

## SHAPING THE SOCIAL AND WELFARE SECURITY IN INDONESIA THROUGH IMPLEMENTING MACRO-ERGONOMICS

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Ergonomics as a scientific method was familiar in industrial regimes. Its trajectories have rapidly grown up to multiple dimensions in which the socio-technical aspects are inherent. Since ergonomics has promoted a new perspective in view of the relationships among the man-machine-systems, it has brought the remarkable progress compared with mono-spectrum in a mechanistic perspective. In the case of Indonesia, the functioning of ergonomics is urgent as the national productivity level is still less optimal. Since Indonesia has no established policies in societal life quality empowerment, it is important to overcome the insecurity on social welfare for securing sustainability. Since the ergonomics philosophy has promoted a humanity perspective in the country, it is necessary to use it as a means of enhancing productivity in order to achieve societal prosperity. Nevertheless, shaping the social prosperity by counting on ergonomics is insufficient, the development of policies and strategic plans should be addressed by identifying existing mapping of the roles of stakeholders in multiple perspectives. This paper is focused on describing ergonomics-based foresight and its prospectus for shaping the social and welfare security in Indonesia by analyzing its roles in social development.

**Key words:** social welfare; macro-ergonomics; Indonesia; socio-technical systems; productivity.

### INTRODUCTION

A review of the Indonesian development at the end of the 1960s revealed some of unanswered questions as to whether we have successfully achieved the means of developing its prosperity. It is of interest to know what we have obtained over the last 40 years in national development and how we did its development. Achieving prosperity is certainly constructed by the development process itself. In the early stage of the new order regime, the economic growth addressed the issue of development paradigm where the stability of national security has served as its backup. During the last 30 years, development trajectories clustered through four phases characterized by economic liberalization, oil booming, industrial policy changes and the development of high-technology industries. The success in the economic growth based on manufacturing industries has developed Indonesia to become part of tiger economies of Southeast Asia. Most these experiences were assessed as a miraculous achievement in the previous era until the economic crisis in the middle of 1997. This crisis raised the awareness that the national economy is less powerful than imagined in the previous times. Further, there still remain many problems that need to be solved such as insecurity of social welfare and prosperity. It is believed that prosperity can be secured only through enhancing productivity performances, whereas there are a number of constraints that need to be addressed.

Previous experiences show that the improvement of productivity performances has been achieved in various ways often with negative impacts such as exploitation of employees. In contrast,

Japan and other OECD countries have been successful in achieving prosperity through high productivity performances. We should note the close relationship between social welfare security and productivity enhancement. Improved productivity performances have obviously been influenced by the quality of workers' skills. It is of interest to study the ways and means of implementing ergonomics principles for shaping social welfare security. Attention is drawn to the roles of good incentive policies and their instruments reflecting these principles.

In relation with the enhancement of the productivity rates in Indonesia, macro-ergonomics has good prospectus as an alternative solution. Nonetheless, since macro-ergonomics is still new in Indonesia, one might see it as 'too simple things' by counting on the ergonomics perspective only, while it is only a subset of disciplines. On the other hand, we need to look at the experiences in implementing the new technological framework in Indonesia as most of them failed by the influences of multiple factors such as socio-cultural factors. Then, it is important to examine how to build macro-ergonomics into our social-welfare policies. Based on this background, this paper focuses on describing the macro-ergonomics foresight and its prospectus in shaping the social welfare security in Indonesia in the perspective of scientific and technological studies.

#### *Ergonomics and scientific management*

Ergonomics has been known as a scientific discipline to analyze working system performance. It has grown altogether with the scientific management since the early 20th century in industrial fields. Now, its growth has progressed up to have a multi-dimensional perspective in macro-ergonomics. As the ILO (1995) has indicated that workers' skills have contributed significantly to productivity growth, it is essential to encourage investment in people ('human capital').

Taylorist scientific management is predominantly associated with a technology-centred system, as it seeks technological solutions which minimize dependence on unreliable human elements (Ennals and Molyneux, 1993). Frederick Taylor intended to bring the workers closer to management and developed the four principles of scientific management (scientific development of work practices, scientific selection, individual training and co-operation). He believed that each job could be broken down into simple, basic elements, and an accurate control of those elements through time studies would ensure higher output and better compensation for workers (Paez et al., 2004). However, Peters and Waterman (1986) views Taylor's approach as one that treats workers as robots. In addition, according to Mayo (1949), "Taylor's 'time and motion' ideas were adopted throughout the Western world, without considering the true objectives of scientific management. Most managers saw their goal as achieving maximum prosperity for the employer, but gave little thought to the workforce."

#### *Socio-technical systems*

The study of socio-technical systems was inaugurated at the Tavistock Institute, and the term was first used by Trist and Bamforth in 1951. The idea was strongly influenced by Bertalanffy's open systems theory (Mumford, 1987). The open system deals with sustaining congruence among the organization's subsystems and between the organization and its larger environment (Bertalanffy, 1956). Socio-technical systems theory is a framework for studying how social and technical systems interact to affect organizational performance (Majchrzak, 1997). It is devoted to the joint optimization and blending of both the technical and social systems of an organization (Fox, 1995). The technical subsystems refer to the equipment, facilities, methods, programmes, procedures, etc. that transfer input into output, whereas the social subsystems refer to the set of members of the organization acting in their roles, relationships, authority structure, communication structure, learning mechanism, etc. (Majchrzak and Roitman, 1989).

Furthermore, a set of principles for designing socio-technical systems was developed by the Tavistock Group to be an aim and a checklist for organizations (Mumford, 1987). Chens (1987) summarized these fundamental concepts into the following nine principles: compatibility, minimal critical specification, variance control, information flow, the multifunctional principle, boundary location, power and authority, support congruence and transitional organization.

### *Science-Technology-Society (STS)*

Social construction of technology sees that the technological trajectories as contingent or an accidental process. The technological changes have not been analyzed as fixed or linear trajectories, and further, they have not also been explained by the technological or economical perspectives. The technological changes have been explained by referencing them to a lot of technological controversies and conflicts in which multi-actors and the various relevance social groups are involved, each of the actors having their own technological frame. Those multi-actors have been involved into strategic arrangement in achieving their own goals by shaping their relevance to technological frames in their planning. Figure 1 illustrates the technological frame in science and technology studies.

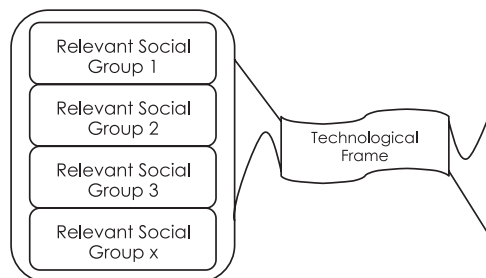


Fig. 1. Technological frame views (Bijker, 1995).

- Societal knowledge production seen as network processes between governments, businesses, users and consumers, knowledge institutions and institutional actors such as business, environmental and consumer organizations (Gibbons et al., 1994).
- Innovation theory about processes of stabilization and transition in innovation systems, including theories related to path dependency, path creation, sustainable transition and development arenas (Karnøe and Garud, 1998; Rip, 2003).
- Research and development processes seen as socio-technical processes shaped by actors' ideas about the future and by their actions, where persons, technology, etc. consciously or unconsciously are given roles in research, innovation and future use of a technology. Theories about actor-networks, laboratory programmes and techno-economic networks are used (Callon, 1991).
- Environmental assessment organized as social and scientific processes by using methods like life cycle assessments and chemical assessments and methods of dialogue-based environmental assessment, where the focus of the environmental assessment is shaped in interaction among actors (Bras-Klapwijk, 1998).
- Governance of science and technology as policy network processes involving many different stakeholders (Schot et al., 2001).

## DISCUSSION

Implementing the new technological frame in Indonesia has met with much of failure experiences in its diffusion process. There is a significant finding in recent research (Evers, 2000) that most of these projects have been undertaken without considering their pre-condition requirements such as social-cultural aspects. Further, this has become an obstacle for the government and some of multinational corporations in running their programmes. In discussing the macro-ergonomics as the driving force at policy level for shaping distinct social-welfare security purposes, the similar situation will be met in its implementation. Therefore the pre-condition analyses should be first conducted in its process .

The discussion will be clustered into two major sections. The first section is focused on describing the existing insecurity, productivity performances and the worker skills empowerment in

Indonesia. At this section, the roles of ergonomics in the change prospectus and mapping of tentative models for analytical frame will also be discussed. Then in the second section, the pre-condition requirements in implementing ergonomics artifacts into the policy level will be discussed. This section will be focused on analyzing ergonomics growth trajectories by identifying much of relevant actors that have influenced the constructing process.

### *Insecurity and productivity*

The insecurity of social and welfare framework in Indonesia has been influenced by multiple factors of poverty such as [1] lifecycle risks, [2] economic risks, [3] environmental risks and [4] social/governance risks (Jørgensen et al., 2005). The accomplishment of these complications needs a social protection recovery, where five elements are involved such as [1] labour market policies, [2] social insurance programmes for health, disability and work injuries, [3] social assistance and welfare for vulnerable groups, [4] micro-area based programmemes for community vulnerability and [5] child protection for future workforce (Cuyvers and Rayp, 1988; Callison, 2002).

Based on these parameters, it is shown that the relation between the social-welfare security constructions and the workforce productivity is tight. Further, the standard economic growth theory explains that in the long run output per worker (productivity) is determined by the rate of investment in capital and by the efficiency of labour (ILO, 2005), i.e. workers' skills for utilizing the capital. Investment in capital has three functions: (i) to replace that part of the capital stock that is consumed during the production process; (ii) to increase the capital stock to supply additional labour with a sufficient capital base; and (iii) to ensure the use of latest technologies in the production processes. Thus, investment intends to maintain the capital stock in line with the "technological frontier". Investment in people ("human capital") aims at maintaining the workforce skills required for operating the capital stock efficiently. It is the simultaneity of investment in physical capital and in human skills that allows for the maximum production of income.

Figure 2 illustrates the relation among these mutually influencing elements into the constructing of the social-welfare security, where the mapping of ergonomics positioning is to show the prospectus of its roles in the recovery process. Since the workers' skills are assumed to be less powerful in

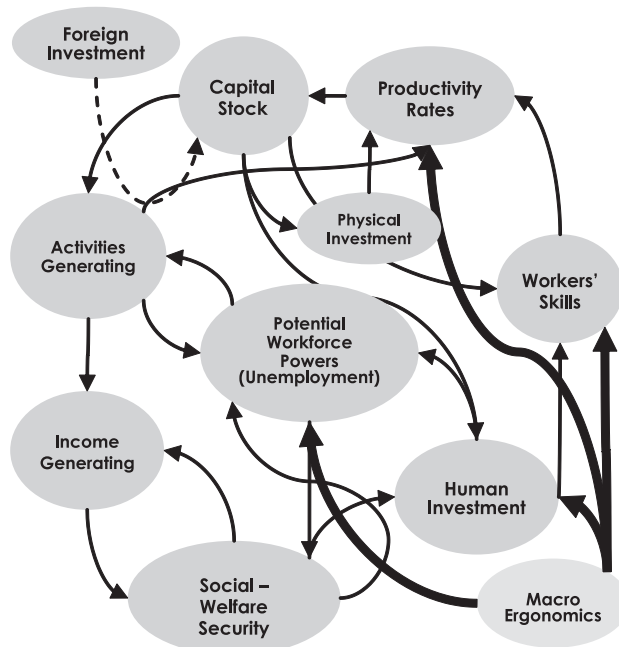


Fig. 2. Causal loops of social-welfare security relations.

productivity growth rates than usually conjectured, they have affected the growth of capital stock itself. In other words, since Indonesian economic growth has been counting on the capital stock reserve only and mostly based on foreign investment, the economic crisis in 1998 has contributed to the collapse of all activities in the various sectors, with the rising up of unemployment rates. Since there were not much of activities in collapsed private sectors and businesses, much of the troubles could be seen in income generating processes. The impact was the insecurity that came as a main trouble. As shown in the figure, macro-ergonomics has roles to play in effective ways in improving the existing situations. This is obviously the case for Indonesia where similar loops can be identified.

### *The productivity performances*

As mentioned at the previous section, economic patterns have significantly influenced the growth of related activities. It is interesting to explore how Indonesia's workforce performances have significantly contributed to constructing the prosperity. By reference to the measuring of total factor productivity (TFP) (Depnakertrans, 2003), it is known that the TFP level has declined during 1993–2002, where one of the most influenced factor was the lack of national capital stock. In contrast, before the coming of the crisis, the TFP level was stable where the most influenced factor was the surplus of capital stock. Here, Indonesia workforce performances are still less productive in its contribution.

Figure 3 describes the growth rates of GNP, workforce, capital and TFP of the industrial sector during the period of 1993–2002. Since 1993, the growth has declined straightly down to the low level in the years of 1997–1998, then it rose up to the normal condition in early 1999. The recovery condition has taken place under President Habibies regimes. It has led to a miracle progress where its downfall in 1998 could be recovered in the one-year period only. Nevertheless, there was a serious decline under the President Megawati period where the reason was the low capital stock investment.

From these conditions, it could be concluded that since its economic growth has been counting on the capital stock by foreign investment only, it has been associated with the low productivity performances. This has proven that communities empowerment in achieving good prosperities is still lacking along the development programmes of the country.

By reviewing the previous policies, we should note that since the early stage of Indonesian development under new order regimes, other influenced factors have driven people into project-oriented mind-set (Laufer and Hoffman, 2000) through the years. Then new cultures have grown in Indonesian communities where project-orientedness has become the first aim. These cultures were not constructive because they contributed to shaping much of opportunist and speculator mind-set. On the other hand, such cultures have also cut away the growth of young generation's creativity itself.

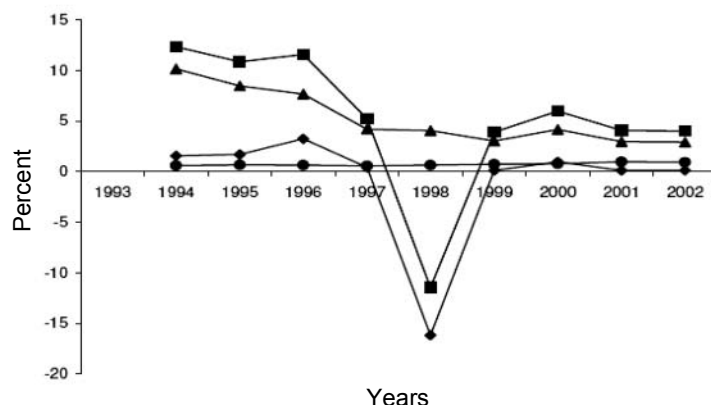


Fig. 3. The growth of GNP, workforce, capital and Total Factor Productivity (TFP) of the industrial sector during 1993–2002. GNP,  $\blacksquare$ ; workforce,  $\blacktriangle$ ; capital,  $\bullet$ ; TFP,  $\blacklozenge$ .

### *The failures in labour market shaping*

Analyzing the failures of social security shaping in Indonesia should be taken by identifying the previous experiences. Since the unemployment rates were higher than employment rates, the unbalancing conditions in income generating have influenced the constructing of poverty, a complex situation in which many multiple aspects are contained. In the strategic planning of national workforce during the period of 2004-2009, it is mentioned that the most impeding in labour market shaping are demographics, capital stock investment, exports protection by developed countries, some of destructive regulations and bureaucracy behaviour. Here, the government has implicitly stated that the most of its failures were caused by the external factors. Nevertheless, less attention was paid to labour market gissues. Therefore, while learning from previous experiences, one of the feasible ways is making human investment programmes as the first priority action. Nonetheless it is not addressed in the temporary programme such as 'Jaring Pengaman Social' (JPS). Further, the growth of the workers competency and capability should be addressed in the sustainable development perspective expected in the programmes. Therefore it is necessary to develop ergonomics as an effective instrument.

### *Ergonomics as 'transaction tools'*

Now, what is the role of macro-ergonomics in the economic recovery process and how to make it functioning? By implementing 'ergonomics' for maintaining the workers' skills and human investment activities systematically (shown in Figure 2), it is expected that the productivity growth rate would be gradually rising, simultaneously affecting the growth of capital stock reserve itself. In accordance with the growth of capital stock reserve, the government should be addressing the opening of new sectors of activities generated both at the industrial and services business sectors in order to distribute the unemployed workforces. As mentioned above, workers' skills have conjectured as main obstacles in the productivity, and therefore the human investment programmes should be addressed as a national priority where 'ergonomics' can contribute as effective tools and as the basic frame in its empirical studies of policy making. Simply, functioning of ergonomics will be addressed in two major areas, where physical and technical systems will be covered by micro-ergonomics while the multiple systems involving socio-technical systems will be addressed by macro-ergonomics. Here, the role of the two areas of ergonomics in the recovery process is to serve as the tools for 'assessing the process of work transaction empirically based on human factors perspective'. Therefore, the regulations and policies should deals with the workforce and its instruments in Indonesia relying on empirical studies in the first place. This should replace the traditional practices where the regulations used to be based on 'law' regimes only without considering the human factors perspective.

Table 1. Ergonomics functioning in two areas.

Scientific area	Functioning
Micro-ergonomics	Physical and technical level
Macro-ergonomics	Complex system and policy level

Therefore, the proper use of ergonomics is expected to reduce some of social-welfare insecurity associated with the unemployment problems. Next, 'the human investment' programmes should be addressed at both the employee and unemployment communities by means of creating and empowering many of existing technical center facilities such as Unit Pelaksana Teknis (UPT) and Balai Pelatihan Teknis (BP) which are undertaken under the Depnakertrans and other relevant departments. These human investment programmes should be funded ultimately by both the government and the corporate itself by implementing corporate social responsibility (CSR) policies.

*Ergonomics existing and in foresight*

After discussing the prospectus of macro-ergonomics, we should then identify what are the pre-condition requirements in implementing ergonomics. In answering this question, the characteristics of ergonomics should be well known in details. The following are some qualitative experiences and actors' opinions dealing with the ergonomics growth. The International Ergonomics Association has defined the ergonomics as follows:

“Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.” (IEA).

This definition implies that ergonomics has both a social goal (well-being) and an economic goal (total system performance), that ergonomics considers both physical and psychological aspects, and that ergonomics is looking for design solutions in both the technical and the social environment.

Implementing ergonomics as the driving forces into policies level is not an easy task. Ergonomics itself has been well known as a subset of a discipline. Therefore, it would be more difficult in its implementing process. One might see it as ‘ridicule’ statement, but here the following arguments and opinions are presented from the experts supporting the active roles of ergonomics. Dul and Neumann (2005) noticed that during the past 25 years, several authors had emphasized that ergonomics had a problem to be accepted in the ‘business society’. Perrow further argued that ‘the problem of ergonomics is that there are not many ergonomists working in companies, that they have no control over budgets and people, and that they are seen as protectors of workers, for example not blaming human errors to the workers but to the designers and managers of the systems’. Hal Hendrick, the former president of the International Ergonomics Association (IEA), wondered “why it is that organizations with their strong need to obtain employee commitment, reduce expenses, and increase productivity, are not banging down our doors for help”. He suggested that there are too many examples of bad ergonomics, that ergonomists –wrongly – presume that others are convinced of the importance of ergonomics, and that the benefits of ergonomics are not well documented. Another former president of the IEA, Martin Helander, listed seven common reasons that ergonomics ‘was not implemented’. He noted, among other things, that people think that ergonomics is to design chairs, that ergonomics is common sense, and that organizations first design the technical system and then consider ergonomics.

In the case of Indonesia, the government does not consider ergonomics to be a discipline that can contribute to the policies and strategies and to reaching business goals like quality and productivity. Nevertheless, it happened not in Indonesia only. As suggested by Dul, it is clear that in the policies and management perspective, ergonomics is an alien discipline that is not embedded in the growth perspective. In contrast, further, it has been more associated with costs such as sickness absences, disorders, pains, injuries, and the labour inspectorate. Ergonomics is not generally associated with organizational effectiveness (Dul and Neumann, 2005). To mention other facts, the government and business communities are not to be blamed for that. A review of articles in 97 business and management journals including popular journals like *Harvard Business Review* and *Fortune*, during a 10-year period revealed that in 90 journals (93%) no ergonomics paper at all has been published. In only 7 journals there were 10 articles on ergonomics topics. These articles confirmed that ergonomics has a limited scope (physical ergonomics). This means that ergonomists rarely write articles in business and management journals.

From its trajectories mentioned above, it can be concluded for a while that the growth of ergonomics has been influenced by many actors who looked un-supported since they have promoted ergonomics in such a social perspective which requires some costs. It is interesting to explore more in ergonomics phenomena where the scientific growth and its applications had been strongly influenced by such political and economical interests.

Figure 4 illustrates the conjecture of its ergonomics growth where it has met with some obstacles from various regimes. The described conditions indicate that it has been impeded by multiple

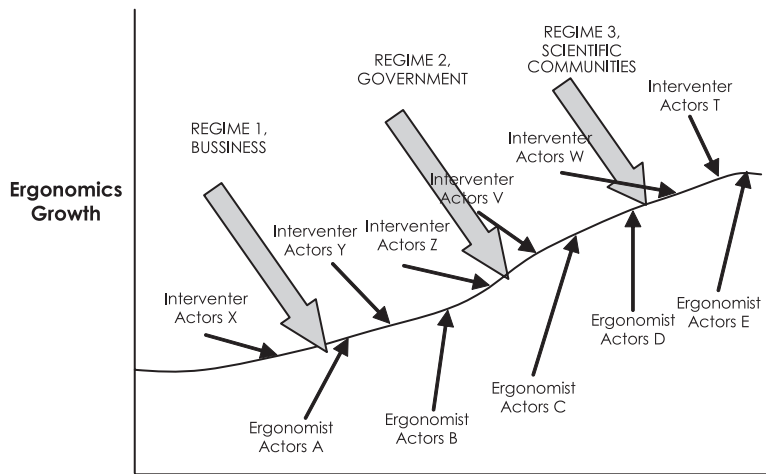


Fig. 4. The conjecture of ergonomics translation.

regimes, which certainly would make the ergonomics growth more difficult. For instance, the Indonesian regulations of workforces such as in UU no. 13/2003 has explicitly eliminated some of the labour rights without considering human factors perspective. Since there were no good empirical studies on policies making as basic references, regulatory measures have neglected labour rights in the human factors perspective. In the case of UU No. 13/2003 in Indonesia, it has become a valuable fact that much of obstacles will be met in implementing ergonomics at policies level.

Other kinds of influences in constructing the un-established status of ergonomics were conjectured of its capitalist mind-set, where 'the profit-oriented' became the ultimate aims for them. Based on the research in KADIN (Pujasakti, 2004), the interview results show that most of the Indonesian entrepreneurs are still far away from industrialist characters in planning and running their business. Further, most of them are running business for long term often without tangible visions and missions. Another finding is that most of them are hardly thinking about investing in research activities. Therefore, most of them occasionally have no ideas in developing new technology and its prospectus. From this finding, it could be concluded that there will be a resistance from the entrepreneurs in developing their systems in 'investing' schemes, and in developing ergonomics, since it has been assumed as costly activities.

By reviewing ergonomics translation experiences, it is suggested that the most crucial thing that should be addressed in implementing ergonomics at policies level is the roles of its relevant actors. In coping with the obstacles, these actors should form alliance with the similar groups. Here there are two things that should be addressed in establishing ergonomics as pre-condition requirements. The first is making the macro-ergonomics as an autonomous scientific knowledge such as in other popular scientific disciplines (economics, physics, etc.), and the second is making alliance among these relevant stakeholders by political action.

In order to make an autonomous development of ergonomics, some of instruments should carefully be assessed first, including the growth of scientific studies in the global frame and there should be an effort to recognize ergonomics as an autonomous knowledge area in formal institutions (schools and academic institutions). We should collect much of relevant literatures in the multi-disciplinary perspective, and therefore it is expected to become a new and original knowledge base. One of the most crucial things in opening of new schools in Indonesia has been the graduate market. Since it has become an obstacle, it is important to recognize the roles of ergonomics for multiple stakeholders such as the government, NGOs, private sectors and fishing and agriculture communities. Therefore, the diffusion of ergonomics activities into public communities should be promoted in a smooth manner.

In the alliance process undertaken through political actions, the socialization of ergonomics



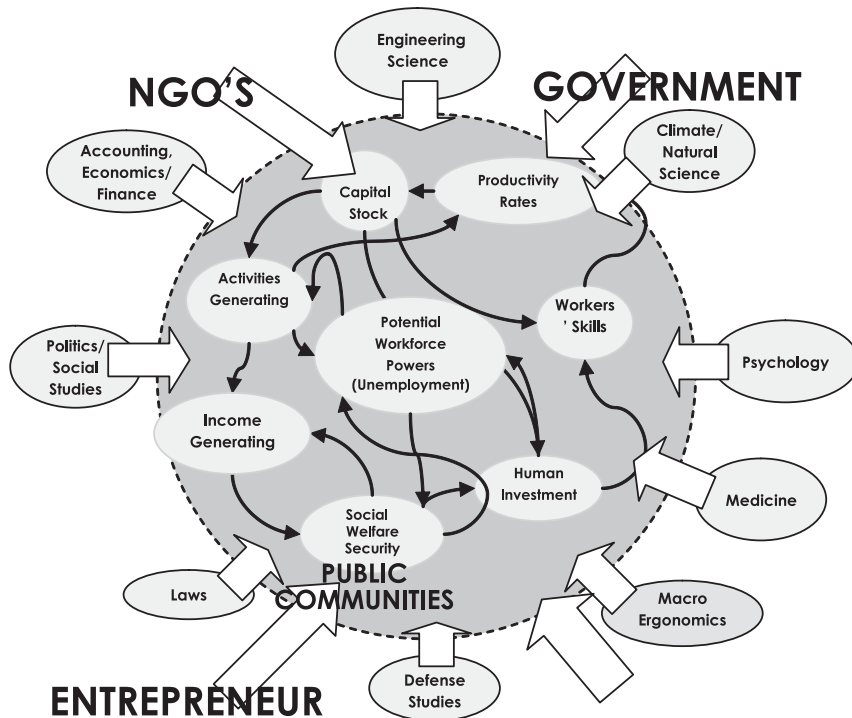


Fig. 5. The prospectus of 'ergonomics autonomous' in its contribution toward social-welfare security.

should be addressed as a national priority with its influences taken into the social-welfare security domain. This collaboration must be supported with some of responsible proofs with empirical facts in all relevant communities such as labour unions, NGOs, governance, legislation and entrepreneurs.

## CONCLUSION

Since the national productivity programmes have been weak, the decline of capital stock has influenced activities in enhancing generator effects in private sectors and corporates. The low productivity rates were indicated by workers' skill performances. Nevertheless, raising the workers' skill performances is necessary. Therefore, one of the feasible ways is to implement macro-ergonomics as a solution. By its characteristics, it has good prospectus for controlling work transaction activities. Nevertheless, from these findings mentioned above it can be assumed that foresight of ergonomics has often met with uncertainty conditions since its growth experiences has encountered many obstacles. The most significant finding is that the political factors have influenced its growth. Here, it can be concluded that the growth of scientific studies are influenced by many multiple actors along its trajectories translation. While the obstacles come from both the entrepreneurs and the government itself, it also comes from its scientific communities (Dul and Neumann, 2005). The most feasible way to implement it at policies level is by shaping the alliance of multiple stakeholders. The strategic progress is made by promoting ergonomics as an autonomous scientific knowledge such as economics, psychology and policy studies in multidisciplinary perspective and by translating it iteratively so that it should be constructed as an original discipline. Socializing ergonomics science in the public areas could be accomplished by opening the ergonomics field as a recognized discipline. The most crucial thing in opening this school in Indonesia is to create the market of its graduates. Making the alliance with the multiple stakeholders such as the government, private sectors and NGO communities will allow us to promote the diffusion process of its discipline into their practices. Then, the dif-

fusion process will generate the growth of ergonomics needs in Indonesia. In the end, if this has been done, then the implementation of macro-ergonomics in shaping 'social-welfare security' will soon be put into practice.

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