

A TOTAL APPROACH IN ERGONOMICS IS A MUST TO ATTAIN HUMANE, COMPETITIVE AND SUSTAINABLE WORK SYSTEMS AND PRODUCTS

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Globalization brings along complexity, competition and change as anticipated by working in teams, quality enhancement of human resources and a change of mind-set to be more holistic in approaches. Enhancement of expertise, widening of the horizon, developing added values as well as preparedness to carry out management of the future have to be built and developed. Conditioning and customizing programs through formal and informal education and training should also be carried out in bridging existing gaps, filling needs and solving key problems. New proper and appropriate curricula must be developed together with encouraging the change of mind-set. It is essential to attain the highest capabilities to work in a team and to think and act holistically, as well as to enhance human relations capabilities in communicating the research results. By so doing, the gaps between research and implementation and between theory and practice need to be bridged; the felt real needs of the target groups could thus be filled; and the root causes of the problems faced in any activity could be solved in a sustainable manner. In implementation, a SHIP (Systemic, Holistic, Interdisciplinary and Participatory) approach must be conducted for identifying, analyzing and solving the problems so as to attain sustainable results. In defining the technology being used, it must be comprehensively assessed through six criteria so that it can be technically, economically, ergonomically and socio-culturally sound, save energy and preserve the environment. Through this total approach, work organization and work systems and their products are expected to be more humane (healthier, safer, comfortable, efficient), competitive and sustainable, as prerequisites for survival and continual development.

Key words: holistic approach; ergonomics; work system; work organization; sustainable development.

INTRODUCTION

Globalization brings along complexity, competition and change. This is anticipated by the trends toward working in a team, quality enhancement of human resources and a change of mind-set to be more holistic in approaches. In practice, there are many obstacles and constraints to be solved in achieving the goals set.

Meanwhile, there are still several problems as challenges of ergonomics and occupational safety and health which must be taken into consideration and need serious attention if we want to cope with the global market problems and issues. These challenges could be classified into five highlights as follows:

(1) Based on long experiences in working in the fields of ergonomics and occupational safety and health, it practically seems that we are still running at the same place up to now. Accidents in fact are still happening, even also in workplaces fully equipped with up-to-date laws and regulations as well as safety measures such as personal protective devices. Priority must be given to tackling and manag-

ing unsafe behavior and developing safe behavior with positive thinking and acts. Mind-set changes become an important issue that needs to be successful. Thus a total approach must be taken to solve the problems completely.

(2) In spite of recent advances in applying ergonomics knowledge and experiences in occupational safety and health management systems, prevention of accidents and health interventions, there remain huge gaps in the research and application of ergonomics and occupational safety and health in the real work due to limitations in various means.

(3) In doing research, it seems that the same kinds of actions that have been done previously are often taken as research steps. Basically by doing so, the problems have not been solved wholly and solutions implemented are not sustained. This could mean a waste of time and cost, in spite of a short period of euphoria felt especially by the researchers concerned. In fact, progress is not satisfactory while different people and different methods and technologies may be used. No advances are often seen in respect to the problem solving as a whole, leaving at large the root causes of problems.

(4) It appears that a very limited horizon owned by the researchers may constitute the real root cause of the existing situations. The widening of the horizon and the development of future management with a new mind-set are really needed to start and anticipate the changes in solving the problems.

(5) The community at large and the industrial community in particular look forward to real and beneficial improvements which are also meeting the globalization demands. This should lead to humane, competitive and sustainable work systems and products.

It seems that in meeting the challenges we face in ergonomics and occupational safety and health, a particular effort must be done in line with the demanded tasks that have emerged due to globalization. This is essential if we want to survive and win the global competition. In short, we have to work out all those problems and issues to attain the quality of life of the people while simultaneously anticipating globalization. It is impossible to carry out this work by conducting the effort separately from each other, for example, by only doing ergonomics and occupational safety and health as separate subjects, or doing only sustainable development effort as management goals. Joint effort must be done holistically and comprehensively, if we want successful results.

This paper tries to illustrate the efforts about how to bridge the existing gaps, fill in the needs and solve the problems being faced through applying a total ergonomics approach to attain humane, competitive and sustainable organization of work systems and products.

METHODS

The characteristics of a SHIP (Systemic, Holistic, Interdisciplinary and Participatory) approach that must be conducted in identifying, analyzing and solving the problems so as to attain sustainable results are discussed. As a means of defining the technology being used that should be humane and competitive, six criteria for assessing the technology comprehensively are taken into account; namely, it must be technically, economically, ergonomically and socio-culturally sound, save energy and preserve the environment. The means of attaining humane, competitive and sustainable work systems and products through this holistic ergonomics approach are then examined.

RESULTS AND DISCUSSION

Recent experiences confirm that conditioning and customizing programs through formal and informal education and training should be carried out in bridging the existing gaps, filling the needs and solving the problems. These experiences also indicate that new proper and appropriate curricula must be developed and that conditioning the change of mind-set must be encouraged. It is important to attain the highest capabilities of people to work in a team and to think and act holistically. It is equally important as well to enhance human relations capabilities in communicating the research

results. In the field of ergonomics, it is vital to anticipate priority tasks by means of enhancing expertise, widening the horizon, developing added values and increasing preparedness to carry out management of the future. In planning and designing work systems and products, designers or policy makers must give more attention to human beings as subjects rather than objects in the design process. By so doing, the gaps between research and implementation and between theory and practice can be bridged; the real and felt needs of the target groups can be really filled in; and the root causes of any problem faced in any activity can thus be solved in a sustainable manner.

Some examples of the challenges and the anticipation that must be dealt with are illustrated.

(a) What you see depends upon where you stand

In many areas of technology, we meet a large amount of excellent experimental products done by the students in relation to their final assignments. These study results tell us how the inventions or improvements have been done and how some ergonomics hazards have been treated. Some of the results show how the productivity has increased significantly in comparison with the previous processes. Other results demonstrate how much advantages the enterprises could collect with the new processes of work. Obviously we could see those advantages without any doubt about them. We could imagine if one worker with the new machine could result in outputs 20 times higher than before, how much could be attained with 20 workers in using the same machines. The employer would be very happy about it. But after we keep asking several questions to the students, we often find that all those improvements in fact have created many new problems as side effects that have never been expected by the students. And if we calculate how much money should be expended to anticipate and overcome those disadvantages, perhaps it would be higher than the advantages the employer would have with the new improvements. As we knew, along with the use of new machine for improving the work processes, additional impacts usually emerged. The workers may be exposed to noise, vibration, dust, high temperature and possible accidents. And these impacts have never been thought and calculated by the students. They practically think how to improve the process from engineering aspects only. This could be well understood, especially when the students have never been taught about how to think and act holistically during their study. The problems become more complex when we add the questions such as “how much money the owner or the employer has to expend for the machine, and where would be the break-even point?”. Other pertinent questions include “has the machine already been ergonomically assessed for health and safety purposes?”, “with the new machines, what happened with the environmental impacts raised as consequences?”, “where the waste goes?”, and “how about the reaction of the surrounding community due to the noise, dust and waste as the end products?”.

Of course we do not expect that the students can readily have the answers, especially good answers. Even the teachers are also having a limited horizon and have never been trying so far to fit themselves to new developments. They mostly keep static views and are sometimes arrogant with respect to their own domain, feeling proud about it, which is really a pity in this changing world.

Without any change of the mind-set, such a case may happen from time to time, especially for the teachers, and could happen in every place. A new mind-set combined with a new approach that is holistically based must be encouraged in many educational institutions in relation to the design of products to be used by human beings. A new ethics with due consideration of the users of the products designed and produced must be developed. Not only that but also the impacts created by what they have produced, particularly those to the environment, should be taken into account. Just as in the case of medical ethics practiced by physicians in helping their patients, what has been produced should not give side impacts to the environment.

And in fact, the issues of ethics and sustainable development are commonly emphasized as in the Engineering Education Symposium held in Madrid from 27 March to 2 April 2006. Increasing attention is drawn to the ethics and the holistic approach that should be built in within the curricula for engineering education. Sustainability must become a strong concern and commitment for engineers. In so doing, they have to work closely with other disciplines such as sociology, psychology,

medicine, etc., by applying a holistic approach. Arrogant attitude must be thrown away.

These experiences clearly point to the need for the mind-set change, to start thinking and acting holistically, to widen the horizon and to work in a team. It is important to establish ethics for sustainable development with due considerations about human beings to whom the products are being made and passed to be used.

(b) Bridging theory and practice

In many scientific journals we could see a number of good scientific articles which were written in an excellent way and supported by significant evidence-based data. But these highly value-added articles usually remain in the libraries, without any direct contact with the target groups that really need the conduct of the results mentioned in those articles. There are few or no communication routes being seriously built between the research results and the target groups who could use the results. So there are still gaps between research and application.

To overcome such a constraint, the human relations capabilities of people must be developed. Communication, motivation, leadership and empathy as part of human relations skills must be encouraged to be owned by those who are involved in this “ice breakers” effort. Students should not only be taught about how to write scientific papers properly but should also be able to write popular articles as well. They must be taught and conditioned as to how to conduct good communication, motivation, leadership and empathy. These capabilities must also be developed among those who have the authority in managing research and public services especially at university level. They must be able to work together to arrange all the research results in a package that can be transferred to the community at large that really needs those products. Only by taking such an approach, we could bridge the gaps between research and implementation. And by doing so, a university is really doing its ultimate role, for which it is founded, to solve the problems in their surrounding community. And a fair reward system must be provided in association with the linkage between research and public services performance to promote the approach by our graduate and postgraduate students. And fair consideration must also be given to research products written in scientific journals and communication papers presented in scientific meetings to be included in their proceedings. Those who are benefiting from the meetings to build and develop networking can thus be more successful in applying their knowledge. The students could in this way become good scientific writers, but we should note that most of them may be more isolated from the community that really needs their expertise. We should be able to support graduates who own those two capabilities in this competitive world.

(c) Languages barrier is really crucial

Talking about communication, language capabilities should also be encouraged and developed through effective and efficient approaches. There must be something wrong when we consider that while English has been taught for nearly six years in high schools and about four years at universities, it is still very rare to find university students who could communicate well in English. We should be able to find out the most effective and efficient learning process to attain good English-speaking skills of students.

In this competitive world, the ownership of more than one languages especially in the Asia-Pacific region becomes a requisite, as the region is considered as the one of the new economic development regions. Japanese, Korean and Chinese are among the languages that need attention of our young generation for their survival.

The added value of the language skills in addition to expertise in their field is really important in meeting the demand. The language capabilities beside computation skills should be attained fully, both in theory and in practice. Training in various levels must be encouraged and reinforced.

(d) Unsafe behavior

A traffic user in a crossroad usually reacts to the yellow sign by speeding up the transport means to cross the road. This is really an unsafe behavior customized by most of the road users, irrespective

of their position, education, gender, age, etc. It is understandable if an accident should happen in such a situation. In industry where a helmet becomes obligatory for everybody entering the factory premises, very often we see some employees or foremen come in without using it. They thought that they would not need it as they get into the factory only for just a few minutes. They never think that with such a step they created or developed a bad image to be imitated by the workers. They destruct the good image that should be built by them. And once in a while accidents may happen as a follow-up of this step. We do have helmets and regulations, but due to such unsafe behavior, accidents could still happen. With this lesson, our mission is how to change the unsafe behavior into safe behavior. And one of the efforts that should be done is to give a good example, and the other is to enforce the law. The use of a helmet could be enforced by taking a sensible step to those who are not using it. This enforcement, if carried out consistently, may become a habit for the workers using the helmet. This may be just like how we train our children to get into a bath in the morning, starting with enforcement, so that afterwards it becomes their good habit.

Another approach is taken by having a conditioned program through what we call an Integrated Ergonomic SHIP Approach Workshop in which participants are trained and conditioned to think and act holistically. During the workshop with the theme related to safety and health issues and using democratic and human rights principles, they try to come out with action plans for solving the problems they presented at the beginning of the workshop. Through the process that consists of identification of problems, making priorities, writing forward-looking sentences, determining the real conditions through SWOT analysis and writing the strategic planning, they come up with action plans. The sense of belonging and the sense of responsibility of what should be done, especially in a significant relation to safe and healthy conditions, can thus be built and developed through this conditioning process. By such an approach, safe and healthy behavior can be built and developed.

(e) Total approach for sustainable development

A hotel was built in a very nice location at the bank of a river having a good surrounding view. The owner asked an architect to draw the plan; an engineer/developer to build it and a certain amount of money to support the development were provided. In short, only engineering and economic aspects were considered in this process. No other factors or disciplines were involved in the planning and execution. And then what happened? Protests came from many sources. The local people protested for not being involved in recruiting the workers. Most employees were recruited from outside the surrounding villages, and very often from other islands, to result in different ethnic groups and different religions, etc. The hotel said that they had suitable skills and capabilities needed by the hotels. Obviously this was not an expected answer, as it was still possible to train local people to do the same with appropriate training steps. But the hotel did not do so as it was cheaper to recruit workers in this way. Due to an unsatisfactory answer, the protest went on, very often followed by disadvantageous steps, often resulting in uncomfortable acts as consequences.

Protest also comes from the people worried about the holiness of the place. They questioned why they were not consulted when the hotels chose the location. The people believed that the location was actually holy for the local people, and could not understand why the hotel was built there with all the unsanitary places like the kitchens, toilets, etc. The protest became severer as it was related to many uncomfortable feelings among the people. A ceremony had to be held to overcome all those incidents, and the hotel had to pay for it. Until this was done, protest took place from time to time. Very often a holy place monument had to be built as a consequence. And a budget had to be compiled for building and maintaining it and for regular offering by the hotel. Another protest also came from the housewives, as they had difficulty in getting enough clean water for their domestic work. They blamed the hotel for taking their water by building a deep well that made their wells dry. Understandably this created a long debate to solve. And a lot of time, energy and money had thus to be expended. The last complaint arose among the people living downstream. They complained of the water polluted by the waste water thrown away from hotels' kitchens, baths and toilets, etc. Skin irritation and diseases were the complaints. Obviously a lot of money had to be spent to construct proper

cleaning means of disposing all waste products from the hotel. This step had to be taken especially because this protest was supported by environmental NGOs and because it was necessary to avoid more serious impacts as a result of exploitation of the case.

From this case, it seems that a holistic approach in designing a product becomes a necessity. In doing so everything must be assessed systemically, holistically and interdisciplinarily and followed by participatory approaches. And in using the technology, it must be assessed comprehensively by applying the six criteria so as to confirm that it is technically, economically, ergonomically and socio-culturally sound, saves energy and preserves the environment.

(f) Transfer of technology and participatory approaches

In many papers delivered in various scientific meetings, we often find that numerous equations are applied by the authors in solving problems being faced in a certain workstation, workplace or work conditions and environment. Most of these equations are developed or originated from industrially developed countries that have so many particular differences compared with industrially developing countries in terms of cultural norms and values, daily environmental conditions, habits and behavior in conducting certain activities, besides anthropometric data in general. Based on these differences, it could obviously be well understood that not all equations could be used and transferred as such, as it could mislead the results. For example, the hot and humid environmental conditions in most developing countries obviously give additional load to the workers in doing the same job as those in developed countries where the environmental temperature and humidity in general are usually lower. Under the circumstances, it is not wise to use such equations in evaluating the load borne by the workers. Logically the load tends always to be higher for doing a similar job in higher humidity and temperature.

Similar results may also be found if we are using equations based on unit body weight in spite of body size differences. It seems that more realistic results could be achieved if we try to evaluate the load in a more holistic way based on the real environmental conditions being faced. By so doing, the results can be used in a more sustainable manner, especially if participatory approaches are taken properly and appropriately. Involvement, active contribution and responsibility through the sense of belonging of the target group must be encouraged and implemented consequently. Involvement must cover not only the body, but also the mind and the soul. They are not being invited only to hear what should be done but they should be involved from the beginning of introducing the idea. They have to hear on the first hand what the problems are, how we could solve the problem and what kind of actions could be done. Involvement must be started along this process, especially when we are discussing what should be done. This should lead to a better solution based on local wisdom and to more sustainable products.

(g) Time management

Widening of the horizon is becoming important recently as there is an anticipation of a limited horizon among both the teachers and the students. The feeling of satisfaction about what they have done very often makes them too lazy to do something more which is actually still needed. By so doing, they make their horizon so limited that in the end they tend to limit their capabilities for bargaining purposes. It is important to keep their eyes, ears and other relevant receptors open in widening their horizon. And this step only needs the existence of willingness, capabilities and courage that help them utilize available time as effectively and efficiently as possible. Time management is really the drug of choice in this matter. And time is really an asset and obviously is also your life itself. Effective and efficient utilization of time becomes a necessity and one of the top concerns of everybody.

(h) Management of the future

Our young generation working in ergonomics must from now on learn what management of the future looks like and what we should do for managing the future. This is because they will be work-

ing in such a situation and condition soon, and if they want to survive and be winning the competition, they have to be inside the management cycle and atmosphere. The change of the workplace, workforce, labor market and work management must be anticipated in an effective and efficient manner. Openness, transparency, working in a team, delegation, appreciating differences, collaboration and democracy as well as human rights must be learned and strongly focused on.

(i) Total ergonomics approach

Based on long experiences, a total approach has been introduced, proposed and carried out to answer all the challenges faced in a total way. As the problems become more and more complex, it is necessary to solve a problem always by starting from the identification of the problem, analyzing and solving the problem by seeing it in the context of a system, rather than seeing it from several related systems, or through various related disciplines. It is also necessary to take participatory steps from the planning phase involving the body, mind and soul of people concerned during the whole process. In using or choosing the technology, it must be assessed comprehensively through the six criteria: namely, it must be technically, economically, ergonomically and socio-culturally sound, save energy and preserve the environment. If one or more criteria give a negative score, steps to overcome these aspects must be added.

This approach has been conducted through 40 workshops held with various themes, by post-graduate students in accomplishing their theses and dissertations, by staff in conducting research and by public services. These workshops have really helped bridge the gaps between what should be done and what already exists. In all these processes, conditioning and changing the mind-set have been done purposely.

By so doing, we are certain that humane, competitive and sustainable work systems and products can be attained.

CONCLUSION

Various tasks in ergonomics and occupational safety and health have to be faced in order to survive in this globalizing world. New approaches which are holistic in character must be used. These approaches should meet all the needed requirements, but their end goals should be dedicated to and directed toward the enhanced quality of working life of people. The technology used should be carefully assessed and adjusted to real needs of the society. The six criteria applied in the SHIP approach are valid in reorganizing our research work and filling the existing gaps. Through this total ergonomics approach, work processes and systems as well as products can be more humane (healthier, safer, comfortable, efficient), more competitive and sustainable.

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