

Ecological Sustainable Industry Development in the Machinery Building

Ioan Ghimbaseanu

Abstract: - The application of the sustainable development principles in the machinery building industry, in Romania, during the transition period is necessary and opportune. This is the reason why the assignation of some priority domains, as part of the different industrial branches is benefice to the national programs meant for research orientation and for the allocation of resources. In the present paper is presented, in an extent background, the sustainable development concept and the particularly elements that characterized the machine tools building industry which is a remarkable share component in economy field. There are pointed out some solutions of approaching the specific activities of the machine tools building and usage. The paper approaches the problem of the treble dimensioning of the working machines functions – technical, economical, and ecological – and to establish an optimal relation between these. There is prefigured a new orientation for the machine tools research – design activity, in the relation to the life cycle of these, in the prospect of the sustainable used of the resources.

Keyword: - sustainable development, ecological design, machine tools, technologies.

I. INTRODUCTION

The economical sustainable development which is a relatively new concept, appeared after the Second World War, underlay a growth model that meets the consumer needs of the present generation without compromising- or prejudicing - those of the future ones.

After during the '70s when the world scientific community observed that the traditional model of economical development is affected by serious energetically, social, ecological and other problems, there were put forward new variants for the growth models that should correct the shortcomings of that was practiced before. All of them had as main objective to determine which is the way that the development process should follow, to assure the use of Terra's resources to pleased the whole world and, in the same time, to avoid the risks that could appear if some of them will be petered out or others' penury. These models approach this subject between two limits delimited either by an optimistic development diagnosis or by the skeptical, fatalist alternative. In his first study, "The growth limits," the Club from Rome offered a solution to solve the severe effects of the traditional development, so called "zero growth strategy."

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The model, which is based by a mathematical one proposed by the Jai Forrester, wasn't approved by the economical great powers because, according to the opinions unanimous accepted at that time "any theory is good if it propagates the end, closing the angle of the world natural evolution." However, the paper was able to draw the attention on the "unlimited development" consequences if there is no correlation between this and his resources. It follows other growth models among which it was remarked that one of the limited growth, followed by the fourth report of the Club from Rome, entitled "Let's get out from the waste epoch" that chooses a sober economic development, promoted with measured sense and that of the time that we lived.

The following evolutions, [1], [2], pointed out that even in these conditions, to approach the development upon only one sovereign criterion – the profit – doesn't resolve humanity problem on the long term. The paper takes into consideration the environment as main supplier of resources during the development process and as unique support of life. Under the circumstances there were delineated the new concept, that of the SUSTAINABLE ECONOMIC DEVELOPMENT (s.e.d), which found the consecration in the "Our common future" report of the Independent World Commission for Environment and Development and was adopted during the World Conference from Rio de Janeiro in 1992. The sustainable economical development supposes a new attitude relative to the environment, the change of the relations between human being and nature and that means a new ratio between the two entities, an equilibrium, and harmony between them. S.e.d. can't be limited only to the economical growth and to the environment quality insurance, but it has to include the development of a favorable medium for solving the social problems with which an individual and the community confront. The development, under the present circumstances, can be sustainable as far as the interaction between the above-mentioned components is focused on human being and on satisfying his needs, because he is the main protagonist and the final addressee of the ecological process, but of course under the dictum that says: "the environment is everything including the human being..." [1].

II. THE MACHINE TOOLS INDUSTRY-PRIORITY BRANCH OF THE SUSTAINABLE DEVELOPMENT

The machine tools, as main producers of the capital goods, needed in the economical growth programs, had – and still have – a very important role as part of the development process. Till now their conception and the design had on the base two dimensions to whom were

subordinated all the others components of their manufacturing:

- technical;
- economical.

and the criterion of their operation efficiency was that of the maximum profit [3]. On the one hand, the interaction between their manufacturing and their operation, and the environment, on the other hand, had never been a main criterion in relation to the design.

The level of their production and exploitation and the intensity of their operation with a view to product new capital goods, which satisfy good enough the social need, did not generate satisfactory effects that could make the producers decide to change their products projects in this field. The effects were situated, with some exceptions, in the environment tolerance limits, so that the men of science warnings in relation to the serious consequences of the machine tools development using an unique criterion, that of the profit, on long term, were, in most cases, ignored or took into consideration only on a formal way. On the other hand, there is little information about the relation machine – environment determined the appearance of the idea that the machine tools have a minor influence on the environment so that it could be ignored. Latter researches but especially the phenomena that never appeared till now – the energy and materials resources penury, the degradation of the natural environment and so on – marked out the falsify of this conception. In the papers [2], [5], [7], there are presented some of the effects of the traditional

The increase of Terra' population to more than 6 milliards of people and their wish of having a standard of living as high as possible, will increase the influence of each factors that determine the satisfaction of this desiderate. Accordingly to this, it should be reconsidered also the producing means of capital goods so that the noxious effects of their manufacturing and operation could be reduce to minimum, because, on medium and long term, these will increase proportional with the demographical growth and the certitude of the severe effects on the environment it should not be necessary to be proved because according to the first law of the ecology “everything is interconnected to everything”. [1], [4]. Therefore the produces of the machine tools industry, in fact as well as all the other produces made by human, should have functions characterized through three fundamental dimensions:

- technical – which should express the performances of the products;
- economical – that should be determined by the manufacturing and operation efficiency of the products;
- ecological – that has the role to mark out the way in which the product – with all his aspects – satisfies the conditions of an optimum relation to the environment.

Only in these conditions, the machines that produce capital goods will satisfy the needs of new concept of the economical development, they will response to the present, and future desiderates of a sustainable civilization.

III. MAIN DIRECTIONS OF THE MACHINE TOOLS DESIGN AND OPERATION PROSPECTIVE TO SUSTAINABLE DEVELOPMENT

The overwhelming importance of the producing means of capital and material goods was completely proved, along the whole social development, by the contribution to the increasing the standard of living. This was possible only after there were improved, varied and produced in a bigger quantity. That is way the powerful industrial countries present themselves in a double hypostasis: as big consumer of machine tools and also as big producer of these kinds of goods.

The continuous increase of knowledge during the contemporaneous epoch allows the improvement of the machine tools in a very substantial way so that now, it could be made so many and so different processing and with effects that could not be thought out a few decades ago and especially in 1789 when Maudslei was improving his lathe – the first machine tools cited in documents till now. These days' machine tools – in the greatest part design with a half or at most a decade ago – include in their structure components and subassemblies manufactured by using the scientific information obtained during the contrivance years and satisfy, in a satisfactory way, some of the users requirements.

However these machines are not ecological, therefore there are not able to respond to the sustainable development requests. In particular, the machine tools produced by the machinery building industry from Romania are part of some manufacturing lots older than those mentioned above, thus that besides the absence of the ecological function there are some technical performances lower than those promoted in the projects of the firms with tradition in this field from power industrialized country, so that becomes necessary to be made both some conceptions improvements concerning ecological point of view and an improvement of the technical dimensions of the specifically functions [5].

For bringing the machine tools, part of the machinery building industry from Romania, to the level required by the sustainable development principles, it is necessary to be taken into consideration two groups of machine tools:

- ❖ the machine that still are in exploitation but whom don't finished their useful life cycle;
- ❖ the machine tools that will be manufactured upon the new projects and which have to replace the existing ones.

The first group has to be modernized and remanufactured and it doesn't concern this paper.

The machines that will be manufactured by taking into consideration projects based on ecological aspects should have on the base a reconsidered conception with the view of life cycle and resources utilization.

Thus, it has to be considered the following stages of the machine:

- the contrivance-design stage;
- the exploitation and improvement possibility in this stage;
- post-exploitation stage.

During the contrivance-design stage, besides the usual steps that should be done, there have to be adopted or elaborated technical solutions that will determine the achievement of the ecological function of the product and furthermore, to make the updating be possible during the exploitation. It is also establish the destination of each component after the useful life cycle ending. A very important role in this stage it could be hold by the putting into practice of the value engineering techniques. Upon this stage are depending the following two.

The exploitation stage should be conceived in such way that the user could obtain – from the machine tools – all the performances provided in the prospect, observing the work conditions, the prescriptions from the technical documentation and the minimum consumption. The novelty elements in the exploitation stage relative to the existing conceptions in the former lots of machine tools, which should be implemented in the project, are:

- the design of some subsystems that after there will be implemented on the machine there will ensure automatic maintenance activities;
- the continuous control of the work parameters and their adaptation to the condition dictated by the manufacturing target;
- the minimum effects of the exploitation upon the attendance personnel and the environment;
- the ability of being easily modernized if this is necessary during the exploitation stage of the machine tools.

The above requests were in fact desiderates of the contrivance and design also for the machine tools from the lots manufactured one or two decades ago.

There were not achieved either because of the lack of needed scientific information and the existing technical possibilities or because of their totally subordination to the economical criterion, being took into consideration only the exploitation effects on short and medium term. The results of some machine tools manufacturing upon the projects that didn't design them on those functions that can made them respect the above requirements are characterized by some variants that are very difficulty to be use and also uneconomical.

These machines, through their exploitation effects, determine a very high energy and materials consumption, increasing the risk that such exploitation represents on long term.

Therefore, during the contrivance-design stage it is necessary to be found and implemented, as part of the project, those solutions that make the exploitation be possible only if there are accomplished those conditions that satisfy the above requirements.

The post-exploitation stage analyses the machine after the ending of his life cycle regardless if it was modernized during the exploitation or was used as the producer manufactured it. At the time of the machines life cycle ending not all their components lost the usefulness. Although some mechanical components have a lower wear degree and they fit in the normal exploitation parameters, there are submitted to the same regime: there are abandoned and remelted.

The impossibility that the dimensioning of all structure elements of the machine tools be made so that their exploitation period be the same, determined that some of these be designed by taking into consideration only the criterion of attributions pursuance, functions that they have in the assembly in which there are used and ignoring the aspects with ecological effects.

A very clear example to prove these facts is the bed frame. That the bed frame could accomplish the functions, which it has, as part of a machine tools, it is designed – at least using the present knowledge – to have a high stiffness and dimensions that allows assembly of the component machine subassemblies on it. In these conditions, result very large buildings on the bed frame, capable to satisfy the technical conditions required by his functions, but with a high material consumption and a weight that exceed with 50-80% the whole machine weight.

On the other hand the papers [5], [6] disclose that the bed frame is a structure component of the machine tools, which, at the life cycle ending of these, have a low wear, insufficient to become necessary to take them out from their functioning parameters. However, at the life cycle ending of the machine tools, their frame has to follow the same steps as the components that wore over the admissible limit and depleted their reuse resources. The same remarks are available also for other elements from the mechanical structure of the machine tools: housings, supports, some axles and so on.

The design of those structure elements of the machine tools that don't lose their utility at the same time with the life cycle ending, taking into consideration the new concept of design, does not satisfy the ecological condition.

These elements, even if they are still able to be useful and take in important quantities of energy and materials resources and also human effort, are considered culls and sent to resmelted. All the consumes and the effects of the manufacturing beginning with the smelt metal stage to the mechanical component one, upon the environment, will be reconsidered by taking into consideration the predictable economical and environment consequences.

The post-exploitation stage of the machine tools, settled during the contrivance-design one, has as main purpose the capitalization of the utility potential stocked into their components and has as finality an economy of effort, financial and human, but especially the decrease of the resources consumption that is directly correlated to the conservation of the environment equilibrium, the main development supports.

IV. CONCLUSIONS

- The concept of sustainable development appears as a necessity during the evolution process of the human society, regarding all their components and has as main purpose the social requests desires in correlation to protect the environment;
- The machine tools as main producers of the capital goods, concur to the continuous demotion of the environment, the redesign of them becoming a

necessity because their noxious influence must be minimum;

- The redesign of the machine tools, in the spirit of s.e.d, is necessary and possible only in the conditions in which during the stages of contrivance and design will be take into consideration either the technical and economical condition, as it was done till now, or ecological ones, according to the environment laws;
- There can be conceived methods and solutions for the machine tools optimization, from ecological point of view, so that these satisfy – in the present knowledge conditions – the requirements of the economical sustainable development.

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