

Participatory Ergonomics Intervention in an Industrially Developing Country—A Case Study

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In industrially developing countries, a few ergonomists have directed great efforts towards developing ergonomics awareness among managers and workers in organizations. There is little research on the degree of their success, though. Furthermore, access of organizations to ergonomics knowledge is usually very difficult, especially in industrially developing countries. Thus, building ergonomics awareness is certainly the first phase of the process. Three companies from one industry (44 people: 14 females and 30 males) participated in a project aimed at improving their work system. At the beginning, we needed to create a common goal and ensure participation with appropriate ergonomics tools. The findings of this study were the key issue for the ergonomics intervention (i.e., a shared vision, awakened need of change and learning). Further, to build ergonomics awareness and develop a continuous learning process in the company, it was necessary to use more ergonomics tools through workers' participation in different workplaces.

ergonomics tools intervention participatory ergonomics industrially developing countries

1. INTRODUCTION

Since the Oostebek Forum in 1972 scientists have emphasized the importance of ergonomics application in industrially developing countries as a measure for improving working conditions and productivity [1]. The International Labour Office's international programme for the improvement of working conditions to assist industries in finding practical solutions for improving working conditions is a worldwide comprehensive attempt in this area [2]. However, awareness regarding ergonomics and its application is still low in many industrially developing countries [3, 4, 5]. The field is not well recognized by name, either [3]. Creating ergonomics awareness in those countries is the main aim of ergonomists who try to improve the work environment [6, 7]. Different models

and methods for building vision and developing a change programme have been presented in the literature [8, 9].

In Iran, ergonomics started in the early 1970s with a few isolated studies [10, 11, 12]. In 1977, H. Shahnava introduced ergonomics into the curriculum in industrial engineering at the Tehran Arya Mehr University (Sharif). Since then, ergonomics has been taught as a supporting subject for one or two credits in a few universities. However, for Iranian industries, ergonomics was until recently an unfamiliar subject. The first systematic attempt to introduce ergonomics in Iranian industries started at Glucosan factories [13]. A comprehensive attempt to introduce ergonomics to Iran and to make use of its benefits in Iranian industries was started systematically, in several phases, under the auspices of the Center for

Ergonomics of Developing Countries (CEDC)¹ [14]. The use of system thinking and system practice of ergonomics intervention has resulted in a definition of the ergonomics intervention programme technique in Iranian industries [15]. It has been shown that if ergonomics awareness increases, people can contribute positively to solving problems in the work environment and to productivity [16, 17, 18, 19]. Ergonomists' work in industrially developing countries has one thing in common: with appropriate types of ergonomics interventions, there will be improvement in quality, productivity, working conditions, occupational health and safety; there will be a reduction in rejects and rejection costs; and profit will increase [18]. Local solutions have been shown to be effective and acceptable by both management and employees [20, 21, 22, 23]. Participation of people involved in programmes for identifying problems and developing feasible solutions has been shown to be effective [24, 25, 26, 27, 28, 29]. For successful application of developed solutions, management commitment and employees' motivation is important [30, 31, 32]. Lack of employee commitment to an organization and its goals has been identified as a major constraint upon its performance; this includes its ability to change [33]. "Commitment is particularly important for the successful implementation of projects and strategic programmes. The introduction of new technology or strategic initiatives represents a period of discomfort and risk. Commitment can help to smooth this period of transition by removing the delays, decision constraints and reversion to the old ways of working associated with non-commitment or mere compliance. Therefore commitment is an important factor both in getting the resources required for a project and ensuring that it can avoid and/or overcome the barriers to implementation that can arise" (p. 227) [30].

2. AIM

The study's aims were to create ergonomics awareness that could lead to finding problems in the work system as well as to developing feasible and acceptable solutions for improvements. The study's purpose was to develop vision, ideas and action plans for improving the work system.

3. METHODS

3.1. Subjects

In 2004, a large industrial establishment made up of three subsidiary companies in the State of Gilan, Iran, became interested in taking advantage of ergonomics. One of those companies (a mother stock farm) had four divisions. Another one had three divisions (a parent stock farm, a chicken factory and after-sales services). The third company dealt with machinery and equipment. More than 300 people participated in this project. All managers (3 top managers and 8 heads of divisions), supervisors (28 people) and experts (5 people) of the three private poultry companies participated in training workshops on different methods of creating ergonomics awareness among managers and employees. Altogether 44 people (14 females and 30 males) took part; their average age was 26 (22–30) years for females and 40 (25–55) for males.

3.2. Setup

In March 2004 the Mehr E Nami Institute (MENI)² received a request from the top management of three poultry companies indicating a desire to improve their companies' activities. A meeting was held with the top managers (owners) of the three companies. In the second meeting, the benefit of ergonomics and the experience to be gained from applying ergonomics in Iranian industries was discussed for 2 hrs. After that session the worksites were visited; eight divisions were visited

¹ <http://www.cedc.info>

² In November 2003, a few Iranian industrial managers established the Mehr E Nami Institute (MENI) with the aim of supporting Iranian industries that were interested in ergonomics application, training, consulting and research. MENI supports research on the development of the ergonomics intervention programme technique.

in 3 days. During the visits the heads of divisions introduced the working situation and explained the positive and negative aspects of their work system. Then, the top managers participated in two more meetings. The results of the visits to the worksites were discussed in two 4-hr sessions. The top managers provided more information about their companies. Furthermore, in those meetings more general ergonomics information was given. It was agreed to have the last meeting of 4 hrs; the project underlined by this study was then discussed and planned. The duration of the project was agreed to be 12 months following the first workshop.

3.3. First Workshop

The Future Workshop (FW) was introduced and conducted with all 44 subjects at the end May 2004. It lasted 3 days and was held in one of the offices of the companies in Rasht City. The workshop was video recorded.

The FW method is a well developed method for identifying problems at work and for developing feasible and acceptable solutions for improvements. The method was introduced by Junk and Müller [9]. It was later spread to other countries and used mostly for optimum utilization of human and material resources at work to make companies more competitive in this world of rapid changes [34, 35].

A FW is a well structured process with the following five phases. It is guided by two facilitators.

1. Preparation phase; its aim is to define a clear, short and challenging theme for the workshop, acceptable to all participants.
2. Experience or critique phase; it aims to highlight all problems experienced by participants with regards to the theme of the workshop. A complete catalogue of problems is developed.
3. Fantasy phase; its aim is to come out of the daily limitations that usually lead to restraint, traditional thinking and traditional actions. People have many ideas that have never been expressed or formulated because they are framed in what they believe is not right or possible. In the fantasy phase, everything is possible. There are no barriers, no economic, personal, technical or organizational limitations. The idea is to develop future visions.
4. Strategy phase; its aim is to go through all the written fantasies to find all the barriers regarding their realization. Groups can use several techniques to develop a feasible strategy and solution to the problem at hand in the workshop: various brainstorming techniques, desirability and possibility assessment, a circle model or a development model activity [36], a triangular model [37] and a cause-and-effect diagram [38].
5. Action phase; after the workshop, a complete report is prepared containing all the critical problems, fantasies as well as the programme/plan proposed by the participants. The report is a catalogue of ideas for future actions.

3.4. Second Workshop

After a week, a one-day workshop took place; an ergonomics checklist [2] was introduced in one of the divisions (the machinery and equipment division). A facilitator conducted the workshop with all 44 people. They were divided into six groups (one group consisted of 9 people). The results of the checklist activity were presented by the groups to the head of the division as action plans.

3.5. Third Workshop

An evaluation workshop took place 2 weeks later. This was a meeting of the 44 people who participated in the second workshop. The group visited one of the divisions and discussed implementation of the action plan developed after the ergonomics checklist was used for a day in that division. The workplaces in the division were video recorded and photographed during this workshop. The group agreed to work according to a "work and moral charter" which was to be developed through participation in the first session of a strategy committee. Then, they discussed the question of how the checklist could be used at all worksites of the divisions. It was planned that special questions should be discussed in separate groups consisting of

the 8 heads of divisions. The heads of divisions decided to work in two separate groups with different problems. In the first session, the groups replied to two questions: Why should we change? How should we change?

3.5.1. Meeting with the heads of divisions

Over 3 months, every 15 days, 10 people (8 heads of divisions, one top manager and one facilitator) had collective half-day meetings in one of the divisions. In these meetings they discussed the progress of the groups, co-ordination of the activities of the various divisions and ways of providing better support to the steering committee (SC), which was established after the second workshop. In these meetings the project facilitator informed the participants about organizational and managerial functions, project monitoring and evaluation. The aim was to conduct the project well. In the first meeting the heads of divisions discussed why and how meetings of the heads of divisions should be held.

3.5.2. Strengths, weaknesses, opportunities and threats (SWOT) analysis for the organization

Another activity after the FW was a SWOT analysis of the organization with the 44 participants, which started after 2 months. This was to develop a vision for the poultry company.

3.5.3. Planning committee of the heads of divisions

After 3 months, one of the top managers and the heads of divisions formed a planning committee for a better running of the organizational and managerial functions in the three companies as well as for a better follow-up phase of the FW.

3.5.4. Evaluation workshop

The facilitators conducted a one-day evaluation workshop after 6 months. All action groups (AGs) presented past activities, which were then discussed by the whole groups. Each member of the AGs answered and discussed in the group questions which the facilitator presented a week

before the workshop: Why do you want to continue working in this group and what are the group's aims? What are you proud of and what is the group proud of? Where are you standing in the process of ergonomics improvement and real organization of work in your company? Where is the group unsuccessful? Where has the group failed? What do you need to continue your work? What do you want to achieve and where are you going? A success story of the group was also to be described.

3.5.5. Meeting with top managers

The heads of divisions and the AGs presented their success stories that resulted from a year's effort in a 4-hr seminar. The top management discussed the implemented projects and gave feedback to the AGs.

4. RESULTS

The high degree of involvement of the 44 people could be seen during all the workshops, meetings and sessions with the heads of divisions. The results of each method used are presented in this section.

In the first meeting a top manager thus expressed the general problems of the companies: "Physical growth of work during past three years. No proper work organization. We have about 40 experts, who mostly work as engineers in animal husbandry, and 40 experts have experience from this company only and have not worked long in our company. Our company needs to have a mother company". The eight divisions of the three companies were visited. The visits and negotiations with the 8 heads of divisions indicated the following issues: no (or unsuitable) planning, organization or control; isolated work; stress; no balance between work and private life; and no meetings of managers. When the heads of divisions introduced their work, they mostly talked about crises at work and their successful handling of them. The heads of divisions were considered to have good qualifications if they could solve crises on farms and at worksites. They complained of the physical growth of the worksites during the past 3 years. Work

organization was not suitable. They mostly feared what would happen in future; they were worried about the top management's lack of control.

After the results of the visits were introduced and the planning for change was discussed, the top managers discussed ways to build a vision and to design suitable organization. The involvement of people in planning and controlling their own work activities was emphasized. The benefit of sufficient ergonomics knowledge and the power to influence process outcomes to achieve desirable and feasible goals were discussed. The managers agreed that training all 44 people from the different divisions in the use of the FW and the ergonomics checklist should be included in their programme.

The facilitator prepared a full report from the FW; it contained problems and solutions. Most of the documented problems were related to work organization, which the managers of the three companies also emphasized. They observed how a proper participative procedure would help in identifying various problems at work and in developing acceptable solutions.

The 3-day FW was conducted as follows. Lectures in macroergonomics took place in the morning of day 1. Their objective was to enhance the participants' knowledge on macroergonomics to fully utilize the potential resources of the three companies, especially human resources to improve the efficiency and productivity of the whole organization. The following topics were discussed: an introduction to macro- and microergonomics, the changing world, the work environment, productivity and quality at work, the role of the participatory ergonomics process and the FW technique.

Compiling a catalogue of problems and developing feasible solutions was the subject on the afternoon of day 2. The participants prepared a catalogue of problems related to the theme of the organizational behaviour FW. They voted 67 different problems from a list of 150 that were worthy of thought and action. Those problems were categorized under five main headings. The participants were voluntarily divided into eight groups to work with the selected topics: one group of 8 people worked on work organization, a group of 7 on culture and training, 6 people

worked on welfare. Three groups of 5 people each worked on management, whereas two groups of 4 each worked on planning. Each group analysed the assigned problems and developed the best possible solutions for each recorded problem.

On days 2 and 3 the participants continued their work in the fantasy and strategy phases. Each of the eight groups developed a detailed plan for improvement on day 3. Some examples of the results of their activity follow.

The management groups evaluated a strategic view for the future of the companies (i.e., one year ahead) as well as running the divisions by participation. The groups formed technical committees on services. The work organization group evaluated the distribution of work and set up a meeting for the heads of divisions. The group evaluated the volume of work and solutions for improvement. It considered lack of responsibility and authority of people at work. The group also evaluated the problem of lack of co-ordination among staff. The planning groups planned the payment of salaries, a reward system and implementation of team work. The culture and training group evaluated a strategy for training experts and managers. It evaluated the problem of lack of reliance on one's knowledge to make progress in the company's ultimate goal. The welfare group evaluated a new welfare system and various problems expressed by the participants of the workshop; they worked on complementary insurance for all personnel.

In a one-day, second workshop (at one worksite) the group learnt how to apply an ergonomics checklist, a useful tool for improving workstations. The result was that the head of the division accepted most of AGs' suggestions that followed from the workshop. Several members of different AGs indicated that when they worked on a workstation together with the workers, they received better information and suggestions of solutions.

The evaluation workshop focussed on the result of meeting the workers of the division; the 44 people from the second workshop took part in it. They observed the results of the action plans and activities of the AG after 2 weeks. Figures 1–12 illustrate one worksite before and after improvements.



Figure 1. Worksite before improvement: poor posture, air pollution due to welding, no general ventilation.

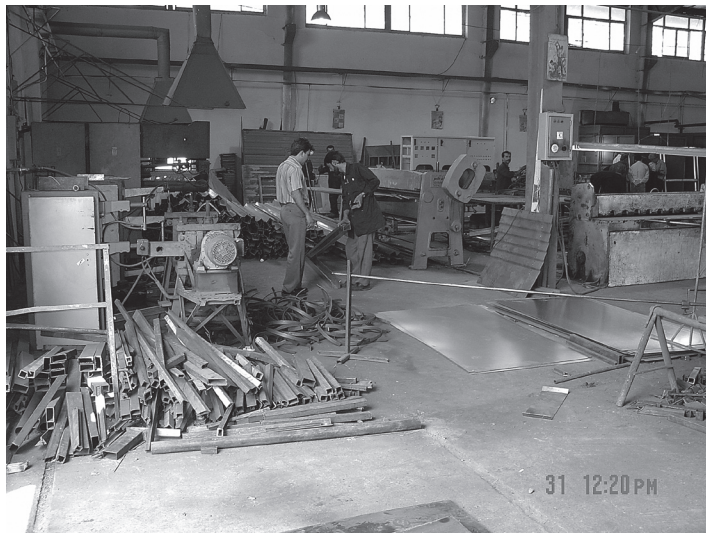


Figure 2. Worksite before improvement: no storage for materials, unused materials on the worksite.

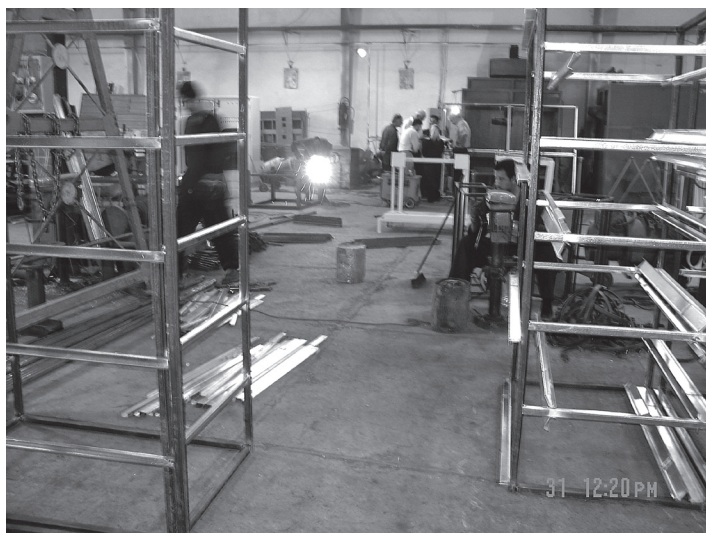


Figure 3. Worksite before improvement: no marked escape routes clear of obstacles, air pollution.



Figure 4. Worksite before improvement: no cover on fan, poor posture due to lack of table.



Figure 5. Worksite before improvement: no personal protective equipment for welder and coworkers, poor posture.



Figure 6. Worksite after improvement: lines separate transport areas from working areas, transport areas clear.



Figure 7. Worksite after improvement: a working table for laminator, though its height is not suitable yet.



Figure 8. Worksite after improvement: worksite clear of used and unused materials, clear working area.



Figure 9. Worksite after improvement: light walls, improved lighting conditions and workplace atmosphere; clean windows and well-maintained light sources help to increase lighting.



Figure 10. Present situation: no chairs or stools for occasional sitting in different parts of worksite for workers to rest; workers not allowed to sit during working hours.



Figure 11. Present situation: painter's area clear but no suitable space or light; no personal protective equipment.

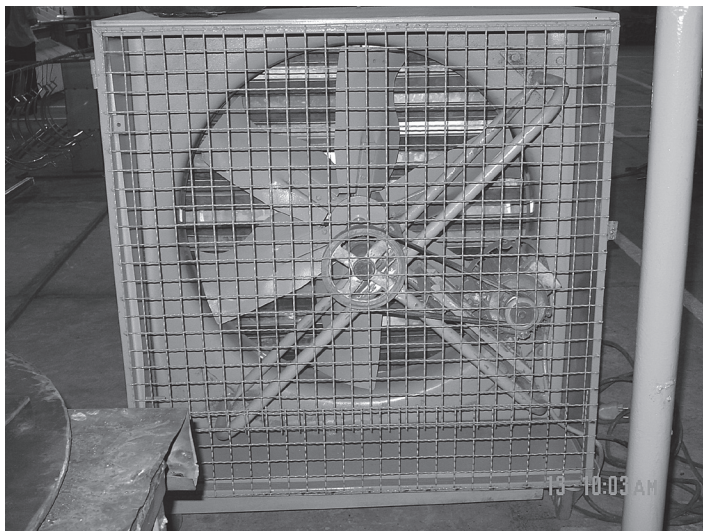


Figure 12. Improved fan.

The results of the observations from the workstation, based on the video recording, photographs and the action plans, indicated a need for improvement (Figures 6–12). The recommendations for the worksite were as follows: improve workplace air, provide suitable lighting, clean windows (well-maintained light sources help to increase lighting), provide chairs and stools for occasional sitting in different parts of the worksite, make it possible for workers at the worksite to enjoy improved working conditions and welfare facilities, minimize manual material handling of loads heavier than 10 kg, arrange the production line better after the first improvements and provide a training programme and encourage workers to participate in it.

After 2 months, the head of the division reported that no- and low-cost changes at the workstation positively affected productivity. As a result the capacity of their production increased easily. Other heads of the division confirmed this increase in capacity and in the number of orders. They were increasingly satisfied because more machinery and equipment were built for poultry farms. The top management rewarded the personnel of this division (3 foremen and 32 workers) with 2 months' extra salary.

The group (44 people) agreed to work according to the work and moral charter, which consisted of 15 topics developed by the participants. Then, as a result of the meeting and in response to the question of how the checklist could be used in all divisions, an intervention team was formed to apply the checklist in all the divisions. Nine AGs were formed together with a SC for the three companies, with all 44 people involved. One of the top managers became the SC's head. Thus, the trainers were divided into 9 AGs consisting of 4–8 members from different sites. There were 9 AGs because the situation was different in different areas: (a) mother stock farm, 6 people; (b) mother stock farm, 4 people; (c) after-sales services, 4 people; (d) chicken factory, 8 people; (e) mother stock farm, 4 people; (f) Rasht office, 5 people; (g) mother stock farms, 4 people; (f) machinery and equipment for poultry farms, 4 people and (i) parent stock farms, 5 people.

A SC consisting of 10 members was also formed to supervise the AGs' activities. Members of the SC were selected in a participatory process by the participants of the second workshop. The SC consisted mostly of heads of divisions.

The AGs of each division were responsible for spreading the checklist information to the employees at their division and creating a participatory environment for employees' involvement. An interval evaluation committee was also established after the workshop to assist the AGs in matters of their activity and of the SC. One of the facilitators participated in some meetings of the AGs and the SC to help manage the project and form external evaluation. The SC's and AGs' responsibilities were discussed with the group and the following were suggested: setting policies and administrative procedures for their activities, interacting with AGs and documenting the progress of the project, promoting AG activities, reviewing and approving AGs' plans for ergonomics implementation, supporting and confirming AG activity plans (time, place and budget); evaluating AGs' activities on a regular basis and designing rewards and systems of motivation for AGs.

Furthermore, the AGs were responsible for training employees at their workplaces on the usage of the checklist and ergonomics checkpoints [2] as well as for creating good conditions for employees' involvement in workplace improvement. They were further responsible for (a) evaluating each workplace using an ergonomics index that was an adaptation of the Finish ELMERI safety index calculated as a percentage of all items in the checklist (seven topics and a total of 128 items). This index can be calculated for each part of the checklist to identify the major sources of problems and ergonomics bottlenecks in the workplace [39]; (b) implementing the project proposal after the SC approved it; (c) evaluating the progress of their own activities (i.e., both group members' and the group's activity) on a regular basis and (d) spreading ergonomics knowledge at their worksites by applying the ergonomics checklist and creating ergonomics awareness and participation.

The facilitator was responsible for ergonomics awareness building, project monitoring, evaluating and assessing the activities performed, providing support, developing research plans and assisting in network building.

The participants said three issues had to be discussed: planning, organizing and controlling. They also said that the company’s activities and related problems depended on one another. They decided that the problems should be surveyed in two separate but related groups, so that they could be surveyed and understood better. The heads of divisions followed the participants’ suggestion.

In the first meeting the heads of divisions replied to the question why these meetings should be held by the heads of divisions. Thirty-one good reasons were expressed by participants, e.g., to analyse problems related to the market, to take advantage of the experience of individuals and units, and to provide group support to promote one another’s capability through close interaction. Some criticism was made against the company: there were no intermediate positions of managers in the company (production management, financial management, technical management, etc.). At the same time, organizational tasks were not distinct because the company had grown. Furthermore, the heads of divisions replied to the question how meetings of the heads of divisions should be held. Ten different paths were discussed, e.g., responsibility and authority of each individual in the session should be defined, importance should be given to training and a proper reward and punishment system should

be considered. Then, questions listed in Table 1 were considered by the heads of divisions.

The object of the workshop with all 44 people to develop vision for the companies after 2 months was to learn about the strengths and weaknesses of the organization as well as the opportunities available and the dangers that threaten it. In other words, which aspects should be safeguarded from change? Which aspects can be improved? With those considerations in mind, they conducted a SWOT analysis. Table 2 presents the outcome.

In the evaluation workshop after 6 months, in all divisions, FW participants developed action plans for carrying out the proposed improvements and changes. There were many action plans for improvements in the company. Action plans were regularly followed up after the FW. Most divisions also started weekly meetings. Job rotation and job enrichment were other parts of their activities. Factors considered as positive and contributing to the success of the FW were interested personal and friendly communications, participation, team work, systematic approach, finding cause-and-effect problems in the work system, ergonomics and facilities for learning at the workplace. FW participants’ perspective regarding the receptiveness of managers and experts within the three companies and the overall effects of the FW were considered very positive. Everybody requested a continuation of the workshop and recommended that other employees also participate in such training sessions.

TABLE 1. Why and How Should We Change? (Responses From Heads of Divisions)

Why Should We Change?	How Should We Change?
To progress	Change middle-level managers
To be able to compete	Organize properly
To provide optimal employment of personnel (for personnel to be more efficient)	Recognize points where change is necessary
Not to be left behind in the changing world	Accept criticism
To make the company grow	Create atmosphere of talk and understanding
To use facilities optimally	Delegate authority
To have the company survive, with survival depending on change	Define a suitable style of management in the company
Not to be destroyed due to lack of change in production and sales	Apply technology
	Not speak ceaselessly or admire ourselves

TABLE 2. Outcome of the Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis for the Organization

Strong Points (Capabilities)	Weak Points
Winning a greater part of the market	No Planning
Strong, young and specialized staff	No established (written) programme
Variety of work	No work system
Changeability	No training system
Forward-looking	No strong marketing
Introducing a new breed of chicken in Iran	No separation of project management and production management
Export of chicken	No Organization
Employment of native people and using non-native specialized forces	Centralization
Positive view toward the company	No organizational chart
Humanitarian view toward the individual	No distribution of work or delegation of authority
Supporting services (machinery and equipment built for poultry) from one of the companies	No separation of work possession and capital possession
	No Control
	No evaluation system
	Concealment of mistakes
	No Planning or Organization
	Added pressure of work, in speed and execution
	No job description
	No research activities
	No supporting staff
	No acceptance of criticism
Opportunities	Threats
Creation of a research and development department	Waste and no use of all positive thoughts in the company
Production of competitive high-quality products (standard)	Lack of qualifications of technical specialized forces
Use of foreign training possibilities	Reduction of motivation and productivity
Improvement of personnel welfare	Increase of unhappiness
Participation of people in companies	Creation of informal groups not adjustable to the goal of the organization
Reduction in the risk coefficient of executive work by participation of employees	Reduction of job security
Use of a strong sale/purchase agency in/out of the country	Waste of useful work hours
Quicker and higher-quality services due to the use of technical services for companies	Endangering personnel's physiological and psychological health
Extension and improvement of after-sale services due to the use of the facilities of the technical services for companies	No organizational progress
	Deviation from main policy
	Prolongation of goal achievement
	No optimal use of personnel's capability

Another question discussed was the percentage of the problems solved in meetings of the heads of divisions. Different answers were given in two different responses by each head of division: 100–80%, 90–60%, 50–60%, 55–60%, 50–50%, 90–50%, 50–50%. The average response was 69.28–58.57%.

Different answers were also given on two different occasions (after the FW and 6 months later) by each top manager (the three owners): 80–50%, 50–50% and 60–90%. The average response was 63.33–63.33%.

The participants' responses to the following seven questions and their evaluation of their groups' activity after 6 months were as follows.

1. What is my aim for continuing work in this group and what are the aims of the group? To reduce work pressure, to solve problems by participation, to learn from one another, to engage personnel in decision-making, to introduce innovations, to provide a suitable atmosphere for improving production, to make solving daily work problems easier, to communicate better with colleagues in the workplace.
2. What am I proud of and what is the group proud of? Variety of work and production, friendly environment, satisfaction of performance, feeling of responsibility, low- and no-cost action plans, democratic mentality, more workable solutions, successful group decisions.
3. What is our position regarding the process of ergonomics intervention in our company? Evaluation of organization, potentialities, capabilities, weak/strong points of the organization, a vision for our organizations, good suggestions, positive changes at work, timetable for action plans, participation at work.
4. Where was the group unsuccessful? Where did the group fail? Giving authority to personnel, workers' low literacy and traditionalism, no failure but lack of time, employees' poor financial prospects, workers' low job security, level of work not adapted to old and new workers.
5. What do we need to continue our work? Time, a reward system, good work division, a calm work environment, decisions followed up, a safe and clean work environment, training, more supportive senior management, new individuals and their partnership, executive guarantee for decision-making, specific checklists for worksites, continuous evaluation.
6. What do I want to achieve and where are we going? An open environment for presenting ideas, job security, good quality and quantity of production, more accountability, revenue increase, satisfaction of work, more skill for workers.
7. Describe a successful story of the group. Low- and no-cost implemented activities such as

painting, using a computer networking system, self-evaluation of the positive atmosphere of group activities, election of a foreman by voting, workers finding the result interesting and very desirable, saving time and money in the production process of egg laying in farms, forming a friendly environment (former enemies became friends), ability to do work that could not be done before by participation, positive response to our requests and our proposed solutions.

This information indicated that to be able to assess the participants' attitude and level of motivation as well as their vision, future activities were necessary and expected. The facilitator discussed the information with both individuals and top managers face to face and measures for improvement were taken.

Improvements based on a new concept resulted in a change in the work system. Some covert resistance to change revealed the importance of understanding the current situation. Changing political and economical factors (lack of stability), culture factors (strong stability), habits and working culture is not an easy and straightforward task. More time is needed for the AGs to establish ergonomics tools-oriented conduct at the workplaces and at least a certain time spent with the new method and ergonomics tools.

The results of the work of the planning committee of the heads of divisions were presented after 9 months.

- Conclusion and policy based on data from production; an analysis and evaluation of the results of preparing an annual programme and standards.
- Educational programming; periodic training to increase productivity of all personnel.
- Preparation of an annual production programme; prediction of different needs, quantities and supply strategies for production, separately and per month.
- Production standards; definition of basic criteria for evaluating production factors.
- Quality control; creating a managerial system to avoid inaccuracies and problems in the

performance of the organization and the divisions.

- Programming for a construction unit: list of half-finished plans; doing projects; priorities for half-finished plans of all production units.
- Expansion of activity; expansion of the company's scope of activity and doing new economic and production activities by using potentialities; programming for finances, administration and support (including definition and standards).
- Programming and financial organization; preparing and analysing the company's financial operations.
- Programming and administration organization; setting up a unit for services/legal personnel organization.
- Programming and organizing support; preparing and supplying all services and facilities for all units of the company.
- Programming and organizing internal audits; purveying, assessing, preparing an accounting report and other controls related to activities of one economic unit by auditing unit personnel.
- Programming the sales and support services unit.
- Creating moving services of a technical team.

The emphasis was on taking advantage of local skills and resources as well as on appointing intermediate managers for the company in the future. Most divisions designed and formed top charts for their organizations. This process promoted the role of experts and foremen/forewomen in the farms and better communication-building in the companies by participation. They formed an interval network and better distribution of information for the companies.

In a 4-hr meeting with top managers, the heads of divisions presented their success stories and their plans that were achieved after a year's effort. The top management discussed the implemented projects and gave feedback.

5. DISCUSSION AND CONCLUSIONS

On the basis of the results of this project, the following arguments can be made.

1. A shared vision and a programme for change developed jointly by employees and management were vital for a successful change in the management [40]. The FW can be used with good confidence at the beginning of a change process, in terms of action- or vision-driven change [41]. The FW is a usefulness tool for creating ergonomics awareness and developing a process for change [34]. It is a useful tool for an ergonomics intervention programme [15] for introducing changes at workplaces, when the management needs to plan change at the organizational level. In this study, the FW technique was used as a point of entry into participation. This made both management and employees recognize the benefits of employees' active and direct participation as well as of sharing information, knowledge and power at all levels of the organization. The theme of the FW was formulated according to existing needs in the work system, which were determined by participation as organizational behavior. The improvements resulted in better running and changes in organizational and managerial functions (including planning, organizing and controlling) and designing new top charts for the organization and the divisions. This made better utilization of the companies' resources possible. For example, through a matrix structure of the planning committee and participation of AGs, the heads of divisions prepared and presented their plans after 9 months.
2. Top managers informed the facilitators in the first meeting about the general problems of their companies. Planning for change was the most important issue indicating dissatisfaction with the present state and articulating a desired future. People from all divisions of the organization were involved in the planning process rather than

a single entity or a group. How long the top managers were ready to put time and effort on this project was a challenging issue for the facilitators, though. The project required more time allocated by the top managers for meeting and discussing both with the project facilitator and with the employees participating in the project. Subordinates of some divisions were also more powerful in terms of decision-making than those of others.

3. After 6 months, the problems which were solved by the heads of divisions within their regular meetings were improved by 10.71% (58.57–69.28%). This was the result of improved responsibility and authority throughout the organization from the heads of divisions to the personnel of the divisions. However, between the divisions there were marked differences. Some emphasized participation more than others, showing significant managerial change. In other cases, the division head acted as a powerful leader, which the subordinates accepted. After 6 months of the FW, the top managers' responses to the situation did not change on average (63.33 and 63.33%). Furthermore, the top managers differed in their response towards the FW. One of the top managers who was more engaged from the beginning of the project expressed more satisfaction regarding the current organizational situation and improvement of employees' competence. Furthermore, the participants of various divisions did not observe any conflict of interest in their workplaces.
4. Practical support for applying the checklist was also important. The results of the second workshop indicated that participants could learn from one another by using a holistic learning method. They managed to create ergonomics awareness at their workplaces and conducted many small projects with the checklist, such as improving the production line, materials handling (clearing and marking transport routes), lighting, machine safety and workstation design. There were small successes that provided ways to learn new skills and learn more about their jobs, to think systematically about other ways to create good ideas and improve the workplace by team work and using the checklist. These small successes and learning from practice and observations motivated them. They were interested and established an ergonomics intervention team that included the SC, AGs and a facilitator team.
5. The role of the heads of divisions and forming the intervention team. The process of ergonomics intervention is complex and requires organizational intervention [14]. According to Siegal, Church, Javitch, et al. [42] it focuses on managing the transition state, using transition management teams and senior management to help move forward and engage in activity planning. Furthermore, importance of communication, leadership and emotional components for successful change is highlighted [43, 44]. Thus, the role of the heads of divisions in forming and contacting AGs and the intervention team were important for planning effective change in the organization.
6. The SWOT analysis of the organization by participants helped them to gain a better understanding of the situation of the work system and to determine which areas required problem solving and which ones required promotion. The tasks of the modified ergonomics intervention programme were limited. The ergonomics intervention programme was the result of the problem solving process, which could be achieved through workers' and managers' participation and utilization of human resources and through increased motivation of the employees [14]. Furthermore, this was needed to build a suitable vision for the organizations.
7. For a successful application of the developed solution, management commitment and employees' motivation were important. One of the top managers participated in the project from the start. He was more committed to the project than the other top managers who did not participate in the whole project. At the start of the project the top managers

- promised to participate with the facilitators every 2 weeks or every month (depending on their time) in a reference committee. That did not happen regularly, though.
8. Attention paid to the work and moral charter was a key point for support and a good guideline. Workers were more in touch with one another, had more respect for one another and had suggestions for each problem or criticism. They found that coworkers were not a problem but a supporting resource; they understood that not all problems were managerial problems.
 9. On the one hand planning for change considered “the causes of change in organizations, articulation of the vision, how to get from the present to the future desired state and remove the barriers for effective transitions” (p. 58) [42]. On the other hand, ergonomics awareness building required ergonomics training, ergonomics application and evaluation [15]. The best way to use an ergonomics checklist is to use it in AGs. The participants discussed the results of the use of checklists. According to Kogi, it is better to plan the use of a checklist jointly and then to apply it in the form of a joint inspection or joint walk-through round [45].
 10. The present study was an attempt to create ergonomics awareness among managers and workers of three companies in Iran. It showed that a top manager’s commitment was particularly important for the success of the project. The outcomes of the strategic programmes indicated planning change and improvements in the company. The key issue for improving the existing conditions at the workplace was to educate people to be competent in using ergonomics knowledge and practice [46]. Thus, to build ergonomics awareness and to provide a continuous learning process in the whole company, it is necessary to have more ergonomics intervention programmes [15] or to use ergonomics tools through workers’ participation in different workplaces.

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