Factor–Factor Relationship

Any production activity requires different inputs to produce a given quantity of output. There are many ways of combining these resources or production technology in the production process. Farmers are many times confronted with the problem of making a choice of production technology. Farm production facilitates the substitution of resources. In general, a farmer producing farm products does make a choice between nutrients say, organic manures and inorganic fertilizers, human labour and machines, human labour and herbicides, *etc.* Similarly, farmers producing livestock products make an effort to decide upon the quantity of grain and hay to arrive at feed ration. The problem here is to decide up on the most appropriate resource or method or given combination that costs the farmer the least amount in producing a given level of output. The managerial problem here is to find out the least cost combination of inputs for producing a given level of output. The production function here is

$$Q^* = f(X_1, X_2)$$

Where,

Q^* is fixed level of output and X_1 and X_2 are the quantities of variable inputs

The factor–factor relationship deals with two independent variables and dependent variable giving rise to three-dimensional diagram. Iso-quant is a convenient method of compressing three-dimensional diagram into two-dimensional diagram.

ISO-QUANT

Iso means equal and *quant* is quantity. Iso-quant is also termed as iso-product curve or equal product curve or product indifference curve. Iso-quant in the theory of production is a counterpart of indifference curve in the theory of consumption. *The curve representing all combinations of X_1 and X_2 that produce the same level of output is called an iso-quant.* Table 19.1 shows that an output amounting to 100 units can be produced using the input combinations presented. The iso-quant (Figure 19.1) presents all combinations of X_1 and X_2 that produce 100 units of output. Iso-quants can be shown for any level of output. As such, several iso-quants can be shown for various levels of output with different levels of inputs. If a number of iso-quants are drawn in one graph, it is known as iso-quant map or iso-product contour (Figure 19.2).

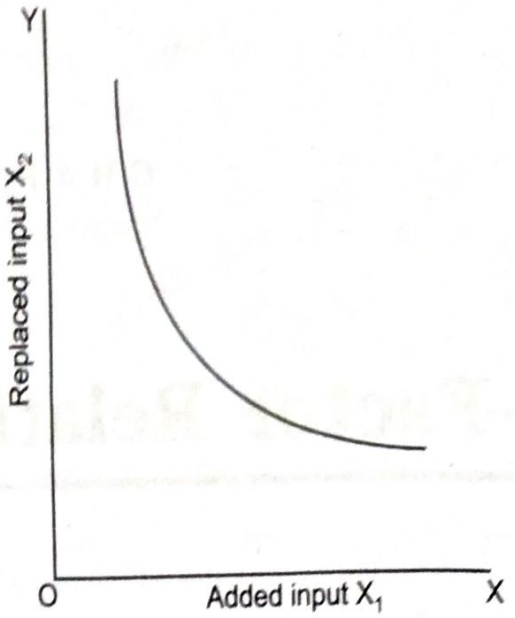

Figure 19.1 Iso-quant

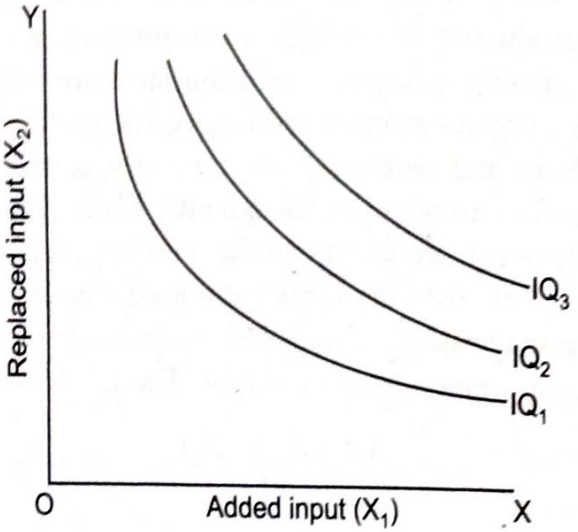

Figure 19.2 Iso-quant map.

TABLE 19.1 Input Combinations Producing the Same Level of Output.

X_1	X_2	Total output
1	13	100 units
2	8	100 units
3	5	100 units
4	3	100 units
5	1	100 units

Properties of Iso-quants

1. *Iso-quants Slope Downwards from Left to Right:* If the quantity of input, say X_1 is increased, the quantity of other input say X_2 must be decreased to obtain the same level of output.
2. *Iso-quants are Convex to Origin:* The absolute slope of iso-quant decreases as we move left downwards to the right indicating diminishing rate of technical substitution. Because of diminishing marginal rate of technical substitution, each added unit of one input replaces less and less than the previous unit.

3. *Iso-quants Placed above Another Represent Higher Output*: Iso-quants placed for higher level of output normally lie above the iso-quants representing lower level of output. Alternatively, iso-quants representing higher levels of output are placed farther away from the origin.
4. *Iso-quants are Non-intersecting*: No two iso-quants intersect each other because the same combination of two input factors cannot produce two different levels of output.

...rate of substitution.

ISO-COST LINE

It is known as price line or iso-outlay line or budget line. *Iso-cost lines represent various combinations of two inputs that can be purchased with the given outlay of funds.* The iso-cost line can be drawn by locating the end points of X_1 and X_2 given the total outlay and the prices per unit of X_1 and X_2. Suppose a farmer has a fund of Rs. 400 and he has to spend on two inputs *viz.*, X_1 and X_2. The price per unit of X_1 is Rs. 10 and that of X_2 is Rs. 8. Given the prices of X_1 and X_2, he can purchase 40 units of X_1 or 50 units of X_2. If the 40 units of X_1 and 50 units of X_2 are graphed, we get iso-cost line (Figure 19.8).

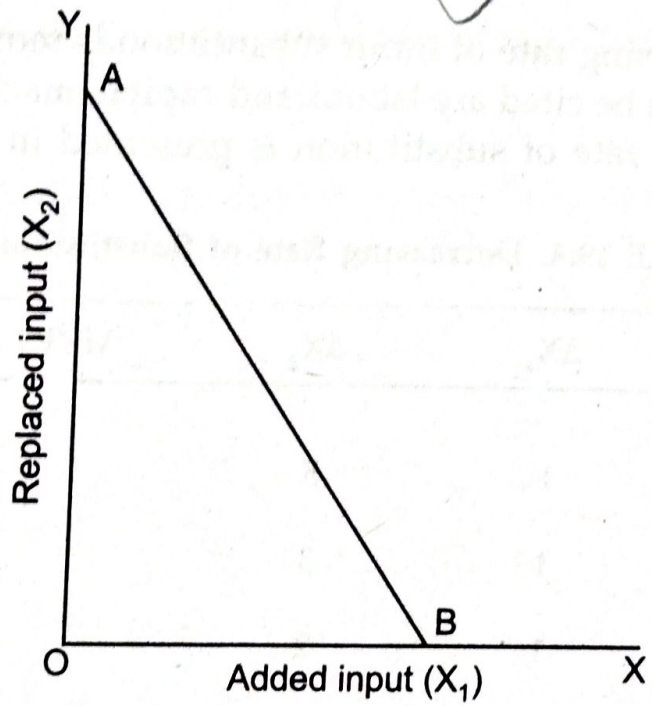

Figure 19.8 Iso-cost line.

When the entire amount of Rs. 400 is spent on X_1 the quantity that can be purchased is OB (40 units) and similarly the quantity of X_2 that can be purchased for Rs. 400 is OA (50 units). If points A and B are joined, we get iso-cost line. For any combination of X_1 and X_2 on iso-cost line, the total cost remains the same.

Characteristics of Iso-cost lines

The two important characteristics of iso-cost line are its distance from the origin and slope. When the total outlay or budget increases, the iso-cost line shifts upwards to the right. Alternatively, the iso-cost line moves farther away from the origin. The slope of the iso-cost line shows the inverse price ratio of factors. Changes in the input prices change the slope of the iso-cost line. An increase in price of an input means less of that can be purchased and similarly more of it can be purchased if the price falls. Iso-cost lines are parallel to one another, since relative price ratio remains constant.