

## **Relationship Between Newtons 2<sup>nd</sup> Law ( $F=m \times a$ From Physics)**

and

## **Productive Forces ( $F_p= M_p \times A_p$ From Commerce)**

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### **Objectives :**

To Create interrelationship between the Force defined by Newton in his 2<sup>nd</sup> law of motion and productive forces defined in the field of commerce.

We need to study both Newtons 2<sup>nd</sup> law and productive forces separately for establishing relationship between these two.

### **Productive Forces :**

*The Productive Forces or The Forces of Production or Productive Powers* refers to the combination (sum total) of all the means of labour i.e. tools, machinery, land, infrastructure etc. with human labour power.

Productive forces are all those forces which are applied by people in the process of production or manufacturing

For Example

- Body & brain,
- Tools & techniques,
- Material, resources,
- Quality of workers,
- Co-operation and equipment etc.

### **Newton's Second Law:**

Newton's Second law is related to the behaviour of objects for which all forces are not balanced.

The Second Law of Newton states that the acceleration (a) of an object depend upon the two variables :-

1. The Net Force acting upon the object (F)
2. The mass of the object (m)

The acceleration (a) of an object depends :-

1. Directly upon the Net Force acting upon the object (F)
2. Inversely upon the mass of an object (m)

**Forces are Unbalanced**

**Theirs is an acceleration**

**The acceleration depends**

**(a)**

**Directly upon the Net Force  
(F)**

**Inversely upon The mass of an object  
(m)**

**Newton's second law of motion can be formally stated as follows :-**

The acceleration of an object (a) as produced by a net force (F) is directly proportional to the magnitude of the net force (m) in the same direction as the net force, and inversely proportional to the mass of the object (m).

This verbal statement can be expressed in the equation form as

$$a = F_{net} / m$$

*or*

$$F_{net} = m \times a$$

The Net Force (**Fnet**) is equated to the product of mass times the acceleration.

#### **Basis of Relationship**

To create interrelationship between the forces of production and Force defined by newton we need to represent these production forces in symbolic form

Let net Forces of Production = **Fp**

As , **Fp** is the sum total of various forces then we need to symbolize subforces also.

Let Tools as Force of Production = **Tf**

Machine as Force of Production = **Mf**

Land as a force of production = **Lf**

Infrastructure as a tool of Production = **If**

We know Force of production is the sum total of various forces used in the process of production or manufacturing.

Now we need to accelerate these forces and each force have their own mass.

**Acceleration of Productive Forces** :- To accelerate these productive forces in production process with management skill and other skills performed during production process.

Symbolically :

Acceleration of Productive Forces = **ap**

Here Vector is used because we accelerate these forces in a particular direction and that direction to attain various Goals/objectives defined.

**Mass** : We use these forces in production process in a well defined quantity/measurement, that can be cardinal or ordinal.

Symbolically

Mass of productive forces = **mp**

#### **Newton's Second Law Basis Of Estimating Productive Forces:-**

➤ **According to Newton's Second Law**

- **The Net Force is Vector sum of all the forces.**
- **The acceleration is directly proportional to Net Force**
- **The Net Force equals to mass times acceleration**

➤ **Estimation of Productive Forces**

- 1) The Net Force (Force of Production **Fp**) is vector sum of all the Forces (Forces used in production process like – tools, machines, infrastructure etc.)
- 2) The acceleration of productive forces (**ap**) is directly proportional to the Net Force or Forces of Production (**Fp**)
- 3) The Net Force (Force of Production **Fp**) is equals to Mass times the acceleration.

**The Net Force (Force of Production Fp) is vector sum of all the Forces (Forces used in production process like – tools, machines, infrastructure etc.)**

We know that in production process we use different forces simultaneously in some specific proportion the forces used in production process may be raw material, tools & techniques, machines, infrastructure etc. the quantity of which depends upon the resources available during the production process.

Here all the forces used in production process have their own significance according to their own significance on the basis of the need of production which depends upon the scale of production.

If we symbolize these forces then :

Let Force of Raw Material	= <b>Rf</b>
Force of Tool & technique	= <b>Tf</b>
Force of Machinery	= <b>Mf</b>
Force of Land	= <b>Lf</b>
Force of infrastructure	= <b>If</b>
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.	.
.	.
.	.
.	.
.	.
.	.
Force of nth item used	.
in production process	= <b>Nf</b>

Then a proportion of these all forces is decided by the management, and used in production process. The sum total of a defined proportion of all forces can be termed as the “Net Force” of Production - **(Fp)**

This Net Force is the sum total of all that forces which are used in the production process.

Symbolically :

$$Fp = Rf + Tf + Mf + Lf + If + \dots + Nf \text{ -----(1)}$$


**The acceleration of productive forces (ap) is directly proportional to the Net Force or Forces of Production (Fp)**

From 1<sup>st</sup> equation Net Force of Production can be calculated but Now the problem arises that these forces does not gives us productivity on their own, we need to accelerate them with the help of skills of management. We have to manage or can say we we hav to perform various functions related to management.

Hence with the help of management skill we accelerate these forces or Net Force ( defined sum total of all the forces)

- We apply management skill to this “Net Force” in a particular direction meaning thereby we have to obtained some specific predetermined objective/goals. With the help of these productive forces with the application of management skill or we can say to accelerate that net force.

**The acceleration of productive Forces is directly proportional to the Net Force**

If  $F_p$     $a_p$   

Or we can say that , if we increase the “ Net Force” or The Force of Production then we need to accelerate them more efficiently and effectively with the help of managerial and other skills.

On the basis of above discussion we reach to the conclusion that if we want to increase the “Net Force” or  $F_p$  which is sum total of various forces, then we have to accelerate them in more efficient and effective way. The requirement of accelerating this Net Force increases with the size of Net Force and Vice-Versa.

**The Net Force (Force of Production  $F_p$ ) is equals to Mass times the acceleration.**

$$F_p = m_p \times a_p$$

The Force of Production refers to the way a given society actually produces commodities and The Force of Production includes raw material, tools & technology, and the knowledge of how to organize the labor power and available tools.

The Net Force or Forces of Production is the product of mass and acceleration.

Because when a ‘mass’ of these forces is increased we feel some problems to accelerate them or we can say that we need more knowledge or skill to accelerate them.

If  $m_f$     $a_p$   

This occurs due to need of accelerating them more efficiently. When the mass of these forces are increased and if this mass is decreased then the need of accelerating also decreases.

***On This basis, we reach to the conclusion that “Net Force of Production” is the product of mass and acceleration.***

**Thus Productive Forces may be decided on the basis of Newton’s second law of motion.**