

## Dwarf Fortress economics, wealth accumulation and in-game progress

### Factors of production, brief historical introduction

Traditionally the factors of production have been divided into three categories: Land, labour and capital.

**Labour** refers to physical and intellectual work performed by individuals.

**Land** traditionally referred to arable areas which could yield crops, the production of which was seen as fairly constant. It can also be interpreted to refer to natural resources, ores, oil, forests and the like.

**Capital** traditionally and colloquially refers to real economic goods that assist in production, such as tools, machinery and buildings etc. It is also defined *functionally* as wealth dedicated to the production of additional wealth. A shovel hung into your living room as a decoration, wouldn't be capital, but if you would take it down and use it for production or commerce, it would become capital.

**Wealth**, then, is the product of the factors of production used either for leisure or business.

An American economist Henry George elucidated the role of land in economics in one of the most influential books on economics called "*Progress and poverty*", and implicitly included *location* under the land classification. The value of a house, or work performed, is dependent on where it is or takes place.

These factors then combine to yield wealth. Crops grow by virtue of nature; Sun shines, rain falls on the ground, and the seeds of plants contain a self-replicating machinery that utilizes these resources to push its stalk from the soil. Labour, is also required, when people toil at the fields and plough the land. Machinery or draught animals, tools and structures contribute their share to the total product.

## Cobb–Douglas, Solow–Swan and Mankiw–Romer production functions and models:

### A brief summary

Land, capital and labour were later augmented and the models developed by economists. You can look up the `Cobb-Douglas production function` and the `Solow-Swan` model from wikipedia for further information.

**The level of technological progress** has been incorporated into the production modelling. The total productivity increases with new scientific discoveries and research, and therefore the technological progress has a role in predicting future growth.

**Human capital** is defined as accumulated knowledge, culture and training that people have. Well-educated and knowledgeable people yield a higher product.

**Capital-intensity and rate of replacement** explains that there's a theoretical equilibrium at which the proportional intensity of labour and capital may stabilize due to capital depreciation rate.

An example in practical terms:

If the entire economy is composed of two jobs, ploughing fields and constructing ploughs, the rate at which ploughs break down is a factor in determining what share of population builds ploughs while the other share works the fields.

Technological progress allows constructing more durable ploughs that last a longer, or more efficient ploughs that yield higher product.

Worker training may contribute to proper handling of tools and efficiency in either regard.

## Dwarf Fortress: Low capital intensity and somewhat variable wealth accumulation

In the context of Dwarf Fortress I think the role of capital is in some contexts fairly low. The amount of labour it takes to produce wheelbarrows and the like, is comparatively low in comparison to how long they're used.

Aggregation of capital is not a very central part of Dwarf Fortress economics. This in a sense makes the progression pattern short. The player doesn't spend a long time accumulating the required machinery and tools to enable production. Workshops are fairly cheap. On the other hand producing materials like metal bars is fairly important, and mining out locations and spaces in which the workshops reside and items are stored, is very important.

Personally I would prefer that each industry would have some niches such that enabling higher production would require "*investments*", that you would have to build a set of tools that would sometimes break down, and switching industries would require making sure that you can conveniently obtain required tools and the industry related "capital" in the sense defined in this text.

In conclusion, I think that by looking at ways of increasing the role of capital in Dwarven Economics, it would be possible to make the game more fun, and longer term.