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# **The Scope of Input-Process-Output Diagrams in Teaching Economics**

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## **The Scope of Input-Process-Output Diagrams in Teaching Economics**

### **Abstract**

This paper discusses the scope of input-process-output diagrams in teaching introductory microeconomics. Research shows that teachers and students both benefit when visual aids are used in classrooms and since input-process-output diagrams are visual in nature, they can benefit the teaching and learning of important economic concepts such as production, concepts related to production, and economic modeling. In addition, input-process-output diagrams are also used in other areas of study, such as computer science and business studies, and hence their use in economics classrooms and textbooks can lead to an easier and better understanding of certain concepts.

*Keywords:* input-process-output diagrams in economics, teaching production, teaching production externalities, teaching economic modeling, teaching economics using visual aids

## **The Scope of Input-Process-Output Diagrams in Teaching Economics**

### **1. Introduction**

This paper explains how Input-Process-Output Diagrams (IPOs)<sup>1</sup> can be used to teach the concept of *production*, certain *concepts related to production*, and as an easy-to-understand example of *economic modeling*. According to research, both teachers and students benefit when visual aids are used in classrooms (Rasul, Bukhsh, & Batool, 2011; Melor et al., 2013; Ghulam et al., 2015;). Hence the visual aspect of IPOs can improve the teaching and learning of certain important economic concepts. Since IPOs (and models in general) are also used in other areas of study, such as computer science and business studies, their use can lead to easier comprehension of concepts. IPOs can also be used to stimulate creative and conceptual thinking through class work or assignments.

A review of the popular introductory economics textbooks by Arnold, Mankiw, and Samuelson indicates that the discussion of economic models is done so without a diagram making it difficult for students to understand the essence of economic modeling. Similarly, the discussion of production is also unaccompanied by a visual aid in all the textbooks that we have come across so far. In the following segment of this paper, we discuss how an IPO can be easily used in textbooks and classrooms when discussing these important economic concepts.

### **2. Implementation**

IPOs can be applied in situations where a process transforms given input(s) to output(s) and by-product(s). Production is defined as the transformation of inputs (factors of production) into outputs (goods or services) (Arnold, 2009). An IPO fits perfectly with the definition of production and hence it can be used to explain the concept of production as shown in the following figure (next page):

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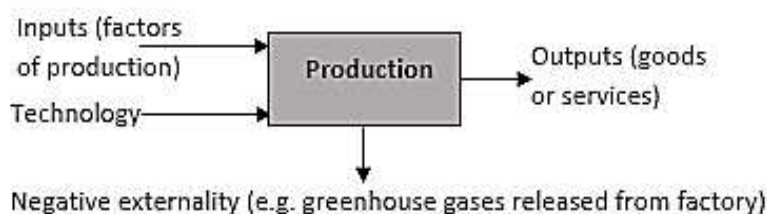
<sup>1</sup> Henceforth input-process-output diagram will be abbreviated as IPO



**Figure 1:** An IPO illustrating the economic activity of production

Firstly, the above illustration (Figure 1) can be used as an easy-to-understand example of economic models (or theories). A model is a simplified representation of something designed to better understand that something (Arnold, 2009; Mankiw, 2012); figure 1 is a simplified representation of the production process which helps to better understand the process. The important role of assumptions in economic modeling can also be highlighted in this discussion. In the model in figure 1 it is assumed that the only inputs necessary to produce the output are one or more factors of production and there are no by-products of this process.

Secondly, critical and creative thinking can be tested and stimulated by asking the students to analyze the assumption above (last line of last paragraph), then improve it and thereby incorporate the concept of technology and externality into the model of figure 1. This can be done by adding one more input for technology and one more output for negative or positive externality (a by-product of the production process) as illustrated in figure 2 below. Alternatively, the instructor may introduce the concept of an IPO first and then assign the students to use it to model the concept of production or consumption and its externalities.



**Figure 2:** Incorporating technology and negative externalities into the model in figure 1

Thirdly, the IPOs in figure 1 and 2 can also be used to illustrate the predictive power of models. For example, it can be predicted that an increase in any one of the inputs (either technology or

factors of production or both) will lead to an increase in outputs, and hence, the instructor may explain the concept of economic growth as a part of the discussion.

The following YouTube video provides a sample of how an IPO can be used to discuss the concept of production and concepts related to production, such as fixed inputs, variable inputs, fixed costs, and variable costs:

<https://www.youtube.com/watch?v=VX9PcHpYTYo&t=59s>

### 3. Evidence from Classrooms

During an assignment on the topic of production, students were asked to explain the concept of production using the example of a small coffee shop. Full marks were awarded if the answer included a sensible discussion on inputs and the output in this case (cups of coffee). Interestingly, almost all the students who used an IPO in their discussion obtained full marks because they discussed both inputs and outputs in the given context. However, most students who did not use an IPO in their answers did not precisely discuss the output in the given case and thus received lower marks.

### 4. Conclusion

Existing research already shows that teachers and students both benefit from visual aids and hence IPOs' simple visual nature can improve the teaching and learning of certain important economic concepts. In conclusion, IPOs similar to figure 1 and 2 can be included in textbooks and class discussions when discussing the concept of production (or consumption), concepts related to production (e.g. externalities and economic growth), and as an easy-to-understand-first-example of economic models. The IPOs can precede the circular flow model and the PPF in textbooks and classrooms thus providing more exercise on the fundamentals of economics modeling or it can be used when teaching the concept of production and its externalities. Of course, IPOs can also be used to teach other concepts of economics and they can also be used to make simple animations in MS PowerPoint. Experimental research can be undertaken to assess the impact on students' learning and their perception of the use of IPOs in particular, and visual aid in general. Due to the limitation of resources, we could not conduct experimental research and surveys on the impact of IPOs which leaves room for further research.

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