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The Structure of Labour Process  
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### Abstract

Our object is to give a rigorous and systematic conceptualisation of Labour-Process which could provide a definite view point or approach to the study of evolution of social technology. Our starting point for this purpose is the basic Marxian view of Labour-Process. In moving towards this conceptualisation, the material structure as also the social element is clarified. Labour-Process is conceived as a unity of three elements: control, operative-mechanism, and motive-force. This unity provides us with an approach towards certain issues in the evolution of technology.

\* This is a substantial revision of an earlier draft, "The Structure of Labour-Process and Evolution of Social Technology: An Exploratory Essay". Content of this paper was the material for a series of lectures at the Centre a few months ago. I gratefully acknowledge the benefits I received from the discussions during the lectures.

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1. Introduction and Outline

Our basic objective in this study is a conceptual development of Labour-Process (LP henceforth) from where Marx had left it off, thereby taking some steps in the direction of development of a whole subject of study with its foundation in labour process. This subject corresponds roughly to "forces of production" in the Marxian scheme. More explicitly, and more academically, we may call this the study of "social production at the material level".

This programme is clearly implicit in the way Marx introduced the concept of LP in Capital Vol.I. But the focus of Marx's analysis was centred around social evolution, and for this purpose Marx used the much more comprehensive notion of "modes of production". Though such an analysis has enriched the concept of LP it has not contributed much to the development of the concept itself. More or less similar criticisms can be made against Marxists all of whom have confined themselves to the notion of modes of production. Thus the concept of LP as introduced by Marx has remained in an "embryonic form" and it provides only a rudimentary basis for the programme envisaged above. Hence it is necessary to attempt a further development of the concept itself.

Now any development of the concept is to go behind the concept, i.e to view the concept in its proper context, in its proper background or to

place the concept in its complete 'wholes' to which it belongs. Any such placement ultimately has to derive its impetus from a definite view point which opens up the concept from within thereby revealing the internal structure of the concept so also establish definite relations with its outside. This essentially means bringing out definite distinctions between components or aspects of the concept thereby opening the road for moving inside the boundaries of the subject erected upon the concept. With this definite problems in the subject of study may be viewed from the 'conceptual frame' provided by the logical structures of the concept, as belonging to the internal or external relations of the concept. This, in a sense, sets the methodology of our approach.

It is necessary at this point to qualify the above arguments with a statement to the effect that the concrete nature of our subject adds a dimension of historicity to all our concepts. With this, all our concepts become historical concepts and all the relations talked about earlier come to represent historical development. In particular, the problems within the boundaries of our subject reduce to the viewing of particular structures within the conceptual frame of labour process, itself a historical and evolutionary notion. By this process, in the end, the whole of the subject reduces to the study of evolution of labour process. This is the programme we set before ourselves. What we attempt here is merely a first step of the programme. Our objective here is a conceptual development of LP from where Marx had left it off.

Before going 'behind' the concept, we attempt a brief exposition of the structure of LP as found in Marx. This forms the subject matter of Section 3. Having touched upon the structure of LP in Marx we go on to attempt one

an initial reformulation of LP in Section 3. This is essentially an attempt at 'placing' LP in its larger 'whole' thereby clarifying the 'external' relations of LP. Section 4 attempts to clarify the social dimensions of LP and Section 5 is a discussion of the internal structure of LP. This, in a nutshell, is what we propose to take up in this paper.

## 2. Structure of LP in Marx

It is well-known that Marx's starting point, in *Capital*, is commodity. He begins by pointing out the two aspects, viz. exchange-value and use-value of commodities. According to Marx, commodity, first of all is an object outside us, a thing that satisfies human wants or a use-value. This is the more basic aspect of the commodity. But in the society under consideration, he says, it is also an exchange value. The first is a qualitative aspect and the second a quantitative. The second, in as much as, it is a quantitative relation between commodities points to the fact that they have something in common. The common property of commodities according to Marx, is that they are products of labour. As conceived above the labour is something abstract. It is labour that is the 'substance' common to all commodities and consequently the commodities are valued by the quantity of this value creating substance. Having introduced labour as an abstract entity Marx immediately goes on to the two fold nature of labour itself. So far as labour finds an expression in value it does not possess the same characteristics that belong to it as a creator of use-values. Different use-values are qualitatively different and the forms of labour that produce them are also different. What Marx is referring to here is concrete labour. It is concrete labour that is behind the different use-values. This concrete

labour, then, is viewed as a process of man working on the material substratum furnished by Nature. Thus matter and labour are the two elements behind use-values. At this point Marx brings into focus division of labour as a necessary condition for the production of commodities. With this, "To all the different varieties of use-values in use there correspond as many different kinds of useful labour, classified according to the order, genus, species and variety to which they belong in the social division of labour." It is clear that this discussion of division of labour and man-nature separation, etc. is with reference to concrete labour.

Having brought out the distinction between abstract and concrete labour, Marx comes back to abstract labour as value creating substance. The productive activity becomes the expenditure of human labour in general and commodities become repositories of value. With these initial clarifications Marx goes on to trace the development of "the expression of value implied in the value relation of commodities, from its simplest, almost imperceptible outline, to the dazzling money-form". For our purpose it is not necessary to go into the details of this development. But what needs to be noted is that commodities are exchange-values and 'money is a crystal formed of necessity in the course of the exchanges whereby different products of labour are practically equated to one another.....'. With the tracing of the crystallisation of money Marx moves on to capital, which he calls money in a process, in which it changes its magnitude expanding all along. Thus capital is money in process, ie. money entering circulation and coming out of it all along preserving and multiplying itself.

The important question posed immediately after introducing capital is that starting with M and carrying out two exchanges, viz. M-C and C-M, how

does one come out with an expanded quantity, for exchanges are always against equals. It is here that the circle is completed by bringing in labour as a commodity - a peculiar commodity - 'whose use-value possesses the peculiar property of being a source of value'. But for labour to become a commodity there are two historical preconditions. Firstly, labourer has to be 'free', ie. the labourer has to be free from any control over his life. Secondly, the labourer should be relieved of any basis for selling commodities, ie. labourer should be totally dispossessed of any right over means of production - raw materials and instruments of production - and consequently the product. Once these two conditions are satisfied labour becomes a commodity.

It is clear that in the discussion so far Marx has introduced notions of labour-process, life process, means of production and surplus value. Labour process was introduced in the very beginning as the substance behind commodities. In the context of labour power becoming a commodity - which also marks the introduction of the notion of surplus value - Marx makes the life process - labour process separation explicit and brings in means of production - raw materials and instruments - as materials behind the product. These are the essential notions needed for Marx's analysis of the extraction of surplus value by capital. In the short discussion of labour process proper the only attempt that seems to have been made is to reclaim these same notions. Let us move on to this part of the discussion in Marx.

The discussion, in Marx, begins with the capitalist buying labour-power, ie. the capacity to work, in order to use it; and labour power in use is labour. The capitalist sets the labourer to produce a particular use-value, a specified article. Labour power producing a particular use-value

is concrete labour and Marx goes on to touch upon the general character of that labour in abstraction of the social conditions, ie. the capitalist-labour relations. The initial statement here places before us the totality of man-nature interaction:

Primarily, labour is a process going on between man and nature, a process in which man through his own activity initiates, regulates and controls the material reactions between himself and nature .....By thus acting on the external world and changing it, he at the same time changes his own nature. (p 169, Everyman)

It is clear that as conceived above labour process is the totality of man-nature interaction. After introducing the concept thus, Marx goes on to elaborate man's activity in this process. According to Marx man's clumbering powers are developed in this process and get stamped as distinctly human. The principles that mark labour process as exclusively human activity are basically two:

- i) the product in the imagination of the labourer before the process begins

According to Marx what distinguishes labour process from instinctive activity is that in the former a certain structure is raised in imagination before the commencement of the activity:

" ..... what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality." Thus in labour process





imagination precedes the act.

- ii) the process directed towards the realisation of the product in the material.

The process, i.e. labour, has a very definite 'end':

"He not only effects a change of form in the material on which he works, but he also realises a purpose of his own ..."

This purpose is the product 'that already existed in the imagination of the labourer' at the commencement of the process. This purpose brings in its trail another principle which in a sense, guides the process to its desired end, viz. close attention:

"Besides the exertion of the bodily organs, the process demands that, during the whole operation, the workman's will be steadily in consonance with his purpose. This means close attention".

In sum, what stamps man's activity in labour process as exclusively human are the principles of raising the product in imagination, purposiveness and close attention.

After introducing labour process in its totality and touching upon the principles which stamp man's activity in it as exclusively human Marx goes on to elaborate the definite 'material environment' of man's activity in the process. Starting with man's activity and looking at its outside first and foremost what one finds is the subject matter of his work, i.e. the material that he works on. Presumably, it is in this that the labourer realises his purpose at the end of the process. Next come the instruments, which are objects of nature, interposed between man's bodily limbs and the subject matter of his work, entering the process as organs

of human activity. With this the totality of labour process consists of man's activity, its subject matter and instruments of labour which are called the elementary factors of labour process.

What are touched upon in the above are elementary factors. Further on, Marx brings in labour process to make further distinctions. Starting with nature as the universal subject matter of labour, Marx goes on to raw materials which are products of labour entering another labour process as subject matter. Such a distinction provides Marx with a basis for distinguishing 'extractive' productions such as mining, hunting and fishing ... etc from other productions. A similar distinction is also attempted in the case of instruments of Labour. Here, again, starting with nature as the universal organ of labour Marx goes on to instruments proper which are 'made' or 'fabricated' by labour:

The use and fabrication of instruments of labour, although existing in the germ among certain species of animals, is specifically characteristic of the human labour process, and Franklin therefore defines man as a tool-making animal.

With these distinctions in regard to means of production one can view labour process as the totality of man's activity, raw materials and instruments proper lying behind the product. It needs to be noted that man's activity is conceived on the life plane whereas raw materials and instruments on the material plane external to it.

Having made these distinctions Marx goes back to the product and views the process from the product end. Viewed thus the process disappears in the product. So what happens in the process, according to Marx, is that man's

activity, with the help of the instrument of labour, brings about an alteration in the subject matter of labour:

In the labour process, therefore, man's activity, with the help of the instruments of labour, effects an alteration, designed from the commencement, in the material worked upon.

The process disappears in the product .....

What is 'implicit' in the above formulation is that the subject matter altered by man's activity is the product itself. It is true that man's activity effects an alteration in what he works on but can it be argued that the product is identified in that object. There seems to be no proper answer to this question in Marx. One way of doing it is by starting from the product end and attempting to reach the subject matter. Some such notion can be identified in the principal substance of the product which Marx talks about. The notion of change is used in moving from the subject matter to the product, but the same concern is not to be found in moving from product to the principal substance. Consequently, principal substance is left 'hanging' with raw material on one end and product on the other. This seems to be an important gap in the embryonic structure of labour process.

It is clear that the discussion of labour process in Marx not only reclaimed notions introduced in the discussion of commodities; but also threw up a few more such as 'change' and principal substance. These notions might have been adequate for viewing the valorization of capital which was his central concern, but these are not adequate for a major task implicit in Marx:

..... little our written histories upto this time notice the development of material production, which is the basis of all social life and therefore of all real history, yet pre-historic times (alone) have been classified in accordance with the results, not of so-called historical but of material investigations.

Since our own central concern is the study of "social production at the material level" we need to attempt a conceptual development of labour process from where Marx had left it off.

### 3. Initial Reformulation of LP

#### 3.1 Man-Nature Interaction

This section attempts an initial reformulation of LP as introduced by Marx. As already mentioned LP as introduced by Marx encompasses the totality of MNI. We begin with an elaboration of the MNI and then make distinctions and separations prior to the development of the internal structure of LP itself.

Initial Reformulation: We begin with a view of the fundamental Marxian formulation of LP:

Primarily, labour is a process going on between man and nature, a process in which man through his own activity initiates, regulates and controls the material reactions between himself and nature ..... By thus acting on the external world and changing it, he at the same time changes his own nature.

(p.169 Everyman)

Already here we see a separation being made between man's activity and the material environment of that activity. What we attempt in our own restatement of the above totality is a clear separation of the activity and its environment. We begin with the fundamental life-nature relation.

Life is fundamentally nature. As a natural being it is equipped with natural powers and is also bound by natural powers. Granting this, we speak of nature as man's physical environment, the 'sum' total of 'objects' outside man looking at it from the stand point of man. His life is sustained in this environment only on the basis of definite man-nature interactions securing the appropriate material conditions of life. We conceive man's labour process at the broadest as what he does in, and for, securing these material conditions. It is thus equivalent to his part in the man-nature interaction lying at the basis of sustenance of life.

It is clear that the reformulation begins with a clear separation of man's life plane from its 'environment' so that we can view the outside of man's life as nature, the sum of 'objects'. The initial man-nature separation facilitates further distinctions. The first and foremost being reformulation of LP itself as man's activity in the man-nature interaction which secures man's material conditions of life. With this one can talk about the processes in nature outside LP within the totality of MN as nature processes. Note here that starting with a man-nature separation or life-nature separation labour process has been viewed as that part of life process severed by the man nature interaction which secures man's subsistence. Thus the two externals of LP are clearly delineated: Life as a larger whole of

which labour is a part and nature as the domain of his activity. With this we can conceive production itself at the material level, ie. at the level of man's environment or 'objects' outside man, as distinct from that of his life process to which LP belongs. With such a reformulation production turns out to be a process in nature securing material conditions of life based on man's activity. Such a notion of production has LP and material conditions of life as its 'external' determinants. In sum, starting with an initial life-nature separation we get three distinct elements in the totality of MNI, viz. man's activity or LP, material conditions of life, and the process in nature or production. Let us elaborate each of these.

### 3.2 LP as man's activity

In our initial reformulation above LP has been conceived as man's activity in the man-nature interaction. Now, to go into man's activity in the interaction we have to begin with the broad spectrum of human actions in general.

By man's activity one means the movement of his bodily limbs. At one end of this broad spectrum of human actions we have actions devoid of any objects. These may properly be called "pure actions", which fall outside the purview of LP as these fall outside the actions in man-nature interaction. Human actions in MNI are always connected to objects, whether as 'tools' or as 'materials'. Let us begin the discussion of such actions with a few examples:

(i) Consider man carrying water in a bucket or some other object. The object is connected to the bodily limbs and the body as such moves from one place to another. So also is the object connected. This is motion in the

sense of locational change of the object; but note that there is no relative motion within the pair consisting of the object and the connected limb. All that we observe is the motion of the human body or the bodily limbs and the locational change of the object connected to the limbs.

(ii) Consider the act of writing. Suppose that the paper is kept on the table and is held by the left hand. The pen is held by the finger-thumb combination of the right hand. Observe that a definite relative motion takes place within the pen-paper pair in the act of writing. Paper is the object connected to the 'extended limb' where pen is the extended limb or tool. The definite relative motion in the pen-paper pair, thus is a determinate motion within the limb or extended-limb - object pair.

(iii) Consider actions like throwing, say throwing a stone. The stone is connected to the hand. In throwing, till the stone is released the limb is holding the stone and the motion of the stone is concurrent with the movement of the limb. In releasing the stone the grip is opened, which means the finger-thumb combination moves in relation to the stone. It is clear that actions like throwing are combinations of actions falling under type (i) and type (ii). For the present we concern ourselves with the pure types (i) and (ii).

Among the actions where objects are connected to limbs, we observe that in the first type there is no relative motion within the object-limb pair. We call the first type of actions locomotion owing to the locational change of the object and the second type of actions operations, the distinguishing feature of which is the relative determinate motion within the object-limb pair. It may be noted that the second does not rule out the

possibility of the simultaneous locational change of the pair itself. With this, the only actions which fall within the purview of LP are locomotions and operations.

So far in the discussion of LP purely observational distinctions have been made with regard to the actions. Now we attempt to carry these distinctions to a more basic level. For this purpose we begin with the fundamental force-motion relation in mechanics. This places locomotion within the area of interaction of forces. In this, certain objects are either moved by certain forces or are prevented from moving. This falls within the area of interaction of forces simply because what is called for here is the force aspect of the object. The role of human beings in locomotion is as a force - supplier. The human action along with the nature processes determine the motion of the object.

In the case of the operation not only that these objects are moved but also that there is a definite relation between motions of the objects involved. The motion of the chisel in relation to the wood or the motion of the paper in relation to the pen are instances. In all these cases we not only observe motion of the objects but also a definite relation between the different motions of the objects involved. This calls for the notion of a system which establishes or determines relations between motions of its constituents. The operation as compared to locomotion not only requires forces determining actual motions but also a system. We call such a system the operative mechanism of LP and the force the motive-force of LP. Thus operation emerges as a unity of operative mechanism and motive-force whereas



a comparison. In the above LP was conceived as a part of life process severed by MNI. Similarly here operation is conceived in the broad area of locomotion severed by the system which makes for the determinate motion.

In sum, LP viewed as man's activity in MNI has been reduced to operations and locomotions. Both these are conceived in the area of force-interactions where one of them is distinguished by the system which establishes some definite relation among the motions of the elements. Having reformulated LP as man's activity and having developed an initial structure let us go on to material conditions of life and production.

### 3.3 Material conditions of life as products

As elaborated earlier, in Marx, the starting point for the discussion of LP was the use-value or product. The use-value, i.e an object outside man satisfying human wants, was called the qualitative aspect of the commodity. We attempt a broadening of this view of Marx. Any broadening needs to go behind the existing conception. Thus our task is to go behind the use-value and begin with the fundamental life-nature relation.

As mentioned above life is a process going on in nature and is sustained by nature. The sum of 'objects' outside it are essential objects being indispensable for its sustenance. Thus looked from life's stand point nature forms the definite 'needs' of life defining the material conditions of life. Starting with such a view of the life-nature relation the task before us now is to move from nature as material conditions of life to some definite 'object' which is a 'need' of life. This implies

an initial object-environment separation. It is only with such an initial separation that one can conceive of product as an object. Having separated the 'object' and identified the 'need' in it let us attempt a further distinction. Now the 'need' may be satisfied by objects or 'events'. To take an example, say the 'need' is the moving of an object from location A to location B. Here object in motion, i.e. an event, is what satisfies the need. Thus product may take an 'object' form or an 'event' form.

#### 3.4 Material Production

So much regarding products. Now, let us move on to what Marx called the different varieties of use-values. Here our attempt is confined to a basic structural division within the domain of products. Our starting point for this purpose is production. As conceived above it is a process in nature securing products based on man's activity. As it is a process it underlies some definite changes. We use the notion of change to draw distinctions within the domain of products. Let us begin with two primitive notions of change, viz. growth and motion.

Growth or Growing is the primitive notion of change associated with all life. Our understanding of these transformations are in the nature of biological laws. Life, as already mentioned, is a natural process marked by birth and death which define the boundaries of life-process. Perpetuation of life is achieved through reproduction, another natural process within life. In some species both may be identical, in the sense that the end of the reproductive cycle marks the end of life-cycle. In some other species reproductive-cycle may be a sub-cycle of the larger life-cycle. To take some examples, in cereals reproductive cycle is co-terminous with life-cycle

whereas in animals it is a sub-cycle within the larger life-cycle.

As viewed above life has a definite environment in the 'sum' of objects and events outside it. This environment conditions the growth of life in many ways. For instance, in some species the two cycles mentioned above are seasonal where the stages of growth beginning with birth follow a definite time pattern. In other species no such seasonal influence on stages of growth may be observable. On the whole, it clearly points to growth being conditioned by the environment. In such a transformation the product is identified at a definite stage of the process.

Now let us consider the other primitive notion of change commonly known as locomotion. Locomotion is the movement of an object from location  $L_1$  to location  $L_2$ . No change in the object itself is contemplated, the change is essentially in its relation with the outside. Here product is identified in the movement itself.

Having touched upon the two primitive notions of change, let us go on to 'making'. 'Making' cannot be comprehended within the above frame. This is something 'new' and owes its existence to man's doings. Take for instance the primitive tool-making. The stone is sharpened at one end and shaped appropriately at the other end for a grip. The substance remains stone throughout only its form is different. These forms, here the 'tool', owe their existence to human conception. Thus the product is conceived and then realised on the material plane.

These are some of the structural domains corresponding to the products. The treatment of these structural domains has no claims to comprehension.

The attempt was only to touch upon some types so as to facilitate the exposition of labour process later on.

### 3.5 Role of Man's Activity in Material Transformation

Starting with nature as material conditions of life we moved on to objects as products. After some clarifications certain structural domains corresponding to these products were touched upon. Now let us come back to man's activity which is at the base of these processes and see what 'role' man's activity plays in these transformations. The starting point for this discussion is man's activity in the MNI. As elaborated earlier these fell into two types: locomotion and operation. In locomotion the movement of the object is concurrent with the movement of the limbs connected to it as there is no relative motion within the object limb pair. Thus locomotion of the object is fully determined by the human locomotion; consequently man's activity plays a determining role in locomotion.

Now let us go on to operation. In operation, as ~~already~~ mentioned there exists a definite relation between the object and the limb which is the determinate motion. To clarify the role of operations in material transformations let us take an example. Consider the primitive tool-making. Say, a wooden piece is taken. The axe, an extended limb, at every hit removes a chunk and gives a sharp edge at one end of the piece. Similar actions at the other end give a proper grip. The operations thus transform the wooden piece into a tool where the transformation is 'making'. The transformation is coincident with the operation and hence the operation fully determines the transformation. The role of operations in 'making' is one of determining. Thus locomotion and operation are the only two types of actions in LP and locational change and

making are fully determined by them. With this, we can move on to the role of man's activity in 'growing'.

Growth, as already mentioned, is the essential transformation in life and life process is an interaction with nature. As life is a process in nature man's activity in growing is limited to only those points where the life unit concerned interacts with its environment. For example, in plant life such objects of interaction are soil, nutrients, water .... etc. Man's activities then, are clearly confined to the preparation of the soil, manuring, watering ..... etc., each of which involves either locomotion or operation by man. Growth in itself is an internal property of life and it can only be conditioned by man through these activities. Activities may be performed but that in itself does not ensure the necessary growth of life. The determining role played by man's activity in the case of locomotion and making does not exist here. That is why we call the role of man's activity in growing as conditioning.

Conditioning, as introduced above, adds a new dimension to the discussion. In the 'environment' of life we have not only identified human actions but also material transformations determined by them. These material transformations may be called auxiliary processes and the objects which are involved in these processes may be called auxiliary materials. Thus at one level we have the transformation corresponding to the product and at another level auxiliary transformations which are validated in the former. This calls for a proper identification of the objects involved in the production process.

### 3.6 Identification of objects in the production process

So far in our discussion we have identified only products in the

'environment' of man's activity. 'Tools' are termed as mere extended limbs and we leave it at that for the present. Continuing along the objects in the 'environment' our discussion has mainly been in terms of 'change'. Now change takes place on definite material planes and consequently it is conceivable to go 'backward' from the product along such planes to identify raw materials which in some sense form the material base of the product. This is one approach for identifying objects starting with product and change. There is another approach for identifying objects starting with human actions. We began our discussion of human actions in MNI by distinguishing actions where limbs are connected to objects. These objects may be called work-pieces. Thus in the material environment of man leaving aside the 'extended' limbs, we have identified products as 'objects' satisfying definite 'needs' of life. Then, starting from products and going back along the plane of transformation we identified raw materials as the 'base' of the products. Looking from another angle, viz. that of LP we identified work-pieces, as objects on which man works.

Having made a distinction between raw materials and work-pieces we can go on to answer a question posed earlier in the discussion of Marx's subject matter and principal substance. The work-piece may be the material base of the product or not depending upon the role played by human actions in the 'change' corresponding to the products. If the role is one of determining then the work-piece is the raw material; whereas if it is one of conditioning the work-piece may as well fall in the category of auxiliary materials. So far in our discussion we have been able to provide a view of the totality of man-nature interaction. As conceived above this totality has man's activity on one side; material transformation and product appropriation on the other. In this totality LP has been conceived on man's life plane as his doings in

man-nature interaction. Now, in order to move towards any structure of LP we may approach it through its 'core', i.e. man's doings in man-nature interaction and attempt its 'completion' on the life plane. Any completion on the life plane is essentially a process of 'bringing' the totality of MNI on to the life plane. This 'bringing' means viewing the totality from within the plane of the core, i.e. the life plane. Now, this viewing is an activity on the thought level, i.e. a certain conception of the totality prior to the actions where actions themselves are termed execution. With this LP becomes a unity of conception and execution.

### 3.7 Marx: Points of Departure

Having introduced the structure of LP, it may be pertinent here to go back to Marx in order to mark our points of departure. It needs to be noted here that Marx's object identification, viz, subject matter, principal substance and product, and production as change of the subject matter are all consistent with the structural domain of 'making' or manufacture in his terms. As Marx's main concern, in Capital, had been the capitalist manufacture it is understandable that his conceptualisation was basically that of 'making'. As one moves outside such concerns into wider areas one realises the inadequacies of Marx's conception of LP. It is in this light that the reformulation was attempted.

As an initial reformulation has been made above it may be pertinent to touch upon the points of differences and departure. First of all, in Marx human activity is viewed as one of the factors of LP where the emphasis was on the principles which stamp the activity as exclusively human. The bodily movement of the limbs was not gone into. We have made an initial

attempt in going into it. As to the product, it was introduced in Marx as use-value which satisfies a definite 'need' of life. In our formulation the attempt has been to begin at the level of nature as material conditions of life and then go down to objects, by making definite object-environment separations. Further distinctions were made between objects as products and objects in processes, i.e events, as products. Further on, in Marx the notion of 'change' has been introduced but this has not been used in arriving at a proper conception of production. In our formulation material transformation at the level of man's physical environment based on man's activity has been viewed as production. With these distinctions not only has it been made possible to identify 'objects' in the production process objectively but also the whole question of the 'role' of man's activity in production has been posited. These in a nutshell are the points of departure as compared to Marx.

#### 4. Labour Process - Technique Relation

LP as introduced in Section 2 is a part of life process marked off by man-nature interaction. As conceived above it refers to the 'individual' life unit and the social character of it is missing. It is our purpose here to go into the social dimension of LP in some detail.

LP, as conceived above, is a component of life activity. Any component of life shares in all general characteristics of life, like 'part' sharing in the general characteristics of a 'whole'. Now, man is born heir to a social tradition which stamps his life with certain social determinancies or determinancies of social tradition. His activities which are concrete expressions of this social tradition and owe their definiteness to this



tradition may then be called social activities. Labour process, as an expression of some component of social tradition, is thus a social activity.

It is necessary here to point out an aspect of the definiteness of social tradition itself. All definitenesses of social tradition are subject to transmission of the acquired tradition by older generations to younger generations. That is, these traditions are subject to the 'vagaries' of social reproduction and their determinancies are governed by the modes of reproduction. This applies to LP as well. Hence LP, as an expression of some component of social tradition is also governed by the rules of social reproduction.

Having touched upon the definiteness let us go on to the components of social tradition of which social activities are expressions. Any activity, as conceived above, is simply movement of bodily limbs. Now, if the component of social tradition is what 'carries' these activities then there must exist something corresponding to the bodily limbs at the social level. This is exactly what one finds in the 'extended' limbs or 'tools'. Let us elaborate the notion of tools.

We begin with human actions and in particular operations. It needs to be noted that at the very base of all operations lie the prehensile hands of human beings. The hand assumes various positions while holding objects and reaching for objects. These actions of the hand are of two types: the power grip and the precision grip; the power grip produces stability when an object is held in a kind of clamp and it is in this position that the hand exerts maximum pressure on the object. The precision grip is the position when the object is pinched between the flexed fingers and the opposing thumb. This position provides maximum accuracy of control. It is owing to these

grips that human hands can not only 'use' tools, which all higher primates do, but also 'make' tools. These tools conform to patterns governed by a tool tradition which is a social tradition:

The tools that distinguishes the genus Homo from other primate taxa is not the same tool that the chimpanzee uses. There is no evidence that there is a tool tradition among chimpanzees (a cumulative body of knowledge which chimpanzees pass on by means of symbolic communication from individual to individual). The tools of non-human primates are not made according to a plan, they do not conform to a style tradition, they are objects which are picked up and used on the spur of the moment. (p 188, Origins of Man, Buettner - Januschi)

It is clear that 'tools' are objects playing definite roles in human actions. With the above formulation the component of social tradition referred becomes the tool tradition and the social activity, which is an expression of this tradition, becomes mere 'tool-using'. But, as mentioned earlier, the definiteness of the activity does not lie in the 'use' of the tools by the human beings, it lies in the definiteness of tool governed by the tradition. This definiteness is the definiteness governed by the 'plan' according to which the tool is made. Thus 'tool' 'making' emerges as a repository of all definiteness of social activity.

So much regarding the tool-activity relation. Now, let us go on to the purposiveness of social activities. All social activities are purposive, i.e. the activities serve definite 'ends' in life. We may call these activity-end unities practice. But that in itself does not tell anything about the

'ends'. Now, we shall try to bring in distinctions in practice through "differences in ends". This cannot be done without elaborating on the 'ends'. For this, let us go back to the notions regarding product introduced earlier.

We began our restatement of LP with the fundamental life-nature relation. There it was mentioned that the sustenance of life depends on the appropriation of nature as material conditions of life or as products through definite man-nature interactions. Thus these 'objects' in the material environment of man may be viewed as definite 'needs' of life. To put it differently, these 'objects' which are appropriated through man's activity in nature may be looked upon as embodying a purpose, viz. the satisfaction of the 'needs' of life. In brief, we may say that product embodies a purpose..

With this we can move on to the 'end' of LP. LP like every social activity is validated in life. Now labour process is validated in life-process only in the sense that it is an activity with nature as its domain and some object in nature satisfies a definite need of life. Thus the validation of the activity in life is through the product, consequently the labour-life relation may be cut into two, viz labour-product relation and product-life relation. The ultimate validation of labour in life is to be seen in the product-life relation. But abstracting from that relation one may say that the 'end' of labour process is the product.

Having elaborated upon the material plane on which the 'end' of labour process is realised, let us go back to practice. As conceived above all practices are activity-end unities. With the identification of products as

objects satisfying definite needs in life, ends can be certain objects beyond and beside the activities. With this, we can use the products as ends to draw distinctions in the broad area of practice. The activities where the end is identified in the products may, then, be called techniques. It is clear that it is production which provides a definite basis for distinguishing techniques in the wider area of practice.

It may not be impertinent, at this stage, to point to a rich tradition which had attempted to grapple with some of these issues regarding technique and production. Many of the points elaborated above are comparable to the means-ends view of activity and product and the more comprehensive theory of causes attempted by Aristotle. (Ref. Appdx).

To continue along techniques, we brought in differences in the end, the difference being product as the end, to distinguish technique in the wider area of practice. But all along, the 'core' of technique has remained 'tool' and 'tool-using'. This is because, though we have talked about a certain external plane, i.e. the material plane, we have done nothing to 'bring' it over to the plane on which the activity is conceived, viz. life-plane. This is what we attempt here.

The totality of man-nature interaction consists of man's activity which is 'tool-using', and material transformations corresponding to products. To put it differently nature is the domain of man's activity as well as the environment in which man identifies the material conditions of life. Our understanding of these processes in nature is in the form of 'laws of nature'. It is through these 'laws' that the totality of man-nature interaction is

'translated' on to the life plane as knowledge of the totality. This knowledge at the level of social tradition is what is at the base of the realisation of product as the 'end' of the activity in labour process. As in the case of tools above knowledge of the totality is put to 'use' in the interaction. In the case of the tool the 'use' was governed by the 'make' so also here the 'making' of knowledge is through language. With this technique emerges as a unity of tool and knowledge of the totality conceived at the level of social tradition.

Before going any further a few words need be said about the structure of knowledge corresponding to the structural domains for the sake of completion. In going into the structure of knowledge we may make use of the distinction as regards man's role in production drawn earlier, viz. determining and conditioning. As elaborated earlier, in the determining cases the material transformation is coincident with man's actions and as such the knowledge which is coincident with man's doings may be called practical knowledge. Scientific knowledge, then can be juxtaposed with the above as knowledge of the material transformation independent of man's actions. Let us take an example, say growth. As already mentioned abstract notions such as 'time' are called for in coming to grips with growth which is a/<sup>natural</sup>

process. To bring out this distinction clearly it may be useful to refer to the appropriation of plant and animal products prior to agriculture proper.

Already, at the stage prior to agriculture proper, primitive man comes to build an abstract frame for viewing the different life processes outside him. This is amply illustrated by the "seasonal wanderings" of aborigines. We quote Grahame Clark on Australian aborigines:

..... although compelled to move more or less widely over their traditional territories, their seasonal wanderings are anything but haphazard, being based on a remarkably exact understanding of the life-cycles of the various plants, insects and animals on which they depend. (p 106, Prehistoric Societies)

Same is true of Eskimos:

The more one looks at the culture of Eskimos, the more closely one sees how closely it depends on exact knowledge both of seasonal changes and of the lives and habits of the various animals on which they directly depend for their very lives. (p 119)

It is clear that primitive agriculture was begun on the foundations of such knowledge. It needs little labouring to point out that the structure of knowledge is different depending upon the structural domains. Any comprehensive account of the structure of knowledge would require a comprehensive account of the structural domains itself which is not our concern here. What is of interest to us is the evolution of the structure

of knowledge in 'making', especially 'tool-making' which attempts to answer a few questions regarding the so-called science based technique of Industrial Revolution.

Now let us move on to labour process. Labour process, as already mentioned, is conceived as an expression of technique. This essentially means that the technique is translated on to the individual life plane as LP. Technique, as developed above is a unity of tool and knowledge of the totality and as such LP may be viewed as a unity of conception and execution corresponding to the unity in technique. Here conception is of a certain 'whole' and execution is the 'carrying out' of the same. This is the initial unity in LP. In going inside execution one can view it as a unity of action, which is tool-using and the realisation of the product. Action has been elaborated earlier. Now, moving on to realisation, it is a process through which the actions and the 'goings on' in nature corresponding to the actions are observed, compared with the norm conceived, and decisions are taken so as to correct deviations from the norm. Correction itself is action thereby completing the circle: action - observation of the goings on in nature - comparisons with the norm - decisions to correct - and action. The essence of this process is control. It is essentially a process of going from action to conception and then from conception to action which in a sense brings the essence of conception on to the level of execution. With this, one has moved from the conception - execution unity to the action - control unity of LP.

As developed above actions are of two types: locomotion and operation. Further it was shown that the essential principles underlying these actions

are motive-force, operative-mechanism and control. Now the structure of LP may be viewed from two angles: from the angle of components or parts LP is a 'whole' containing many action-control unities; from the angle of aspects LP is a structure having the three basic processes of motive force, operative-mechanism and control.

Now, these processes, in as much as they are processes in life cannot be thought of without respective 'tools' of the processes. Then, in as much as LP has a structure in terms of these processes the 'tools' also have a structure. This structure has its 'base' in the human body unit itself. The evolution of these processes, as already mentioned, is coterminus with the evolution of these 'bases' in the human body unit. Our next task then, is that of tracing certain systems in the body unit which are at the base of these processes and 'root' them in these appropriate systems of the body unit.

##### 5. The Internal Structure of Labour Process

The structure of LP developed so far is the operative/locomotion - control unity at one level and the unity of operative mechanism, motive-force and control at a more basic level. In as much as these are processes in life they are activities which have to have their 'tools'. The tools, in this case, are certain systems of the body unit. Our, first task, in this regard then, is to trace the evolution of these systems corresponding to the operation/locomotion - control unity or to trace the 'making' of the human body unit, so to say. Once this is done we go on to 'root' the basic processes of LP in these systems in the body unit which are then viewed as the 'tools' of these processes.



A convenient starting point for viewing the evolution of the body unit as 'making', of the tools of labour may be found in Engels: "..... the hand is not only the organ of labour, it is also the product of labour" (Dialectics of Nature). The story of the production of hand by labour is the story of human evolution for in this production "hand did not exist alone, it was only one member of an integral, highly complex organism". Engels' discussion of the "production" was short and it ties other developments around that of hand. He views the development of speech along with the development of the hand and views these two developments as stimuli for the development of brain and "its most immediate instruments - the senses". But the discussion in Engels is rudimentary mainly because labour process itself is left at a rudimentary level. Since we have developed the structure of LP it is possible for us to talk about the production of the different systems of the body unit as 'tools' of these processes. This is exactly what we attempt now. Our starting point for this purpose is primate evolution. We do not propose to get into the controvercies surrounding the evolution of man, but only propose to keep to the basics, so to say. First of all, in primate evolution the body plan of the animal changed from a pronograde quadrupedal to bipedal. In this a number of muscles and bones changed their structure and relation with other muscles and bones. It also required the reorganisation of nerve paths, internal organs and blood vessels. Erect posture was a kind of preadaptation for the development and selection for efficient bipedal locomotion. Quadrupedal's vertebral column is shaped like a bow. The change from pronograde to the orthograde position of the trunk shifted the position of the vertebral column which in turn led to changes in the functions of the column particularly supportive

and weight bearing. The pelvis changed more than the vertebral column during the evolution of habitual erect posture and the bipedal gait depending upon the various demands placed on it. Among the three bones that make up the pelvis - ischium, ilium and pubis, the ilium has changed the most. The broadening of the ilium and the reduction of the angle between ilium and ischium brought the gluteus maximus behind the hip-joint which emerged as a powerful extensor of the leg. The pelvis functions so as to hold the trunk erect and stable in bipedal walking.

Along with the vertebral column and pelvis the foot also changed. Man's foot is not prehensile. The big toe is parallel to the long axis of the foot. The other toes are shorter and much less mobile. The base of the big toe is one of the principal supports of the foot. And the foot itself may be considered as a two armed lever. In the foot the force of contraction of the calf-muscle is transmitted through the Achilles tendon attached to the talus. This force lifts the heel and the ankle when man walks.

The erect posture brings about changes in the anatomical complex consisting of arms, shoulder girdle and thorax. It freed the forelimbs by tying locomotor functions to the hind limbs. But all the primates except man, use their hands as major organs of locomotion. Man alone has freed his hands for manipulation through erect posture and bipedal locomotion. Thus, we see that the vertebral column, pelvis and feet together provide the necessary structure for locomotion in man and these have evolved as organs in the evolution of bipedal locomotion

Now, let us move on to the evolution of hands of man. All primates have



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prehensile hands and they vary enormously. They demonstrate no trends from lower to higher primates. But in all primates prehensile actions can be observed. Prehension in man evolved through the development of voluntary control over each digit of the hand. This required major advances in the anatomy of the hands which can be classified as the convergence of the fingers, divergence of the thumbs and true opposability of the thumb. This not only required a variety of bone and muscle changes but also neuro-anatomical changes. The centres in the brain concerned with association and control became highly developed. An enormously complex cerebral cortex and the nervous system developed. The developments in the hand went hand in hand with the developments in brain and organs of vision. Though hand can be used in many prehensile actions it emerged basically as an organ of mechanical skill. It is this 'organ' of mechanical skill which is at the top 'base' of operation.

Note that in the above discussion evolution of two complexes are opened up but not gone into, viz. the anatomical complex consisting of arms, shoulder girdle and thorax, and the complex consisting of sense organs, nerve paths and brain. We now go into the latter. The evolution of erect bipedalism and mechanical skill made for changes in the brain and sense organs. Most important in this is the eye. The primitive mammalian eye is changed in two directions: forward rotation of the orbits and sorting of the optic nerve fibres at the optic chiasma in the brain. With the development of visual acuity the area in the brain associated with it, the occipital lobe, expanded. The eye-hand coordination made for the increased complexity and size of the precentral cortex. Thus the evolution of the primate brain can

be described as the extra-ordinary development of voluntary control as well as the retention of basic features of the mammalian cortex. In the cerebral cortex of mammals there is differentiation of sensory areas which receive impulses from various sense organs such as the eye, ear and the hand. There is a motor area which emits impulses that initiate and control voluntary movements. There are association areas between the sensory and motor areas which inter-relate the two. Thus it is clear that the unity of sense organs and brain is an organ of voluntary control.

In human evolution one other noticeable development is the sharp break between the social behaviour of non-human primates and man. The difference seems to be built around the symbolic vocal communication in the hominid line. The evolution of vocal expressions has at its base the evolution of man's larynx. Man's larynx is lower in the throat and farther away from the soft palate than it is in other primates. The descent of the larynx created a long resonating cavity. This tubular cavity made possible the low-pitched speech of man. This, in brief, provides the salient features of human evolution.

In sum, locomotion, operation and voluntary control evolved as definite processes along with the evolution of the anatomical complex of vertical column, pelvic girdle and feet, the hand, and the unity of sense-organs, nerve paths and brain respectively. The evolution of these processes cannot be thought of in abstraction of the evolution of these organs.

Now, let us go on to the second task mentioned above, viz. that of 'rooting' the basic processes of LF in proper systems or complexes of human body unit. Let us begin with control. Control, as developed earlier, is the



essential process in the realization of what is conceived. It is the 'forward' and backward movement' from action to conception and then back to action. The action is reflected on its domain - the material plane - which is observed and compared with the norm conceived. Any deviation needs to be corrected. Correction as such is an action, i.e. some locomotion or operation, but the decision to correct is taken only after comparing the actual with the 'norm'. Thus control is basically a sequence of observations, comparisons and correction decision. Each one of these are processes within control with their own organs. The senses are the 'organs' of observation and brain is the organ of comparison and decision-making. Between observation and comparison - correction decisions on the one hand and between correction decisions and actions on the other lie two other processes, viz. the transmission of information from the sense organs to the brain and from the brain to the organs of operation. This is done by the nervous system. Thus, on the whole, control has many sub-processes each of which are 'rooted' in definite organs of the body. The sub-processes are observation, transmission, comparison and decision making' 'rooted' in the sense-organs, nervous system and brain.

Having attempted the 'rooting' of control, we go on to the operation. Earlier in going into the operation we had begun with the fundamental notion of motion in mechanics, viz. that motion has the interaction of forces 'behind' it. Then we introduced a system behind the determinate relation of the motion in the tool-material pair. This system was called the operative mechanism. The essence of the system, it was shown, was the establishment of definite relations between motions introduced in the system where the introduction of

motion itself was accounted for by some force external to the system which we called the motive-force. Note that motion talked about all along referred to locational change and thus it turns out that the interaction of forces is what governs it. Now, operation is conceived within this larger area of interaction of forces and the severing as such is done by introducing the notion of the system. Once such a view is taken the distinguishing element of operation turns out to be the system. So far nothing has been said about the system itself which is the task of the 'rooting'.

Before going into the details of the system let us just touch upon a consequence of introducing the system in the larger area of interaction of forces. With the system, we can talk about forces outside the system and forces inside the system, the only difference being that their roles will be different. So much for the initial clarifications. Now let us move on to the 'rootings'.

We begin with the operation of writing. Writing as such is a determinate motion within the pen-paper pair. In this the movement of the pen is made possible by the activity of the muscles, ligaments and bones of the hand. The finger-thumb combination holds the pen and the muscles of the hand move the pen. The paper is held by the left hand and any motion of the paper is prevented by the left hand. Now, if we consider the activity of the muscles in moving the pen as the introduction of motion in the pen-paper pair, then what is left is the finger-thumb combination in which the pen is held and the hand-paper combination which prevents the motion of the paper together with the frame of human body. Note that there is no relative motion in the hand-paper pair or pen-hand pair.

while writing. Any relative motion in these two pairs would disturb the determinant motion. Thus what the system essentially does is to eliminate all the disturbing motions by constraintment of motion. Thus in the operation all disturbing motions are eliminated and the desired motion is introduced by the outside force. With this, it can be said that the essence of the system is constraintment of motion. Thus operative-mechanism can be viewed as an arrangement of material bodies which establishes determinate relations between motions of the constituents by constraintment of motion. Our next task, then, is to see how constraintment is attained in the operative mechanism.

As already mentioned processes cannot be thought of without their organs. The organs of operation are the limbs. The working of the limbs is no different from the working of the general skeletal and muscular systems of the body. These two systems are a complex of bones, fibrous tissues and muscles. When two bones come into contact a joint is formed and the area of contact of each bone is called the joint surface. Bones may articulate in such surfaces in many ways depending upon the structure of these joint surfaces. These bones are struck together by fibrous tissues and fibrous cartilages. The bones joined by fibrous cartilages are allowed a limited degree of movement. Bones with other types of joints are 'freely' movable. These may resemble a ball in a socket or may simply be two surfaces sliding on each other or may move like a door on a hinge. Note that in all the 'free' movements the joints or the contacting surfaces are spanned by definite geometric forms, which govern the movements. Thus the constraintment of motions is partly attained because of the geometric forms of the

bones at the joints.

To these bones are attached muscles to span joints. Depending upon the part of the body and the functions the attachments vary. These muscles serve two different purposes consequent upon their flexion and extension properties. They introduce motion in the system and secondly by forming definite combinations with bones and ligaments they constrain motions in the system. But the way constraintment is brought about by muscles is, in a sense, different from the way constraintment is brought about by bones. Muscles bring about restrictions by balancing the force applied and bones by their geometric forms. Thus constraintment of motion in the operative-mechanism is attained by the arrangement of bones and muscles, bones providing a frame and constraining motion by their geometric forms and muscles by varying the force applied at different points.

We end our discussion of operative mechanism by defining a system parallel to the operative mechanism outside the human body unit. It is clear that operative mechanism is a system situated within the human body unit and comes into existence only at the flux of the operation. We can conceive a similar arrangement of material bodies outside the human body. Corresponding to the joints in human skeletal system we can think of links in this arrangement which are junctions of two material bodies. The arrangement itself can be thought of as a combination of pairs of elements which we may call a chain. Chains can be constrained to execute determinate motions by making one link of the chain stationary. Such a chain may be called an objective-mechanism.



In the objective-mechanism constraintment can be attained in very many ways. Similar to the geometric forms of the contacting surface of bones here the material bodies forming the link may constrain motion by their geometrical forms. Take the case of a wheel fitted with an axle fixed in a groove. The axle-groove link with their geometric forms eliminates all motions of the wheel other than that about an axis. No external force can disturb this motion. Now consider the same axle kept on two poles. If any force greater than the force of gravity is applied from below the motion of the wheel on a horizontal axis will be disturbed. The only way to eliminate this disturbing motion is by applying an equal force from above. In one case no external force was needed to constrain motion whereas in another case constraintment is attained because of the external force. But whatever may be the method applied and whatever may be the 'rootings' of the mechanisms constraintment remains the essence of the system. In the case of the operative-mechanism constraintment is behind the determinate-motion in the tool-material pair. In the case of the objective-mechanism what purpose it serves will depend on the processes in which it takes part. These details as to the objective-mechanisms in processes will be taken up in the discussion of evolution of techniques.

In the above discussion we dealt with the system which established relations between the motions introduced into the system. So far nothing has been said about the force introducing motion in the system. We now turn to the discussion of this force. As already mentioned, muscles serve two different purposes depending upon the processes in which they participate. One of them, the constraintment of motion by the muscles has been touched

upon earlier. Coming to the motion introducing aspect of muscles, to begin with, it needs to be noted that muscle activity is a group activity to which one normally associates such qualities as power, speed and range of movements. What is basic to the muscular activity is the material transformation that goes on in the cells and the energy released in the process. Our concern is with the muscular activity in introducing motions relative to some system and as such the physiological and biochemical processes in human cells and the consequent energy release do not bother us.

As already mentioned, muscles serve two different purposes. Let us begin with the distinction between the two types of forces. The conception in one case is with respect to some 'system'. The force which constrains motion is really part of the system being internal to it. The force which introduces motion, on the other hand, must stand external to the system. Clearly the force introducing motion takes one to the general force - motion relation, which the other kind of force does not, in as much as it has to be comprehended through the system. Further, at the general plane forces introducing motion and forces preventing motion are on par. Thus our distinction between forces 'introducing' motion and forces 'constraining' motion relative to a system is not to be confused with the forces 'introducing' and 'preventing' motion at a general plane.

We shall call the force introducing motion in the system the motive-force of the system. Beginning with force as the structural element of locomotion this distinction is brought about by introducing the concept of a system. With this both the force as well as the system are 'rooted' in the

muscular system and a unity of muscular and skeletal systems respectively.

Having 'rooted' the processes in appropriate systems of the body unit evolution of the techniques may be viewed as improvement of tools at one level and as substitution of 'rootings' of the processes at another level. Here by substitution we mean the 'rooting' of one of the constituents of LP, which is rooted in some complex of the body unit, in something outside it, i.e. in nature. Note that the structure and content of LP itself remains intact, only its 'rooting' changes.

It may not be out of place, here, to touch upon a consequence of the substitution. With it, though the 'content' of LP remains the same unity man's doings in man-nature interaction changes, and man's doings before substitution and after substitution are not the same. In one case it is a unity and in another only part of that unity.

To give an example let us go back to the operation. Operation is conceived as a unity of operative mechanism and force both of which are rooted in the human body unity. When the operative-mechanism is completely replaced by an objective-mechanism the 'content' of LP remains the same only the rooting of the system in operation is changed. In the former case it is rooted in the human body unit whereas in the later case it is rooted in nature. With the emergence of objective-mechanism in operation we can define a process, viz. the Machine Process, a process in which objective-mechanism substitutes the operative-mechanism of LP. The other two processes are still rooted in the human body unit and consequently man's doings are reduced to active-force and control. Further development of this idea shall be taken

up in the discussion of evolution of Social Technology.

## 6. Conclusion

Our object was to give a rigorous and systematic conceptualisation of LP which could provide a definite view point or approach to the study of evolution of Social Technology. Starting with Marx's LP we have been able to develop a structure of LP. In the process, notions regarding product and production were touched upon thereby clarifying the life-process, product and labour-process relations. Further on, efforts were made to put the whole conception of LP on an objective footing by bringing in the notion of social tradition in general and practice and technique in particular. Then LP was viewed as an expression of technique preparatory to the mapping out of its structure. In mapping out this structure to begin with it was viewed as a conception - execution unity and in successive steps it was reduced to operation/locomotion-control unity and operative-mechanism, motive force and control unity. We ended our discussion of LP by mapping out the basic principles of LP as operative-mechanism, motive-force and control, opening out into the study of evolution of techniques. Such a conception, we believe, provides an adequate frame for the study of evolution of techniques.

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Aristotle on Man's Activity and Production

The practice-technique distinction as well as notions regarding production and change have a long history with their roots traceable to early Greek thought. We propose to touch upon some elements of such a discussion in Aristotle, without in any way going into the evolution of these ideas to Aristotle through the different streams of Greek thought. The reasons for choosing Aristotle is that it was only in Aristotle that we see a comprehensive account of the above which has some relevance to our own discussion .

Aristotle's discussion is spread over his different books and may broadly be brought under three heads:

1. activity-end relation; 2. change and causes; 3. purpose and form relation. We propose to touch upon all three, although very briefly.

Aristotle in his 'Ethics' raises the question of 'ends' of activities. He begins by saying that every activity by man is thought to aim at some good. This 'aiming at' clearly points to some end. These 'ends' are numerous and there are differences in ends. Immediately after this he introduces the important distinction between human activity as the end and some tangible result beside and beyond the activity as the end. In fact, he is very explicit about the tangible result and puts it as the product:

a certain difference is found among ends;  
some are activities and others are products  
apart from the activities that produce them. (p 935)

Such a formulation immediately adds a new dimension to the problem. The above distinction between ends could only be made by bringing in the 'plane' of nature as the domain of man's activity on which the tangible result is realised. It is through such a logical separation that Aristotle could talk about 'product' as the end of man's activity which essentially means man's activity itself is viewed as a means towards that end. So much for the discussion of the distinction between activity as end and products beside and beyond as the end.

Now that product is brought in, let us move on to the discussion of the 'plane' of nature. Aristotle's discussion of this plane begins with the 'things in nature' and then goes to the processes 'behind' them. The important distinction made here is between things which have an innate impulse to change and things which are products of art (there are overlappings which are recognised by Aristotle but into the complexities of which he does not go). The key notion here is 'change' or 'motion'. From here Aristotle goes on to the 'causes' of change and develops a theory of causes. He reduces the number of causes to four. The first refers to the 'what' of things which are not changing or which have come off change and the 'what' refers to the definiteness of things as such. This he calls the material cause. The third refers to the initiator of change. In the case of products of art it is man who is the initiator. This initiator of change he calls the efficient cause. The fourth refers to 'for the sake of what', i.e. the purpose or 'end' of change. In the case of products of art, purpose is not difficult to conceive but there are problems regarding the conception of the purpose of 'natural' productions. But, Aristotle, by comparing the

'form' and stages of 'production' of the natural with the artificial says, "If therefore artificial products are for the sake of an end, so clearly also are natural products". This 'purpose' he calls the final cause.

Note here that the first two, viz. formal and material are defined with respect to the plane of nature and the last two, viz. efficient and final with respect to the plane of life. Coming to the links between the different planes one link was already touched upon, viz that between activity and the substratum where the substratum forms the domain of man's activity. Now let us pass on to the other link.

The link between the purpose and nature is posited through the formal or essential cause. The formal is ultimately related to the function. The argument seems thus : irrespective of the efficient cause, this form is for that 'end' or if this end then that form. Whatever is 'behind' the formal is for the sake of the formal and since formal is for some 'final' all formal, irrespective of the processes behind, are endowed with some purpose. Interestingly enough this last is a trail of thought which has come into prominence in the recent past. Observe Charles Monod,

"..... how arbitrary and pointless it would be to deny that the natural organ, the eye, represents the materialization of a 'purpose' - that of picking up images - while this is indisputably also the origin of the Camera" (p 20, Chance & Necessity)

One does not see the materialization of the 'purpose' gone into in any detail in Monod whereas Aristotle does raise a few questions about it.



In the case of man the materialization can be traced to the intelligent action whereas one does not have such a process in the case of animals and nature in general.

It is clear that Aristotle tried to grapple with the different aspects of the conception of man's 'making'. Surprisingly enough these rich trails do not seem to have been taken up in the recent discussion on production and technology.

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