worker, less susceptible to occupational accidents, requires less spending with medical assistance and rehabilitation costs (profit). Conscientious use and disposal of organizational raw material, also represents saving money (profit). PDCA also has its contribution in this sense through the provision of the constantly evaluation of the production process, what allows the organization to keep a continuous evaluation and improvement process, towards excellence, which may represent the conquest of market share (profit).

Increasing production and quality indicators, decreasing occupational accidents, using raw material properly (including human resources), and all of this supported by scientific information, meet the interests of any organization manager which is profit. In this scenery, the effective use and application of scientific information and communication may be considered as one of the major challenges, to be reached by occupational safety and health professionals. Since OSH is a branch of knowledge that deals with human life, comfort and safety become priority issues in order to provide the quality of work life, especially in activities that exposes the worker to occupational hazards, which risks both safety and even the workers lives.

However most needed material goods, we must not forget the following: **ALL OF THIS EXISTS FOR THE MAN.** And he can not have his health unprotected. The workplace control is obligatory. This is a matter of morality. If the work does not contribute to your happiness, it will be a huge and lamentable loss [37].

In work accidents field any kind of adaptation must be unacceptable. After all, a worker who is mutilated by an occupational accident, hardly will to adapt to society and the workplace in order to carry out their routine activities. The accident scene will never be

erased from his memory. Neither compensation, (no matter the value) nor any other social benefit will aid the psychological trauma of an injured worker, or replace the activities of which he was deprived as a result of an accident. Therefore, it is inadmissible to use the term adaptation when it is related to safety and health at work, since the health and integrity of the employee is an acquired right that must be respected by the employer.

Knowledge attracts money, while the converse is not true. Whereas the non-conformities in the workplace may culminate in damages to the organization, investments in the development of the intellectual capital and management knowledge should be priorities to the organizations and be considered as support tools for managing health and safety at work.

Quality management should promote effective changes in the workplace, and these changes should reach and invigorate in all working environments, so that the workers lives, which represents the strength of a nation, be respected and preserved.

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Acknowledgment

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