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Globalisation, energy usage and sustainability

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Abstract:

Energy usage plays vital role in the spread of globalisation, through the process of industrialization and free trade of goods and services, has posed challenges in achieving the goal of global sustainability. Industrialized world has economic growth based on fossil fuel which may lead to environmental degradation. Such economic growth has two problems related to the industrial process from the perspective of sustainable development: intensive use of natural resources as raw material and produced goods from industries; and harmful gases emitted as a consequence. The exploitation of natural resources for industrialized process will lead to unsustainability because of earth's limits of reproduction. Similarly, GHG's emission from industries responsible for global warming is the main cause of climate change will also lead towards unsustainability. This calls for the need of transformation in current industrial production pattern and switching to sustainable energy options for achieving goal of sustainability of globalisation.

Globalisation in its current state is leading the world towards unsustainability through the use of natural resources on large scale for industrial production purpose. The process of industrialization in 'techno-industrial' society as regarded by (Rees, 2006) is considered to be fundamentally unsustainable. He found out the basis of unsustainability in behavior of humans who are consuming the material basis of their own survival. Globalisation has shortened space and time which made flow of natural resources more freely and rapidly than any previous times. Globalisation mainly driven by free trade and industrialization has contributed heavily in the consumption of energy intensive goods across the globe.

Increased consumption of natural resources (primarily from fossil energy resources) in an integrated world by world's population in finite pool of resources will lead to un-sustainability. The rate at which resources are being consumed is higher than its natural reproductive capacity. Heavy consumption not only poses threat to natural resources, other habitats also get affected due to consumption. Near depletion of vital minerals and fossil energy sources, scarcity of good cultivable soils, threatened species birds, plants and fishes, deforestation, crop failures, scarcity of good cultivable soils, food scarcity, protein deficiency in third world countries, pollution, problems of disposal of dangerous wastes (Alexander, 1985) are result of excessive consumption. As a result of increasingly heavy consumption, the country economy will start depending upon imports to meet needs of people and become 'import-dependent country'. Globalisation intensifies the imports of goods in raw and manufactured form via free trade.

The increased energy supply and its use –mainly comes from the source of fossil fuel that is Carbon-intensive and main source of greenhouse gas (GHGs) emissions- by industrialized nations pose challenge to keep the environment clean in a way to keep on development track.

On disposal side, earth has reached its limit of absorbing waste produced as a result of consumption of goods by world's population especially carbon intensive goods from industrial processes.

Statistics shows that increased consumption pattern is non-uniformly distributed among world population. For example, in United States having 10% of world's population consume 25% of natural resources annually. This non-uniform distribution shows economic behavior of people that is un-sustainable. It should also be noted that population growth, as argued by (Daly, 2006) is not much of an issue in achieving sustainability, instead managing the distribution of natural resources among population is. Globalisation can play key role in the proper management of resources distribution among nations.

However, some hurdles have been observed which causes difficulties in moving towards sustainability. On top of such hurdles being the use of term 'sustainability' mostly serves as topic of conferences, newspapers article, and political debates and less action is taken by

governments and global influential bodies. Countries having high rate of globalisation start caring for sustainability when reach at threshold point of GDP growth and heavy consumption could be efficient sign of sustainable behavior toward caring for nature. However, this practice cannot be used as an example for emerging economies or countries yet to be globalized due to limitation of earth's ecosystem. Another hurdle with this sustainable approach (related to Kuznets Curve) is it's manifestation of being sustainable, while in actual it is not. Shifting to paper-less technology, for instance use of kindle, iPad and other e-devices is propagated as sustainability step toward nature preservation by saving trees. While in reality, such paper-less technology require much more resources and economy to produce e-devices than needed for paper production from trees.

Another hurdle which is not discussed in great detail in literature is the blame game. Power game of big economies and influential countries is causing 'sustainability-globalisation' blame game for following reasons. Firstly, the primary focus of economies, both emerging and developed, is to achieve sustainability at local level before start doing any effort at global level. Secondly, countries having record of historical greenhouse gases emissions developed their economies are well-off now; and countries with recent industrial growth results in high emissions are in their developing stage; they both blame each other for taking responsibility and play active role in achieving target of global sustainability. These reasons-shifted focus and lack of responsibility- create environment of less caring about sustainability. These are the main causes behind in-action towards sustainable management of globalisation. Less globalized countries that are large in number also affected because of power game. They are not free in designing inter-state sustainable policy in the presence of influential countries. This blame game is another justification for not doing enough in achieving sustainability targets.

Positive impacts of energy use	Negative impacts of energy use
High economic growth	Main cause of climate change
More development (infrastructure of roads, buildings, schools)	Health problems in residential areas nearby industries.
More equipped and economically stable to	Unsustainable in long run

handle environmental problems

More capable of helping nations with diffusion of technology Threats to biodiversity, ecology – deforestation, floods, erosion

More care towards sustainable energy use Environmental degradation

Table 7.1 Positive and negative impacts of energy usage in globalized world:

It is now becoming clear that how, on one hand, globalisation has benefits in raising people's standard of living through economic growth, while on the other hand, it deteriorates environment and causes climate change by emissions from industries of fuel based economies. It can also be termed as 'energy-prosperity-environmental' dilemma. This calls for a need to design 'climate policy' that bring all nations on-board to develop strategies for the use of fossil fuels in a climate friendly way and/or switching to renewable energy in moving towards a more sustainable energy future.

The purpose of this study is (a) to measure the harm caused by C-intensive source of energy i.e. fossil fuels on a global scale, and (b) to measure the efforts by nations at local, regional and global levels in steps towards sustainable energy future.

Hypothesis for this study is that more globalized countries, having high growth rates as well as high energy consumption, are also capable of protecting environment in a better way to achieve goal of sustainable energy future.

How can sustainability of the current process of globalisation be assured that is fuelled by heavy consumption of fossil fuel as energy and finite natural resources for industrial manufacturing?

What are the possibilities of transition of current process of globalisation from C-intensive energy resources to sustainable energy resources?

We use indicator based approach to test hypothesis by linking Globalisation Convergence Index (GCI), a measure of globalisation, with indicators of sustainable energy use. Globalisation Convergence Index (GCI) is an index of globalisation that measures globalisation in multiple

domains from politics to economy, from technology to social cultural and ecological domain; it measures the extent to which countries are globalized in given domains.

The indicators of sustainable energy are selected from three broad domains (Environment, Economy and Social) as defined by United Nations and World Bank. Among the list of sustainable energy indicators, some serve as drivers, while others serve as outcome variable.

The design of the study is stated as: the GCI will be linked with sustainable energy indicators using correlation analysis to test the strength of relationship between the two indicators. Regression analyses will be performed to assess the variance as explained by GCI (independent variable) in the variables of sustainable energy (dependent variable) with control for confounding factors.

Literature Review

Spread of Globalisation through industrialization and free trade of goods and services.

In current times, the phenomenon of globalisation has touched upon (showed its effects in) almost all areas. The manifestation of globalisation can be observed in global political dynamics, in global spread of technology, in economic agreements on global scale, in cultural integration. Although, globalisation has been existed in pervious time in different forms and at different levels, current form of globalisation has become increased many folds since the beginning of industrial innovation. The invention of steam engine by James Watt in 1765 marks the beginning of industrial revolution that gives rise to current form of globalisation i.e. contemporary globalisation (Rennen & Martens, 2003). In the beginning, coal has been used as fuel to run steam engine which was later replaced by liquid and gaseous fuels. Industrial revolution brought innovation in transportation for the movements of goods and people via land and sea. Global trade and transportation has been used to transport industrially manufactured goods from one place to another. Globalisation facilitated the free flow of industrial goods through the spread of free markets world-wide (Streeten, 1998). Such movement of industrial material gave rise to contemporary globalisation. Such rapid development and movement raised people's living standard by increasing their income level.

Industrialized world has economic growth based on fossil fuel leading to environmental degradation.

Industrial era brought revolutionary changes in the production pattern when it changed from biological metabolism to mineral metabolism in the last 250 years. Industrialization can be equated as rapid development because of its high productivity in comparison to production methods used before the invention of steam engine. Nations started industrializing their economies by adapting new production methods. This development was occurring at the cost of intensive use of resources and fossil fuel for energy use.

Industrial activities and transportation of industrially manufactured goods through free trade heavily affected the nature era in two major ways: exploitation of natural resources for production purpose and emission of harmful gases by the use of fossil fuel for energy purpose. In looking at the history of industrialization, it shows man's devising ability and his unlimited power over nature (Macgregor, 1931). This limitless ability made human to exploit nature at its fullest. Humans are consuming natural resources so intensively at a rate higher than its reproduction rate (Rees, 2006). Emission of green house gases(GHG's) mainly CO₂ from industries and transportation is the dominant factor causing climate change by warming the earth's average temperature (IPCC, 2007). GHG's emission in the environment due to human activities has some driving factors. (Raupach et al., 2007) identified four driving factor of CO₂ emissions from fossil fuel combustion and industrial processes. Global population (P), world's GDP (G), carbon intensity of GDP (h) and primary energy consumption per capita (E) are those driving factors. These two ways are leading the global environment towards degradation.

Both processes will lead towards unsustainability because of earth's limitation of reproduction rate and absorption of waste.

The increased emission of GHG's from industries has been topic of talks and conferences(Rees, 2006), but no action has been taken yet in significant reduction of hazardous gases from the atmosphere. The fact is that no region is de-carbonizing its energy supply. (Raupach et al.,

2007) Thus, the spread of globalisation is leading towards unsustainability though industrialization and free trade of industrial goods (Rees, 2006). Emissions from industries and transportation are so high that it crossed the limits of nature to absorb them.

Need to transform industrial production pattern and switching to alternative energy.

The increased CO₂ level in the atmosphere thus calls for the need to transform current industrial production pattern and switching to alternative means to find solutions of climate change and energy issues. Studies show that CO₂ emission and income level growth both are drivers of alternative energy option (Sadorsky, 2009).

Phases of development to globalisation

Phase I (pre-industrialization ear to beginning of industrialization) (1800-1930s')

- First World Countries (FWC), a term widely used in pre-industrial era, are mainly masters having colonies in different parts of world mainly in Africa and Asia.
- FWC have used-up natural resources on their lands.
- Made journeys to outside regions for more land, more resource. For example, voyages of Christopher Columbus open doors to European exploration and colonization of the American continent.
- Empires of France, Netherlands, Portugal, Spain, Britain, and Belgium on different regions.
- Beginning of industrial Revolution after the invention of steam engine by James Watt in 1865.
- Sudden acceleration of technical and economic development.
- Traditional agrarian economy replaced by machinery and manufacturing.
- Transfer of balance of political power from landowner to the industrial capitalist and created an urban working class.
- The industrial revolution spread throughout Europe and the USA and various colonial empires.
- People of colonized regions are regarded as Third World Countries (TWC) people.
-

Phase II (de-colonization to WCED 1978)

- FWC masters returned to their lands.
- They brought natural resources and human capital with them.
- FWC prosper through industrialization
- Developed infrastructure, better health, better transportation
- FWC flourish, TWC started their development with the support of FWC. Support in both policy and monetary terms.
- TWC despite of having resource-rich were far from development level of FW.
- High level of development in FW at the cost of natural resources mostly from FW.

Phase III (WCED to Kyoto Protocol 1997)

- FW realized the damage done by high industrialized rate (realized the scale of damage as global since environment has no boundaries) and gathered around to discuss its possible consequence and measures to be taken in order to protect environment from further deterioration.
- Their realization coined the term SUSTAINABLE DEVELOPMENT
- Call for need of stern action
- RIO conference 1992
- Since then all discussion, no significant action taken to tackle the issue
- Industries started migrating
- Less migration of people from TWC
- Sharp decline in GHG in FWC
- Increased significantly in TWC, mainly China
- Problem persists, but shifted
- TWC on development track
- Need to stabilize living standard
- Low income per capita than FWC
- More pollution
- Need direction

- FW development track has negative consequences
- Also, limitation of environment (re-production and assimilation capacity)

Material and Methods

In efforts towards bringing globalisation on sustainable pathway, the impact of industrialization and free trade caused by intensive resource and energy use on the spread of globalisation process is measured. The hypothesis for this study stated as countries that are highly globalized, having high growth rates and high energy consumption, are more capable of dealing with environment stress driven by resource scarcity and GHG's emissions than less globalized countries in a way towards achieving goal of sustainable energy future. We used indicator based approach to test our hypothesis. For this purpose, an index of globalisation called Globalisation Convergence Index or GCI is linked with indicators of sustainable energy use. Globalisation Convergence Index (GCI) is an index of globalisation that measures globalisation in multiple domains from politics to economy, to technology to social-culture and ecological domain. It measures the extent to which countries are globalized in given domains. The indicators of sustainability are selected from different domains including biodiversity, land, industry, energy consumption, alternative energy, technology and transportation. The detailed list of sustainability indicator with their definition and source are given in *Table 7.2*. Among the list of sustainable energy indicators, some serve as drivers, while others serve as outcome variable.

The design of the study is stated as: the GCI will be linked with sustainable energy indicators using correlation analysis to test the strength of relationship between the two indicators. Regression analyses will be performed to assess the variance as explained by GCI (independent variable) in the variables of sustainable energy (dependent variable) with control for confounding factors.

Indicator	Definition	Unit	Source(s)	Year
Fish species, threatened	Fish species are based on Froese, R. and Pauly, D. (eds). 2008. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.	Number of species	Froese, R. and Pauly, D. (eds). 2008. FishBase database, www.fishbase.org .	2013
Plant species, higher threatened	Higher plants are native vascular plant species. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.	Number of species	United Nations Environmental Program and the World Conservation Monitoring Centre, and International Union for Conservation of Nature, Red List of Threatened Species.	2013
Mammal species, threatened	Mammal species are mammals excluding whales and porpoises. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.	Number of species	United Nations Environmental Program and the World Conservation Monitoring Centre, and International Union for Conservation of Nature, Red List of Threatened Species.	2013
Bird species, threatened	Birds are listed for countries included within their breeding or wintering ranges. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.	Number of species	United Nations Environmental Program and the World Conservation Monitoring Centre, and International Union for Conservation of Nature, Red List of Threatened Species.	2013
Forest area	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens.	% of land area	Food and Agriculture Organization, electronic files and web site.	2011
Industry, value added	Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.	% of GDP	World Bank national accounts data, and OECD National Accounts data files.	2012
Fossil fuel energy consumption	Fossil fuel comprises coal, oil, petroleum, and natural gas products.	% of total	International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp).	2011

Indicator	Definition	Unit	Source(s)	Year
Electricity production from renewable sources, excluding hydroelectric	Electricity production from renewable sources, excluding hydroelectric, includes geothermal, solar, tides, wind, biomass, and biofuels.	% of total	IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp), Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and Energy Balances of OECD Countries	2011
Annual freshwater withdrawals, total	Annual freshwater withdrawals refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100 percent of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including withdrawals for cooling thermoelectric plants). Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. Data are for the most recent year available for 1987-2002.	% of internal resources	Food and Agriculture Organization, AQUASTAT data.	2011
Renewable internal freshwater resources per capita	Renewable internal freshwater resources flows refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. Renewable internal freshwater resources per capita are calculated using the World Bank's population estimates.	Resources per capita(cubic meter)	Food and Agriculture Organization, AQUASTAT data.	2011
Urban population growth	Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects.	Annual %	World Bank Staff estimates based on United Nations, World Urbanization Prospects.	2012
Alternative and nuclear energy	Clean energy is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others.	% of total energy use	International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp).	2011
Energy use per \$1,000 GDP (constant 2005 PPP)	Energy use per PPP GDP is the kilogram of oil equivalent of energy use per constant PPP GDP. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport. PPP GDP is gross domestic product converted to 2005 constant international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States.	(kg of oil equivalent) per \$1,000 GDP (constant 2005 PPP)	International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp), and World Bank PPP data.	2011
Long-term unemployment	Long-term unemployment refers to the number of people with continuous periods of unemployment extending for a year or longer, expressed as a percentage of the total	(% of total unemploye	International Labour Organization, Key Indicators of	2010

Indicator	Definition	Unit	Source(s)	Year
	unemployed.	nt	the Labour Market database.	
Passenger cars	Passenger cars refer to road motor vehicles, other than two-wheelers, intended for the carriage of passengers and designed to seat no more than nine people (including the driver).	(per 1,000 people)	International Road Federation, World Road Statistics and data files.	2009
Motor vehicles	Motor vehicles include cars, buses, and freight vehicles but do not include two-wheelers. Population refers to midyear population in the year for which data are available.	per 1,000 people	International Road Federation, World Road Statistics and data files.	2009
Population, total		Number of people		2011

Table 7.2 Indicators of sustainable energy use.

Results

i. **Fish, plant, mammal and birds**

More globalized countries, equipped with enhanced technologies, taking steps for the preservation of endangered species.

Example: Tilburg Park for Monkey conservation. Monkeys brought from endangered area around the world to kept at a Conservation Park in Netherlands

Another example: Cocoa farming in Africa sponsored by Netherlands to make use of arable land in Africa.

ii. **Forest:**

There exists no relationship between globalisation and deforestation. It is an indication of less or no presence of forest land due to rapid utilization of woods either as a fuel source or for the construction of houses and to serve human need.

iii. **Industry, value added**

Results indicate as countries are getting more globalized, they are producing more industrially manufactured goods using natural resources. It is a positive sign of industrialization and for the advancement of country level in globalisation; however increased industrial production put stress on environment by depletion and degradation of natural resources which leads to unsustainability.

iv. **Fossil fuel energy consumption**

Results verify the fact that Industrialized and globalized countries have fuel-based economies. It also indicates increase in high consumption of fossil fuel in any form (solid, liquid or gaseous state) with rise in its globalisation level.

v. **Electricity from renewable sources**

As countries stabilize their economies and getting high position in globalisation, they start investing in green energy i.e. renewable energy that produce less or no emissions, though the scale of green energy production is not on large scale with the exception of

few countries like Denmark, France who are getting most of their electricity from renewable source i.e. nuclear energy.

Its increased use will raise question on its feasibility for long term use and dependency on renewable source as a replacement of fossil fuels. Electricity from renewable source can be used for running household appliance since they require less voltage, while it can not be used for industrial purpose as it require huge amount of electricity.

vi. **Freshwater withdrawal for domestic and industrial purpose**

Results show insignificant but positive relationship with globalisation. More development requires more use of natural resources which could be unsustainable if done improperly.

vii. **Alternative and nuclear energy**

Results show insignificant but positive relationship with globalisation. Countries using nuclear energy as source of energy production are putting less stress on global environment than the stress put by the use of fossil fuel.

viii. **Urban population growth**

Results have negative association with globalisation. Unplanned and chaotic urbanization is taking a huge toll on human health and the quality of environment contributing to social, ecological and economic instability in many countries.

ix. **Urbanization**

More globalized countries have reached optimum level of urbanization so negative relationship is evidence of low urban growth in high globalized countries. For example, Belgium has urbanized to 97%.

x. **Energy Intensity or Energy use/GDP**

As country economy grows due to globalisation, its consumption level also increases. It is a measure of energy efficiency of the nation's economy calculated as energy per unit of GDP. Results show high energy use per GDP of countries in the process of becoming globalized. As countries strengthen their economies their energy consumption per unit of economy also reduced.

xi. **Long term unemployment**

High unemployment leads to significantly higher government expenditure and tax rates reduced makes difficult to invest in green energy (Dreher, 2006) . It happens during period of recession.

xii. **Passenger cars**

More industrialization made people to use more transportation. This is evident is positive relationship with globalisation. Industrialized countries with efficient transport system for labor mobility can contribute positively towards avoiding from harming the environment.

xiii. **Motor vehicle**

Similar results as of passenger cars.

S.No	Indicator	Sign of effect			Direction of effect		Time of effect	
		No effect	Positive	Negative	Direct	Indirect	Long term	Short term
1.	Fish species, threatened			✓		✓	✓	
2.	Plant species, higher threatened			✓		✓	✓	
3.	Mammal species, threatened			✓		✓	✓	
4.	Bird species, threatened			✓		✓	✓	
5.	Forest area (% of land area)	✓			✓		✓	
6.	Industry, value added (% of GDP)		✓		✓			✓
7.	Fossil fuel energy consumption (% of total)		✓		✓			✓
8.	Electricity production from renewable sources, excluding hydroelectric (% of total)		✓		✓		✓	
9.	Annual freshwater withdrawals, total (% of internal resources)		✓			✓	✓	
10	Renewable internal freshwater resources per capita (cubic meters)				✓		✓	
11	Urban population growth (annual %)		✓			✓	✓	
12	Alternative and nuclear energy (% of total energy use)			✓	✓			✓
13	Energy use (kg of oil equivalent) per \$1,000 GDP (constant 2005 PPP)		✓		✓			✓
14	Long-term unemployment (% of total unemployment)			✓		✓	✓	
15	Passenger cars (per 1,000 people)		✓		✓		✓	
16	Motor vehicles (per 1,000 people)		✓		✓		✓	

Table7.3 Impacts of C-intensive energy use on indicators

Discussion

Analyses have been done to find relationship between globalisation and indicators of sustainable energy use.

Endangered species (fish, plant, mammal, and birds): There exists negative association of endangered species with globalisation index, GCI. Several studies have been done previously on measuring threat level status of endangered species on country level. (UNEP, 2006; World Bank, 2008). More globalized countries, equipped with enhanced technologies, taking measures for the preservation of endangered species. For example, in Netherlands, which is among top ranking countries in the GCI, a primate nature park has been developed that plays important role in the international breeding programmes for gorilla's, bonobo's, wolly monkeys and many other endangered species. (Clarke, 2014)

Deforestation: Results indicate no relationship of deforestation with globalisation index, GCI. It supports our argument that more globalisation leads to (increased use of natural resources OR affect world ecosystem) through industrialization. Since most of the world's wood has been cut down for serving human needs, no or less deforestation is presently being done therefore no relationship with globalisation. Moreover, large scale deforestation poses threats to thousands of species from become extinct. (Vieira, Toledo, Silva, & Higuchi, 2008)

Indicators related to industrial activities are **industry, value added, fossil fuel energy consumption, freshwater withdrawals, and energy intensity (energy usage/GDP)** show positive relationship with GCI. It upholds the point that countries get more globalized as they develop their economy based on industrialization. The increased energy usage also evidence of more globalisation. In other words, as countries are getting rise in per capita income they get permit to pollute the environment through industrial emissions from increased energy use till the point they reached to the height of globalisation and afterwards take steps to fix the damage caused by them as illustrated in Environmental Kuznet's curve. (Tisdell, 2001)

Urban population growth has positive association with GCI is an indication of migration of more people towards cities to find work in industrialized economies. It might be good sign for country economic growth, but more migration could lead to job-scarcity as shown in our results where relationship has been tested between unemployment indicator and GCI. Another reason for job-scarcity lies in the fact that industry works by advancement of technology; and the more diffusion of technology in industry, less will be man-power needed to run that industry. Thus, main drawback of technology diffusion is that it decrease dependency on men and relies more on machines.

Alternative and nuclear energy has non-significant but positive association with GCI. Few countries adopting alternative (cleaner) ways of energy production with zero or minimum emissions that from fossil fuel, however, its use is not on large scale. Switching towards alternative energy could lead to sustainable energy use, but it should be noted that alternative energy cannot replace current industrial fuel system as the industrial system has been designed to be run by fossil fuel (either in solid, liquid or gaseous state), and not by any other fuel.

Passenger cars and motor vehicle show positive relationship with GCI indicate more economic prosperity of individuals in a country as they get more globalized.

Conclusion

In this paper, we have investigated the factors affecting the spread of globalisation through industrialization and free trade in making the process sustainable. As proved in results, current state of globalisation has many hurdles in achieving goal of sustainability due to industrial activities in oil based economies and transport of industrial goods via free trade. The solution of unsustainable globalisation does not lie in switching to alternative energy; it's our economic behavior towards nature that is causing unsustainability.

The findings support the idea that globalisation defined as integrated process does not get success to deliver prosperity in all its domains and also in all regions. Management of resources distribution has heavily affected by industrialization and free trade. Rich economies i.e. top globalized countries are getting benefitted from free trade, while

poverty eradication is still top issue in African countries. The findings of this study reveal that lifestyle of highly globalized countries cannot be followed by people of low globalized countries because of earth's limitation of resource production and its absorption. There are still disparities in the process of globalisation in making it sustainable. In globalized part of the world, caring for environment and sustainable development is an issue, while in developing part; it is not much of an issue on govt. level or on large scale. Developing world issue are security, daily earning bread, weak govt. policies, unstable price index of basic need items. Furthermore, the standard of living has definition varying from country to country, this also need to be addressed.

This research measured factors affecting global sustainability, however it failed to address some important aspects of globalisation. There exists positive relationship between rise in per capita income and level of globalisation. No relationship has been examined to measure social indicators (also domain of sustainability) with rise in income. The notions of FWC (top globalized economies with high level of development) and TWC (low globalized economies with low or average level of development) still exist despite of claims that they do not exist, also need to be covered when addressing issue of sustainability of globalisation. Another important aspect missing in this research is the presence of influential powers having rights to dictate others sometimes as Aid-donors and sometimes in their national interest and national security.

Further work need to address the problem at the root cause level, and not just the consequence. Our economy has expanding nature. Growth is not the problem, but resource use is. Stats show use of material resource per unit of GDP is declining. Aid receiving countries make themselves dependent on donors. They need to allow standing on their own with the available resources they have. Aid should be limited for emergency purpose (natural disaster), not routine activity.

Given the range of views around the issue of sustainability of globalisation, the evidence from this research suggests that MNC's limit their role of creating desires and focus primarily on providing basic needs. More circulation of money and less accumulation will

benefit more people. Standard of living need to be defined as one definition for all countries.

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