

SOME QUESTIONS ON THE THEORY OF ENGINEERING PRODUCTION FUNCTIONS¹

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THE LITERATURE on engineering production functions asserts that it is often possible to deduce the nature of technical production relationships from knowledge of general physical and chemical laws [1] [2] [12]. In the method followed, an industrial process is reduced to its physical essentials and an idealized engineering model established. Production is analyzed with the aid of the model on the assumption that any productive activity can be conceived as a physical system undergoing a succession of energy changes. Then, if the parameters of the physical system are found, the way to the ultimate objective is open—a design equation can be written which is able to predict the physical system's behaviour under any of numerous hypothetical conditions. In short, the formulation of an engineering design law is a problem in applied science, and the conventional production function of economic theory emerges as some transformation of the design law.

In the engineering analysis of production, a sharp distinction is drawn between economic inputs and the so-called engineering variables; the former are commodities like machinery and raw materials for which market prices exist, the latter represent the physical properties or dimensions of the inputs used in production. Thus, capital goods, as such, are economic inputs; the measures of weight, horsepower, torque, rotational speed, etc. that might characterize these capital goods constitute engineering variables. Of course, design laws, which deal with physical or chemical phenomena, are stated in terms of engineering variables. And, as Professor Chenery observes: The central analytical problem of using engineering results is to trans-

¹ It should go without saying that the variables in the respective input functions must have unchanging economic definitions; thus, if a variable u_1 is used to represent steel pipe at one stage of the analysis, the same symbol cannot be interpreted to mean lead pipe at some later stage. This point is worth mentioning only because elastic definitions do appear in the engineering analysis of production.