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An Engineering Approach to Develop a Mathematical Model for Sustainable Population

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Abstract

Sustainability has been linked with every aspect of present day civilization except size of human population. We talk about sustainable environment, sustainable economy, sustainable education, etc. and end up listing "… and also human population" at the end of the causes of environmental degradation, bad economy, inadequate education etc. Practically, the study of natural ecosystems alone is not getting us anywhere. We have to discuss these aspects for each political ecosystem as defined by the geographical boarders of states as recognized by the UN and consider the human population in each state and determine the sustainability of its size. Political states and their populations have been suffering from the consequences of overpopulation for a long time. Indications of their continuously degrading environment, poor economy and unemployment are undeniable. On the other hand the size and distribution of the population of each state is well documented. Our primitive population model is considering the population distribution diagrams as a basic block with the net births each year as input to this block and the number of people that retire each year as the output. The difference between these numbers for each state will be the number of people that are expected to be unemployed when they reach the age 21 or 22 for university graduates plus the age group (15-24) that has not gone to university. We make a case study for some states and compare their present day unemployment. We open the development of unemployment mathematical model to other interested researchers for further development and collaboration.

Keywords

Demographic distribution, Engineering model, Sustainable population, Unemployment

1. INTRODUCTION

Increased use of water and energy

Sustainability has been linked with every aspect of present day civilization except size of human population and the human population density which can be measured as average population/km2 for each country. We talk about sustainable environment, sustainable economy, sustainable education, etc. but never sustainable population. Is this intentional or merely a coincidence is not very clear.

Countries are ecosystems or parts of a larger natural ecosystem, surrounded by their political boundaries. Their populations are (or should be) responsible for the safety of their part of the natural ecosystem. It is clear however, that global warming and pollution, which seem to be here to stay for a long time, are resulting due to lack of responsibility of world countries (their populations)! It is obvious that if world population was one billion instead of 7.3 billion, no country would dare to burn so much fossil fuel since doing that would not be profitable! Also, we would not be facing such a big unemployment problem for so long. It seems that unemployment especially among the young is also here to stay. It also seems that global warming and the degradation of the environment is also here to stay [1].

Looking at the latest available data on youth unemployment [1] we see that unemployment rates for the European area countries is about 23% and that of France is nearly 25%, well above the present general unemployment rate of the respective countries which is about 10% [2]. Also way above the acceptable rates for countries which have "free" economies, which is about 5% [3]. These countries are considered "developed" countries, and the birth rates in most of them are below 1%.

However, the average population density of most of these countries is above 100 person/km2, (usually assumed as a norm in sustainability quantitative analysis purposes). Examples, France 122, Hungary 109, Italy 207, Portugal 113, etc. These countries are overpopulated and their birth rate is not an issue at present [4].

We shall try to open the way to quantitative analysis to be able to say about resilience what other workers in the area of sustainability have already discussed and predicted qualitatively [5], [6].

In this work we shall use an engineering approach to determine the number of relevant extra births for a country that would contribute to the young unemployment of that country. We assume that the country of concern has no migration (to or from) for that particular year.

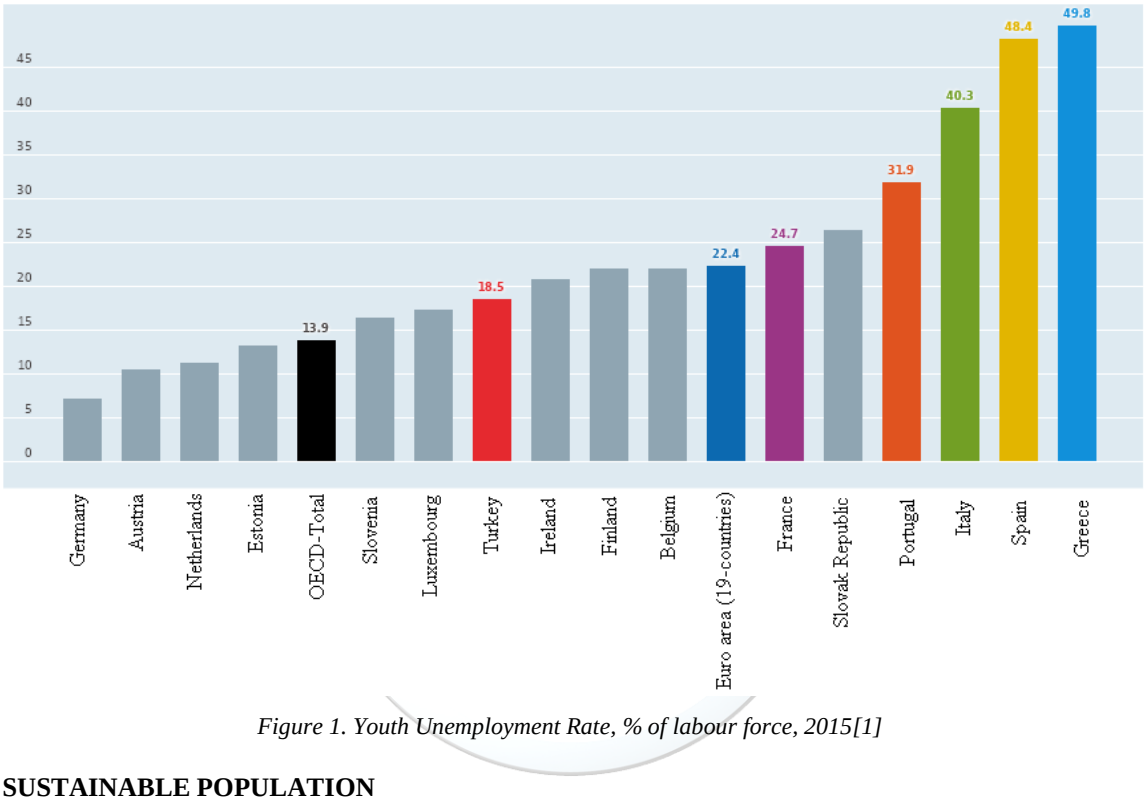

Figure 1. Youth Unemployment Rate, % of labour force, 2015[1]

2. SUSTAINABLE POPULATION

We shall explain our engineering approach by illustrating the steps to be taken for the calculation of extra yearly births that contribute to young unemployment. We shall consider in particular European area countries that have low birth rates but have exceeded the assumed carrying capacity of their ecosystems (100/km2 or there about). These countries are, France, Hungary, Spain, Italy and Turkey. The details will be worked out according to available demographic data. When exact data is not available we shall make reasonable assumptions (such as averaging some figures etc.).

Consider the demographic distribution of a particular country for a particular year. Taking the number of young people who are 15 that year to be (15-24)/10 as input to the work force and the number of population reaching the age of 65 as output from the work force, we see the following three possibilities (we assume equal yearly births and survival numbers (advanced stable population);

1) If population @ 15 = population @ 65 in number there will be no contribution from the 15 year olds to young unemployment.

2) If population @ 15 > population @ 65 there will be contribution to young unemployment, which also means that more births took place 15 years ago.

3) If population @ 15 < population @ 65 then fewer births have taken place 15 years ago.

   This also means that there is more money available for the young employed (resulting from larger number of retired people), hence positive contribution to economic growth.

It is obvious that comparing the numbers of jobs being made available to the age 15 group to jobs becoming available due to retirement of age 65 does not mean that a job vacancy of a 65-year-old will be given to a 15-year-old. What this implies is that the budget resulting from 65-year-old retirement shall be used to create appropriate jobs for the 15-year-old.

3. THE PROPOSED MATHEMATICAL MODEL

From the information we gather from yearly published data on population demographics we can generate Table 1, with the following columns:

a) The first column we list % of young (15-24) unemployment a particular year, say the year 2015.

b) Knowing the population distribution for the year 2015, we determine the total number of young population (15-24) as listed in column (b).

c) From (b) we find the number of unemployed young by multiplying (a)&(b).

d) Consider the number of births @ year 2000 to determine population overshoot contribution.

e) Assuming no input from migration, subtract one tenth the number of (c) from (d) to find the population overshoot due to too many births.

NOTE: This calculation can be made more accurate detailing yearly demographic, but it is not necessary for our purposes in this work.

The calculations above have been made for the European area, France and Turkey as shown in Table 1 below.

Table 1. Year 2000 Population overshoot for some countries

Country	(a)%	(b)(15-24) Persons	(c)(15-24) Unemployed	(d)2000 Births	(e)Overshoot
France	24.68	11,640,263	2,872,817	774,782	487,500
Hungary	17.30	1,669,624	288,845	98,000	69,116
Spain	48.35	6,449,045	3,118,113	397,632	85,821
Italy	40.33	8,372,141	3,376,484	543,039	205,391
Turkey	18.52	20,701,736	3,833,962	1,389,000	1,005,604

4. CONCLUSIONS

From the table it is clear that economic crisis resulting from high unemployment follows from high birth rates. Now it could be argued that birth rates cannot be controlled because of human rights. But human responsibility is also a virtue which is granted for humans only. So why not remind the human race of this virtue.

It is clear that the political ecosystems occupied by countries presently indicate that their carrying capacity is exhausted. An international call should be made to all countries to assume responsibility.

We should remember that throughout history humans have come together to form families, groups, clans, nations which are extinct today. It is obvious from historical findings that the previous human societies were not resilient. If we can predict that a flat tire in a highway can deter our journey (thus we carry a spare tire) we should also be able to predict that if we do not save enough natural resources in our ecosystems, then we cannot continue the journey of civilization. It will be interrupted for sure and the human offspring will have to start all over again!

Finally, we see that a simple input – output model can help to have a bird's eye view of population progress in a human society and helps to predict what actions need to be taken for longevity of our ecosystem.

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