Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 10, October 2021 :3170 - 3192

Challenges and Opportunities of Multidimensional Slats of Sustainable Development in Pakistan

(An empirical estimation with Allied indicators)

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Abstract

Sustainable development is concerned with improving the welfare status of present generation without compromising the future one. A major chunk of the world is signatory of fulfilling 17 Sustainable Development Goals by 2030. Pakistan is not an exception. This thought provoking effort is being executed to present some statistics and debate on Pakistan's current status regarding multi-dimensional slats of sustainable development. Sustainable development consists of multi-dimensions and there is no single indicator which could be declared as enough to provide the complete information about all dimensions. To this end, multiple indicators are required to cover all dimensions of sustainable development. We are going to discuss seven different development indicators to estimate multi-dimensional sustainable development for Pakistan during period 2000 to 2018 with help of secondary data. The indicators which are used for analysis are ecological footprint, sustainable economic welfare index, environmental performance index, sustainable human development index, pollution sensitive human development index, green net national product and genuine saving. The investigation of such indicators is essential to assess sustainable development with precision and accuracy. The finding of green net national product and genuine saving indicators measure the economic sustainability and thereby predicts that during study period Pakistan is on path of weak sustainability. The indicators like sustainable human development index and sustainable economic welfare index which measure the social welfare and social sustainability, has also been improved during the said period. This indicates that Pakistan is on the path of weak sustainability. The pollution sensitive human development index shows no improvement in sustainability while the ecological footprint and environmental performance index predicating weakly unsustainability. There is dire need of holistic policy efforts at national level to control population, CO_2 emission which indicates that the pollution sensitive human development index and ecological footprint

show unsustainability in the economy. So for environmental sustainability's fowling are policies interventions needed, and some are short run and some are long run. So for environmental sustainability there is need to decrease the pollution emission like GHG and CO_2 by using the following suggestions. Efficient uses of oil, multi-cropping in agriculture for high yield, imposing restrictions on consumption of oil, shift from private to public source of transportation, population control and environmental friendly energy production. A holistic basket of policies backed by workable implementation plan might be better approach rather than isolated policies across various sectors of the economy.

1 INTRODUCTION

The nexus of sustainable development was initially discussed in the session of Brundtalnd Commission (1987) known as World Commission on Environment and Development. Sustainable development is meant for meeting the human requirements of current generation by utilizing the natural resources in such a protected manner that the future generation needs does not sacrifice. The importance to preserve and sustain resources was familiar to development thinkers as early as 1800s (Tuazon 2013).

The initial effort regarding sustainable development principle is traced back to United Nation (UN) conference on Environment. That was aimed at relating economic progress to environment in result of Stockholm Declaration (1972). The first empirical effort to estimate the economic development impacts on environmental resource depletion, soil and water quality consider critical parameter for sustainable development (meadows, 1972). The word sustainable development was initially described in 1980 by (IUCN, 1980) international Union for conservation of natural resources. The findings of (IUCN) describes that the quest of mankind for economic progress and pleasure of the nature, must related to the limitations and producing capabilities of the ecosystems necessary take under consideration for next generation. The first discussion regarding measuring and monitoring SD setting instruments for continuous assessment of development across the Globe was proposed in (UNCED) UN conference on environment and development (Rio de Janeiro 1992), famous with 21 agenda. This conference proposed a monitoring and evaluation system to evaluate movement to achieve SD by measuring, social, economic and environmental fluctuations (UN, 1992).

The United Nation (2008) defines sustainable development in terms of improvement in livings of society members on two opinions which are well-beings and welfare commonly used interchangeably The notion of well-being is much more complex than that of welfare. The latter indicates those value or benefits which an individual derive or gain from the consumption of good and services by time to time variations, but in perspective of well-being there is no specific definition, because it not just related to health, but it more comprehensive in combination of mental, emotional, physical and health factors (Evans 2015).

The United Nation Development Program UNDP) provides the bases of Human Development which is derived from capability approach given by Sen (2000). In current time, the SD is very concerning and crucial policy objective for globe and necessary policy measure are designed and implemented to monitor the economy performance and current challenges which are being faced (Costantini, 2015). From a theoretical perception, a combined SHD (Sustainable Human Development) paradigm which defined development in such manner which supports the view that capabilities of present people without negotiating the capabilities of upcoming generations (Sen 2000).

Likewise many other developing economies the sustainable development is very important goal for Pakistan. The trade liberalization which brings economies closer to each other put significant impacts on health, education and improvement of living standards which are important concerns for development. According to Human development report (2018) Pakistan is ranked 152 out 188 countries as compare to

neighboring countries like, India 129, Bangladesh 135, Bhutan 134 and Nepal 147. The Pakistan HDI rank in 2014 was 148 out of 188 countries although Pakistan HDI in 2014 was o.55 but now in 2018 it is 0.56.

Pakistan is member of united nation whose sign the MDGs in 2000 which are completed at the end of 2015.These included reduction of extreme poverty, hunger and disease and promotion of gender equality, education and environmental sustainability. Although the international community was mostly ineffective in achieving these quantified targets by the end of 2015, Pakistan also lagged behind in achieving the desired targets. The Millennium Development Goals have now been replaced by the Sustainable Development Goals after the year 2015. In case of Pakistan many studies are conducted to measure sustainable development, (Khan et al. 2013),(Awan 2013) (Mustaq and Azeem 2012), (Qais, 2002), (Mian and Salik, 2016).

Although these research works contribute so much related to sustainable development in Pakistan, but still there is further need of investigation and work to bridge up the gap which are still present in existing literature. SD is multi-dimensional phenomena which consist of Economic, Social and environment indicators. The previous work just includes one or two dimension of development which does not gives the true picture of sustainability. However a single measure does not perfect to accurately measure sustainable development. On reviewing these studies few questions raise in my mind. What are the multidimensional facets of sustainable development in Pakistan? What are the problems and challenges of sustainable development in Pakistan? What are the policy options which are required to adopt. The previous effort does not answer these questions and on the bases of previous research questions and gaps, this study is aimed quantifying the multidimensional facets of sustainable development in Pakistan. It is going to explore the current position of social, economic and environmental sustainability in the country with respective public policy options.

Although the previous efforts regarding sustainable development in Pakistan contribute much in existing literature but there is need of study which covered all the dimensions of sustainable development. This effort is comprehensive in nature and enhanced understanding about multi-dimensional sustainability along with existing literature and tries to bridge up the gap which previous literature left regarding the estimation techniques, data, and selection of indicators for measuring hypothesis of sustainable development. In this study we use seven indicators to cover multi-dimension of sustainable development. The indicators which are used to measure sustainable development are GNNP (Green Net National Product), GS (Genuine savings), HDPI (Pollution sensitive Human development index), SHDI (Sustainable Human Development index), EF (Ecological Footprint) SEWI (sustainable Economic Welfare Index) and EPI (Environmental Performance Index). These seven indicators cover all the dimension of sustainable development and provide the better picture of economy regarding its situation about sustainable development. There are few limitations of this study about its indicators and the calculation methods adopted for the weights which are assigned to natural resources consumption and the damages cause by emission. The secondary data is collected from World Bank bureau of statistics EPI and some other institutions. This paper is divided in to five parts, rest paper consist of Review of literature, methodology, results and discussion and conclusion.

1.1 SCANNING OF LITERTAURE

There are number of studies which are carried to measure sustainable development, and comparison of developed indices and methods to estimate the sustainable development. The following efforts such as (Strezov et al. 2017), (Armeanu et al, 2017), (Evans et al. 2015), (Costantini and Monni 2015), (Estoque

and Murayama, 2014), (Pillarisetti and Bergh 2013), (Bilbao 2013), (Geoffrey et al. 2011), (Paracchini et al. 2011), (Gomez and Fernandez 2010), (Siche et al. 2008), (Moren et al. 2008) and ((Böhringer and Jochem 2007) with intention to empirically estimate sustainable development and make comparison the indices which are developed to measure the sustainable development. On reviewing the literature there is no one index or indicator which is acceptable to all political and scientific communities regarding is its ability to accurately measure sustainable development.

A comprehensive review regarding assessment ability of six different sustainability indices is undertaken by (Wilson et al. 2007) and provided that there is no clear direction at world level that which methodology is best to measure Sustainable development. Nourry (2008) use eight indicators regarding the different dimension of sustainable development in case of France and finally conclude that, that no indicator comprehensively revel the opinion of sustainable development.

The results of five different indices to estimate the sustainable development provided the conflict regarding their ability to compute the sustainable path (Pillarisetti and Bergh, 2013). There is need of integration regarding the development of indices to measure sustainability among the social, policy makers and physical sciences (Rametsteiner et al. 2011). The findings provide evidence that objectives regarding, environmental concern are more linked with sustainable development rather than social (Steuer and Hametner 2013).

The perception regarding the positivity and negativity of any index depends upon the knowledge and vision of the user of that index and policy thinkers (Krank et al. 2013). The quality of sustainability index is not total depends on the method science which that index is developed but along the improved reception from policy makers (Sébastien and Bauler 2013). There is difference amongst the economy, community and environment is reflected on the bases of sustainability parameters discussed (Morse 2015). The Morse (2015) undertook analysis by monitoring the sustainability indicators of individual on media.

In Pakistan, the existing literature regarding SD is limited. The concept of sustainable development is not completely discussed regarding the all dimensions of sustainable development. This portion of research paper tries to discuss the existing literature regarding sustainable development in Pakistan. Pakistan government starts thinking regarding the friendly environment by taking initiative of national cleaner programed of production by facilitating the industry (Qais 2002). The program was multi-sector and advice to industries regarding industrial waste management and environment friendly production methods. The role of developing as well as developed economies is similar for climatic hazards (Awan 2013). This study measures the Environmental sustainability on theoretical grounds and provide these findings and suggest to control the exploiting the current natural resources. The final conclusion was regarding the judicious utilization of natural resource basket for sustainable development. Innovation regarding the human capital, environmental assets and manufacturing sector for more output is focus for Pakistan economic growth (Khan et al. 2013). The study more focuses on relationship between innovation, growth and sustainable development. Mustaq (2012) provides that in Pakistan the male students are more concerned regarding environmental sustainability as compare to female students. That study was conducted to check the students' awareness regarding the environmental sustainability**.** The primary data of three different universities students was collected and analyzed through descriptive analysis.

If Pakistan wants to meet its SDGs, there is need of collaboration from federal organs to all provinces and further distribution of powers (Mian and Salik 2016). There is an effort required from all the stake

holders to play their role to meet the target. There is very huge amount of work which is done regarding the sustainability and its methodological frame work. From review of previous literature the clear narrative swings in mind that there is need of multidisciplinary approach, for development of the indicators to measure the all dimensions of sustainable development. The important concern here is how we measure all dimensions of SD with ease and precision. This research endeavor explores some workable solutions.

2 METHODOLOGIES

2.1 Sustainable Economic Welfare Index

In the view of many economists that gross domestic product (GDP) is strange paradox regarding its interpretation. The SEWI which more focus on the fact that welfare is different from the growth, and there exist strong direct linkages between these two doctrines growth and welfare. The ISEW is perfect in the discussion on the de-growth movement as becoming one of the fundamental pursuits in the de-growth framework (Menegaki, A, 2018). Index of sustainable economic welfare, measure accurately many dimensions of human welfare which make this index more sophisticated and reliable by (Bagstad, et al. 2014). The performance of any economy is mostly measure through its economic indicators such as, personal consumption, capital growth, expenditure on health and education mostly founded in the country statistical year book, databases and world development indicators of World Bank. The estimation and calculation of these indicators are considered as the basic layer or first part of ISEW. The basic part measurements are homogenous for all economics and similar in many studies.

The second part of ISEW is considerably more important and difficult regarding the measurements of the indicators which are used in this part. The indicators of second part are followings, minerals depletion, CO_2 emissions, Forest depletion, damages due to particular emissions and energy depletion, and these indicators which are not continuously measured for every economy. The third part of ISEW is most sensitive and critical regarding its evolution which is depended on WTP (Willingness to Pay) or WTA (Willingness to Accept). The prices regarding the WTP and WTA are not regularly estimated for almost many economies, regions, jus benefits transfer or cost transfer could be made. This precision of calculations related this portion of index is more difficult. The third part of ISEW is called the Site-Specific layer or third layer. The combination of basic and solid layer is called 2nd degree ISEW and combination of Basic, Solid, Site-specific is called 3rd degree or full ISEW.

To escape from confusion and minimization of arbitrariness, the extent to which level ISEW for any economy is calculated depends upon the reliability and availability of its present data. The high income countries which have developed social panel can only calculate the 3rd degree ISEW otherwise no realistic comparison among the countries is possible, In current turmoil all countries measuring the 1st degree and while most developed measuring 2nd degree. Up to date, this has been done in this regard, for Greece Menegaki & Tugcu (2017), Menegaki & Tsagarakis (2015), G7 countries Menegaki & Tugcu (2016b), emerging economies Menegaki & Tugcu (2016), for Sharan Menegaki & Tiwari (2017).

$$SEWI = \mathrm{PCWI} + \mathrm{GEE} + \mathrm{GHE} + \mathrm{NGK} + \mathrm{MVUPW} - \mathrm{MD} - \mathrm{ED} - \mathrm{CO2D} - \mathrm{PED} - \mathrm{FD} \quad 1$$

WPCI= Weighted personal consumption by the income inequality using Gini coefficient.

GEE= Government education expenses minus 50% consider as defense expenditure

GHE= Government Health expenses minus 50% of it consider as defense expense

NGK= Net growth of Capital includes followings (plant, machinery, and equipment purchases, construction of roads, bridges, dams, schools, offices, hospitals, private residential dwellings, commercial, and industrial buildings, minus the replacement value of capital that is used up in the process of production

MVUPW= Monetary value of unpaid work is also considered under the basic layer of the index as economic variable

MD= Mineral depletion

ED= Energy depletion

CO_2D= CO_2 damages and climatic variations

PED= Damage from particulate emissions

FD= Forest depletion

2.2 Genuine savings

Genuine saving is the indicator which is used to measure sustainability by considering the human and natural facts of country, developed by the World Bank. This index is based on the Hartwick Rule (1977) which indicates that if Genuine Saving is larger than deprecation of environmental and human made capital the economy is sustainable. The Hartwick rule suggest that the rent and price we received from the use of natural resource use and extraction reinvested in the human made physical capital that the level of capital remain maintain (Hartwick, 1977). Considering these specifications the World Bank develops the indicator and measure GS for 140 countries in 2004. The specified equation of the index is mention below.

$$\mathrm{GS} = \mathrm{GNS} - \mathrm{FCC} + \mathrm{EE} - \mathrm{VNRD} - \mathrm{VPED}(\text{carbon dioxide and particular emissios}) \qquad 2$$

So in expression 3 the (GS) is genuine savings, (GNS) is gross national savings, (EE) education expenditure, (NDRD) is value of natural resource depletion and (VPED) is value of particular emission damages.

The natural resource depletion is aggregate of resource depletion and environmental depletion. The depletion in environment is due to carbon dioxide and particular emission (Ditez and Neumayar, 2007). The findings of GS indicate the developing nation which mostly depends upon their natural resources exploration seems unsustainable as compare to the developed nations which looks sustainable (Evans, 2015). GS weak sustainability measure (Nourry, 2008) that no human made capital is accurately substituted for natural capital.

GS has many limitations, measuring the depletion of nature resource is difficult, because the prices which are used in empirical work are suitable but these are neither optimal nor sustainable. Method used while calculating the natural resource depletion is criticized (Hartwick, 1994) and (Hamilton, 1996). Commonly

when we just subtract the damages of Carbon dioxide and particular matter we over-estimate GS not considering the some other vary important environmental aspects like Biodiversity, soil and water. These limitations suggest that cautious conclusions should be drawn for the national sustainability based on genuine savings.

2.3 Green extension of HDI

The green extended Human development index (HDI) is considered as most important index of welfare measurement. HDI is consist of three equal weighted measure like percapita GDP, education level at adult literacy and gross enrolment with life expectancy at birth. There are many grounds on which the validity of HDI is being criticized as index is use as indicator of development. HDI does not precisely reflect the human development (Hicks, 1997), (Dasgupta and Weale, 1992) and (Sen, 1997) due to its technical deficiencies during its constructions (Mac Gillivary, 1991), (Srinivasan, 1994) and (Noorbaksh, 1998). Similar criticism is also on Green extended (HDI) for its construction and interpretation also face and (Evans, 2015). The HDI consists of two measures economic and social but it does not include third measure environment so we could not consider it as indicator of sustainable development. In this content I prefer to use Green HDI which to incorporate the environmental component in the calculation of HDI by using the method which is given by (Lasso, 2001), (Costantini, 2004). (Lasso and Urrutia, 2001) introduce the environmental component to penalizing economic part of the HDI. Lasso and Urrutia estimate an environmental indicator (EBI) on the bases of co_2 emissions percapita along with percapita GDP by using the approach Atkinson's inequality index.

2.3.1 Pollution sensitive HDI

$$\mathrm{HDPI} = \frac{1}{3}(\mathrm{H1} + \mathrm{H2} + \mathrm{H3P}) \qquad 3$$

$\mathrm{H1} = \text{health index } \frac{\mathrm{LE-mini}}{\mathrm{maxi-mini}}$ LE represents life expectancy

$\mathrm{H2} = \frac{2}{3}\frac{\mathrm{AL}}{100} + \frac{1}{3}\frac{\mathrm{ER}}{100}$ (Adult Literacy) AL and (Enrolment Rate) ER

$$\mathrm{H3P}(\varepsilon) = \left[\frac{1}{2}\,(\mathrm{H}_3)^{1-\varepsilon} + \frac{1}{2}(\mathrm{EBI})^{1-\varepsilon}\right]^{1/1-}\varepsilon$$

$H_3 = \frac{LN(GDP)-LN(100)}{LN(40000)-LN(100)}$ Where H3 is gross domestic product per capita

$EBI = 1 - \frac{CO_2}{60}$Where$co_2$ emission per capita, and ε is extent inequality aversion and is fixed 2 for computation

The same economic and social variables are used by lasso and Urrutia but the Costantini and Monni change the parameter of HDI which access sustainable development in more better and appropriate. Costantini and Monni SHDI include the other four indicators with equally weights to incorporate the environmental component in to the HDI like air, water, soil and energy and they also change the economic and social indicators also. Costantini and monni (2005) provide a new method of estimation

regarding education, economic resources (GNNP), Social and natural quality of environment. They presented the sum of four indicator and averaged them to a single index as given below

2.3. 2 Sustainable HDI

$$SHDI = \frac{1}{4}\left[\left(\frac{X1-0}{80-0}\right) + \left(\frac{1}{3}x2 + \frac{2}{3}x3\right) + \left(\frac{\log(x4)-\log(100)}{\log(40000)-\log(100)}\right) + \left(\frac{x5+x6+x7}{3}\right)\right] \quad 4$$

$X1 =$ Tertiary enrolment %

$$\text{X2} = \text{health index}\left\lfloor\frac{\text{Y1} - \text{mini}}{\text{maxi} - \text{mini}}\right\rfloor \text{Y1 LE birth in years}$$

$$\text{X3} = \text{employment index } 1 - \left\lfloor\frac{\text{y2} - \text{mini}}{\text{maxi} - \text{mini}}\right\rfloor \text{ Uem index (y2 un em \%)}$$

$X4 =$ GNNP PCI Index

$$X5 = 1 - \left\lfloor\frac{y3 - mini}{maxi - mini}\right\rfloor \text{API (y3 tons pdpw of NOx, CO,}$$

$$\text{X6} = 1 - \left\lfloor\frac{\text{y5} - \text{mini}}{\text{maxi} - \text{mini}}\right\rfloor \text{ SPI (y5 fertilizersused on arable } land, kg\ per\ hectare,$$

$$X7 = 1 - \left\lfloor\frac{y6 - mini}{maxi - mini}\right\rfloor \text{EI (y6 is tons of oil equivalent consumed per year}$$

The environmental component of HDI include three equal measure of environmental indicators are, air pollution, soil pollution and water pollution. The green extended HDI seems a good indicator of sustainable development has few limitations regarding's its computation and interpretation.

2.4 Ecological Footprint

The idea of EF was initially presented Rees and wackernal, (1994), and wackernal and Rees, (1996). The fundamental objective behind the idea was that to translate the effect of human activities into the available area which arrange the facilities needed for consumption and integrate the wastes produced beneath the productions phenomena in current scenario by Neumayer, (2004). The EF is used an indicator for sustainability which measure sustainability physically in units of land available. EF compares the human natural resource consumption with availability of earth planet to reproduction of these resources and absorbs the resultant waste. Simply the EF is explained as, that the available naturally productive resource needed to meet the consumption requirements of current population. If the value of current EF is more than the present available area, the consumption of current period is not sustainable and the carrying capacity of 6 lands overdone. The economic activities are also responsible for thatEF is unsustainable. The empirically need of timber, food, energy requisites percapita are translated in land terms, which is required to produce these type of stuff. The summation is then equated with the extent of presented by productive per capita land area. Bastianoni et al (2012) present the idea to measure the ecological footprint

$$\text{EF}_{\text{TOT}} = \text{EF}_{\text{DIR}} + \text{EF}_{\text{INDIR}} \quad 5$$

EF_{TOT} is the total ecological foot print

EF_{DIR} direct accupation of crop land

$$EF_{DIR} = \left(\frac{Q}{Yw}\right) \times EQF_{Cropland} \quad 6$$

Q is yield of crop generic harvested (tonnes)

Y_W is world average yeield of production Whole

EQF in known as equivalence factor which is required transform a specific type of land in to global unit of physical productive area in GH. EQF evaluated yearly as the portion of extreme possible ecological yield of globe-average land of particular kind of land to the yield of all available land productivity present on the earth. Set of EQF is published for all kinds of land yearly in report of Global footprint Network. So due to this reason the YW and EQF of different cropland are used.

$$EF_{INDIR} = \sum_{i=1}^{n} EF_i \quad 7$$

$$EF_i = \sum_{j=6}^{6} (R_A)_i \times YF_J \times EQF_J = \sum_{J=1}^{6} \left(\frac{Q_i}{Y_I}\right) \times YF_J \times EQF_J$$

RA express complete required area in PH provided in relationship of quantity (Qi) basic input (i) for productivity (Yi). The used subscript i (=1….n) informs the inventoried inputs. The used subscript j(1…..6) specify the six different types of land used in accounts of NF, grazing, fishing grounds, cropland, built-up land and CF. The YF*j* indicates the yield factor for particular country and *j*-land type and EQF*j* is the equivalence factor particular for each *j*-land kind.

2.5 Green Net National Product

The most commonly used economic measure to trace the national development and welfare is (GNP) Gross National Product. GNP provides the information of goods and services which a country produce with the help of using its owned domestic resources (Land, Labor, Capital, and Entrepreneurship). The gross national product takes human capital poorly and does not incorporate the deprecation of natural resource. To calculate (GNNP) green net national product, the first point is to subtract consumption of human made capital from the GNP. To obtain the GNNP accurately there are many alteration are mandatory. The necessary alterations are derived from growth model which is famous as neoclassical model of growth which assumed the constant rate of deprecation of capital to link up with other variables of environment like (minerals, renewable resources and pollution factors) which are given in (Hamilton 1994) and (Hanely 2000). Reviewing these alterations we understand that the economists are not agreeing regarding the concerns of those modifications and techniques which are employed to estimate them.

The other point on which many researchers are not agreed is the interpretation of GNNP. The GNNP is Hicksian measure of income which indicates that the optimum consumption of present turmoil does not minimize the possible consumption of future generation (Solow 1993) and (Hartwick 1990). This argument provides the logic that if the gNNP is increasing, superior or constant to present consumption, the economy which is under study is considered as sustainable. If GNNP is rising which indicate the higher level of sustainable consumption is improving (Hanley 2000).On counterpart if GNNP is decreasing and level of maximum consumption is falling indicating unsustainability. Many researchers

consider GNNP as weak indicator to measure sustainability like (Asheim 1994) and (Pezzey 2005). According to their views, findings are required to link with techniques of calculations used for rent of natural capital. If the optimal prices would be used which are calculated through theoretical model would not meant that GNNP is Hicksian income, because the issue of sustainability is equity not efficiency (Hanley 2000). So the GNNP is considering true measure of sustainability if the used prices are sustainable. The current prices which are suitable for empirical studies are neither ideal nor sustainable (Pezzey 2005). There also some missing data to estimate GNNP, because the average cost present irrespective of marginal cost and the little flows are include while computing the gNNP due low availability of abatement costs data (Nourry 2008).

To use this indicator for measuring sustainability in Pakistan we used the equation which is developed by (Repetto, 2007) and (Evans, 2015).

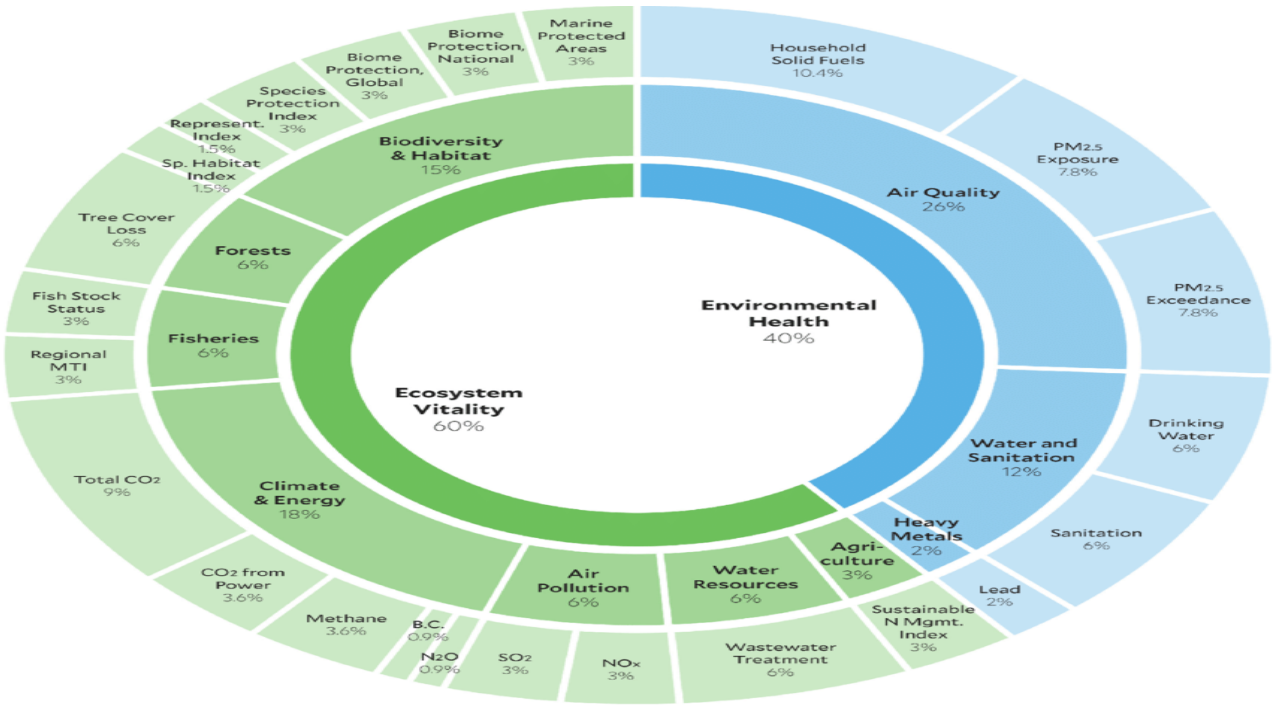
$$\mathrm{GNNP} = \mathrm{gnp} - \mathrm{dp} - \mathrm{dn} \qquad 8$$

$$\mathrm{dn} = \mathrm{rd} + \mathrm{ed} \qquad 9$$

Where, (GNP) is gross national product, (DP) is deprecation of produce capital, (Dn) is deprecation of natural capital,(RD) is resource depletion and (ED) environmental depletion.

2.6 ENVIRONMENTAL PERFORMANCE INDEX

The Environmental Performance Index (EPI) ranks countries' performance on high-priority environmental issues in two areas, protection of human health and protection of ecosystems. Within these two policy objectives the EPI scores country performance in nine issue areas comprised of 20 indicators. The EPI gives decision makers access to environmental data organized in ways that are easy to understand and relevant to policy, with the intention of encouraging nations to compete over advancing policies for the public good. The Index allows countries to compare their performance to neighbors and peers, through the analysis of time series data, see how their own performance has changed over time. The Environmental Performance Index (EPI) is constructed through the calculation and aggregation of more than 20 indicators reflecting national-level environmental data. The indicators used to measure environmental health are (health impacts, Air quality and Water &sanitations) whereas the ecosystem vitality is measured with help of (climate change & energy, Biodiversity & Habitat, Fisheries, Forest, Agriculture and Water resources). For estimation EPI firstly raw data is transformed and then it is standardized according to common units like GDP, land and Population for analysis and comparison. Each indicator is weighted within the issue categories to Create a single issue category score. These weightings are generally set according to the quality of the underlying data, as well as an indicator's relevance or fit for assessing a given policy issue (EPI, 2016). The performance scale start from ((0 to 100) where near to zero low performance and near to 1 showing high performance.
Figure 1



2.7 Data

Multi-dimensional sustainable development needs to cover all sectoral performance to predict the true status of sustainable development. The initial step for precise and accurate of measurement of sustainable development required a data of multiple development indicators. In this effort we used seven different development measures for multi-dimensional assessment of sustainable development using secondary data. There are numbers of indicators data is collected for different data source because all parameters data is not available from single source. The secondary data which is used for the estimation is gathered from different sources, like WDI (world development indicators), Pakistan bureau of statistics, economic survey of Pakistan, SNA (system of national accounts) and EPI (environmental performance index). These sources collect annually time series data for development indicators of economy to monitor the performance of the country. The secondary data from 2000 to 2018 is used to measure the multi-dimensional sustainable development in Pakistan. The missing values of any variable are estimated by using the moving average method. The whole data which is used and analyzed in this work is gathered from secondary sources and their might be little possibility of human error during writing and entering to software and programs.

3 Results and discussion

3.1 Green Net National Product

The data used to measure the (gNNP) green net national product for Pakistan is collected from world development indicators, statistical year book and bureau of statistics. The methodology which is used is discussed in detailed previous portion of research paper. The depreciation of all mineral resources like (cooper, lead, silver, zinc, gold) forest and air pollution has been deducted from NNP of economy. As the fact that marginal costs are not available so we compare the NNP with gNNP with natural resource depletion along with NNP with gNNP with co2 emission damages and Particular emission damages. The NNP (net national product after subtraction of consumption of physical capital) gNNP (green net national

product after subtraction of natural resource depletion from NNP) and gNNP co2 and PE (green net national product adjusted with damages of co2 emission and particular emission includes (So2, Co, NO, and methane).

Figure 2 Comparison NNP, GNNP and GNNP with damages to FCE

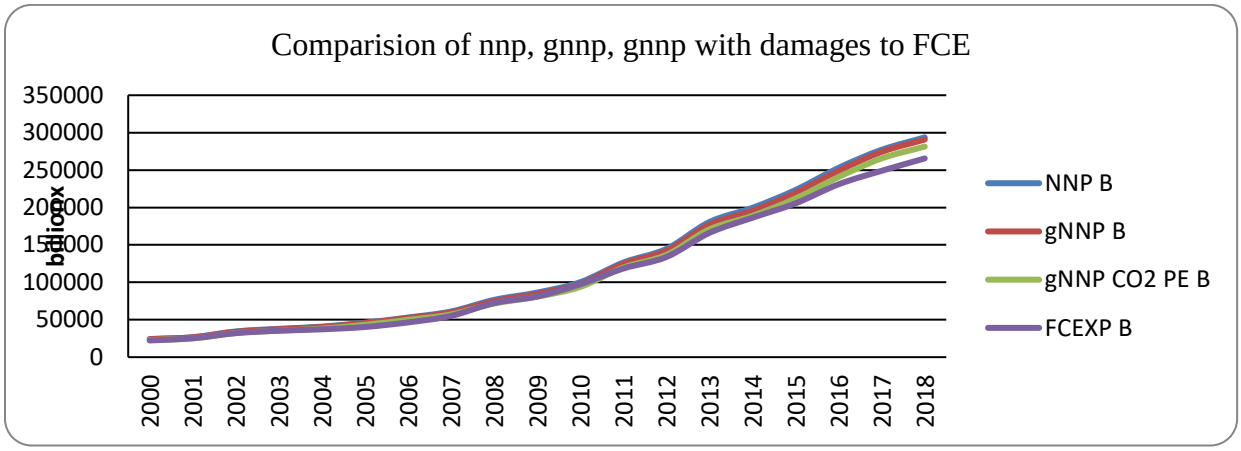


Figure 2 shows the comparison between net national products (NNP), gNNP, and gNNP adjusted with co2 and particular emission damages and current consumption of Pakistan from 2000 to 2018. The compassion provides us indication that we comment on the relationships and draw conclusion. The figure show us during the analysis period the gNNP is always less than the NNP of the country which suggest that the deprecation of environmental resources put significant negative impact on NNP. The value of this environmental depreciation on NNP depends upon the method used for valuation of environmental resources examined. The gNNP of the Pakistan is increasing and higher than the current consumption improving so it is sign of weak sustainability. This result is coinciding with (Nourry, 2008). There are few elements which are not subtracted from gNNP like biodiversity and water pollution due lack of data. Due to this fact the sustainability of Pakistan is Caution. It is concluded that the gNNP results support the idea that still Pakistan is weak sustainable during 2000 to 2018. However the adjusted estimated gNNP has few deficiencies due to all the methods adopted for valuation of natural resource depletion and valuation of their prices so and the damages caused by the emission, Adjusted gNNP is not very much reliable and need to much care for its use.

3.2 Genuine savings

Genuine saving is index which is developed by World Bank to measure the sustainability over the period of time from 2000-2018. GS is calculated for Pakistan by using the data of world development indicators.

Figure 3 Trends of GS with different damages

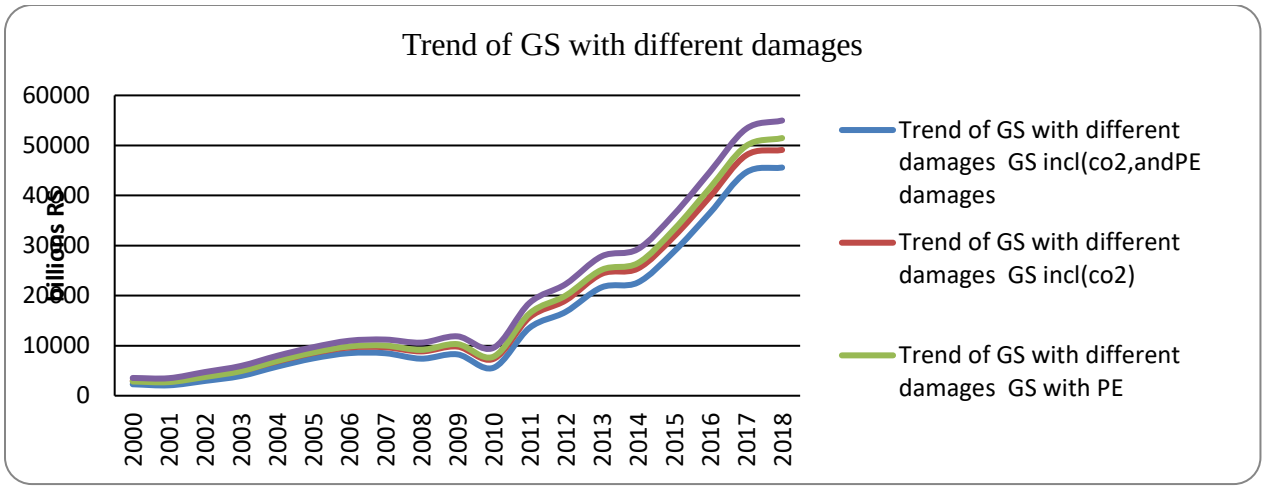


Figure 3 describes the four different GS for Pakistan from 2000- 2018 by using the techniques this is suggested by World Bank. The purple line indicates the GS which is calculated with the adjustment of Co_2 emission damages and Particular emission damages. The green line shows the estimation of GS which is adjusted after subtraction of particular emission damages which includes (Co, So2, No and methane). The red line show the trend of GS which is calculated by adjustment of Co2 emission damages (Fankhauser, 1994). The blue line which is GS saving which is calculated by adjustment of both particular emission and co2 emissions.

The figure 2 indicates that the value of Pakistan GS is always greater than zero means positive and increasing during the period 2000-2018 whatever the index is estimated. The findings suggest that Pakistan seems weakly sustainable in this period and not unsustainable. As we discuss few limitations of the index the conclusion and interpretations must be done carefully. The graphs of GS which indicates different values because different assessments for different damages are used which affect the index value. The Difference between four GS is due to the fact that we use different cost of marginal damages of co2 emission and particular emission which are subtracted. In this regards the estimation technique and the date selection also put significant influence on results.

According to my assessment of GS the inferences about sustainability remain unchanged. However the data of pollution is not comprehensive and not purely precise and reliable. The calculated value of GS is not perfect, which under estimate or overestimate the measure value. So its means that any conclusion on the bases of provided results about weak sustainability is used with extreme caution. The increasing treand our positive value of GS does not confirm the sign of weak sustainability (Pezzey and Toman, 2005) as GS is prejudiced measure of sustainability (Atkinson et al, 1997). So finally we conclude that the results does indicates that Pakistan is weakly unsustainable during the period of study. But the comparison of four GS index provide the concern for feature that there is high gap between the GS without adjusted with damages and GS which is adjusted with damages leave question. If the damages increase in same fashion which effect the sustainability in long run.

3.3 Pollution Sensitive human development index

Estimations of pollution sensitive HDI for Pakistan we used two extension. The HDPI for Pakistan constructed on the method which is given by (Lasso, 2001), (Evans, 2015) and (Nourry, 2008). The date used in estimation is taken from World Bank, bureau of statistics and development reports. The CO_2 emission data is collected form environmental ministry and World Bank development indicators data. For Pakistan this indicator is estimated from 2000 to 2018.

Figure 4

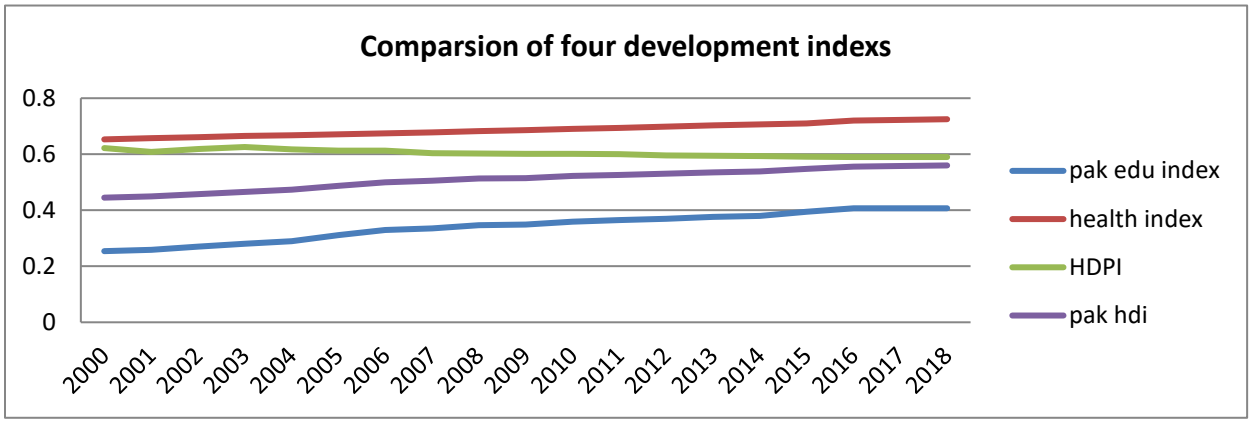


Figure 4 shows the comparison of four indicators HDI, EI, HI and Pollution sensitive HDI. We see that during the period from 2000 to 2018 the value of pollution sensitive HDI is greater than the HDI which is due to the fat that Pakistan is developing country and has less industrial growth. The point of concern here is that while we looking at the graph which provides us interesting findings. The value of HDI, education index and Health index is rising the whole period and showing increasing trend but while we include the CO_2emission the value of pollution sensitive human development index start decline or remain constant which suggest that if we incorporate the environmental component in HDI its value decreased. This comparison indicates that the environmental conditions of Pakistan are degreased during the period. In Pakistan scenario the CO_2emission increased and which effecting the sore of HDPI is decreasing. The value of HDPI indicates that in case of Pakistan the environmental condition are affected which effecting the living of human also. So this index shows that in case of Pakistan, on environmental ground Pakistan is not on the path of weak sustainability it is under stress.

3.4 Sustainable Human Development Index

Sustainable human development index is very commonly used to measure sustainable development of the country. Costantini and monni (2005) provide a new method of estimation regarding education, economic resources (GNNP), Social and natural quality of environment. They presented the sum of four indicators and averaged them to a single index. The method is used and estimated the sustainable human development index for Pakistan using data from 2000 to 2018. This index includes all the dimension of sustainable development which compose on Economic, social and environmental sustainability. The data for relevant variable is obtained from WDI, like tertiary gross enrolment, unemployment rate, GNNP per capita, and other variables energy index, soil pollution index and air index. The above discussed precise formula is used to calculate Sustainable HDI for study.

Figure 5

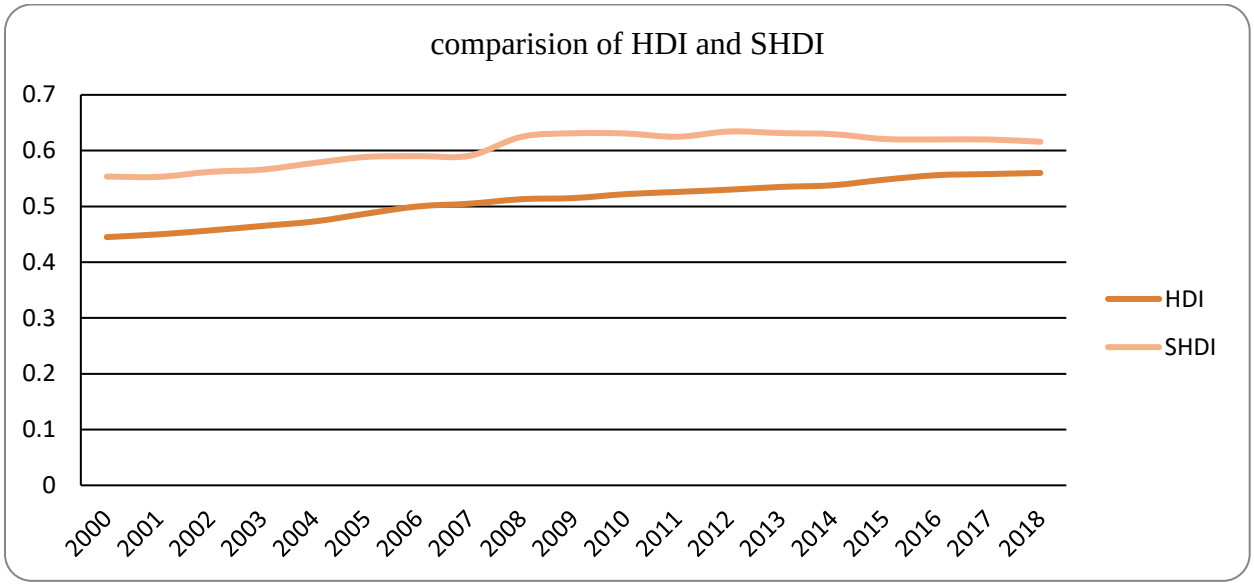


Figure 5 clearly indicates that during the study time the value of HDI and SHDI is increase. There is rising trend in both indexes. The value of Sustainable HDI is higher than HDI in Pakistan which indicates that Pakistan is developing country as compare to develop economy. The developed economies has higher HDI as compare to Sustainable HDI (Nourry, 2008) and (Vega and Urrutia, 2001) because the increase in consumption of available resources and increase output which increase the HDI value and reduce the Sustainable development score. The gap between SHDI and HDI is decreasing over the period of time which insists to think that Pakistan consumption of natural resources increase and the value of environmental index start decreasing. By looking at the picture from 2000 to 2015 the value of SHDI was increasing but after 2015 it is constant or showing decline trend which is due to reduction in the value of air index and soil pollution index which is hitting Pakistan in last few years. But overall the results of both index indicates that during study period the human development in Pakistan is improved. However from these findings we could not conclude that Pakistan's sustainable development is achieved. In this context, any inference about development or sustainability based on an indicator must be used with caution because of the data uncertainties and incompleteness.

3.5 ECOLOGICAL FOOT PRINTS

Pakistan ecological foot is calculated taking secondary data from 2000- 2018 and data is taken from national foot print reports and publications. Ecological footprint sustainability is measured according to land resource, and water to meet the consumption needs of current population comparing with existence of available Bio capacity. The estimated ecological foot print provides a physical amount by using very global hectare unit. According this 1 global hectare means 1 hectare of land along with the mean productivity of the world. In this we compare ecological foot print with Bio capacity percapita. The estimated value of these two indicators and their comparison is shown in the graph.

Figure 6

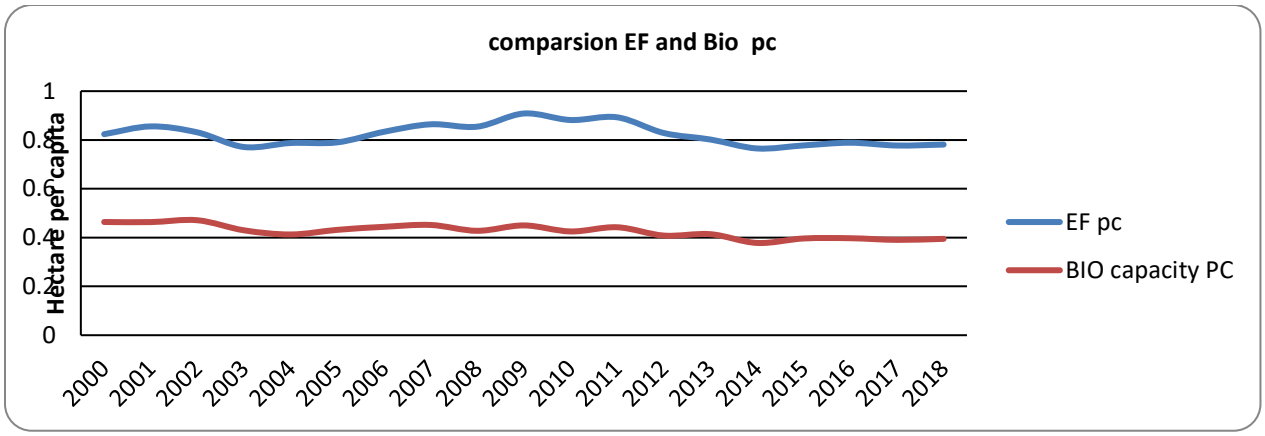
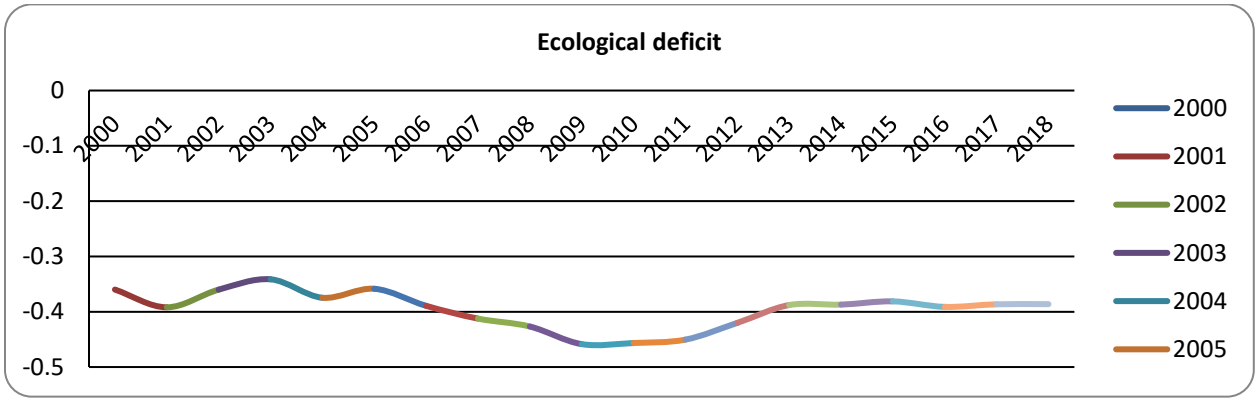


Figure 7



In figure 6 we easily understand the behavior of ecological and bio-capacity per capita in Pakistan since 2000 to 2018. We see that during the period of study the ecological foot print value is greater than bio-capacity. These results indicate that in case of Pakistan the land carrying capacity is exceeded. These results predict that Pakistan economic activity is sustainable and these findings are similar with (Nourry, 2008). These findings also reveals the figure 5 which indicating the ecological deficit which is increasing. Figure 7 indicating that in Pakistan perspective the ecological deficit is always negative. The more concerning point is that in Pakistan scenario the ecological deficit is increasing which indicates that the more pressure on bio-capacity to meet the requirements. This increasing in deficit trend provides the significance evidence that Pakistan is not of the path of sustainability. So according the findings of ecological foot print that the Pakistan economy is unsustainable and growing on the cost of environment. If the country wants sustainability in future there is only possible choice to decrease the utilization of available resources and reduce the ecological foot print within the range of bio-capacity.

3.6 Sustainable Economic Welfare Index

In this section we try to indicate the difference which observed during this research between the GDP and ISEW. The defense expenditure which mostly initially inflate the GDP, but affecting the human welfare firstly. Commonly economies should seek to higher their GDP for the welfare of society not as redressing the living standards. In Pakistan prospective there many variables whose data started publishing from last

two decades for many components of 2nd degree ISEW. This conform Pakistan recent evolutions in the direction of international collaboration and opening new horizon for participating in international markets and institutions. According to the objective limitations which we explain in previous part in site-specific layer for Pakistan is not calculated in this study because of data constrains. So due to the specific issue the total ISEW per capita, is composing of basic layer and solid layer in case of Pakistan.

Figure 8

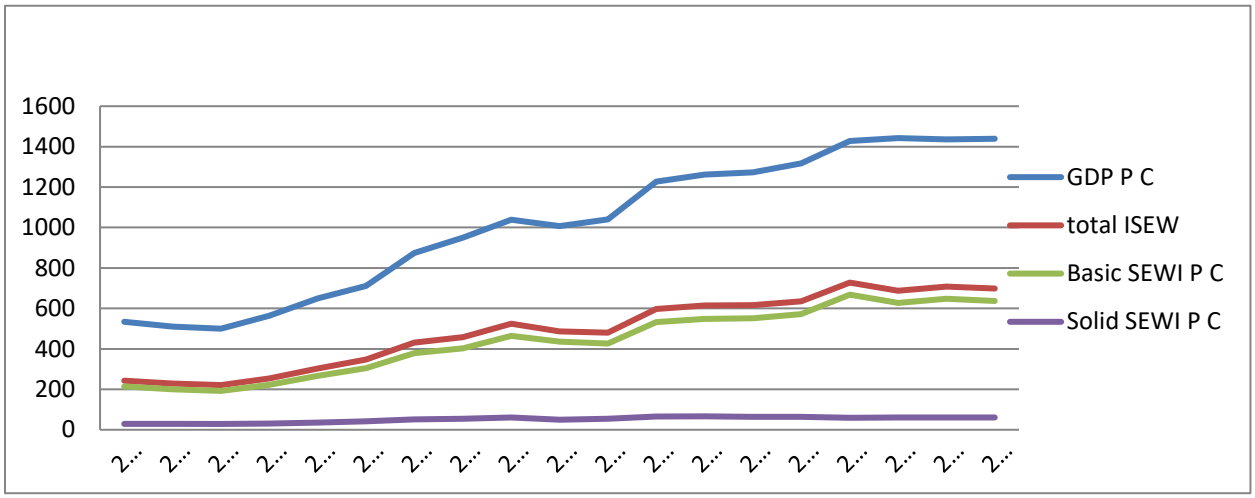


Figure 8 depict that the smaller difference between PC GDP and ISEW is in 2002 which is 278 and the highest difference in founded in 2018 which is 754. The SEWI and basic SEWI moves in similar directions if the education, health, adjusted consumptions increase then total value of sustainable economic welfare increases and if they decline then overall index value starts declining. There is also a smooth increase in 2nd layer of index which indicates that in case of Pakistan the co2 emission mineral depletions, forest depletions and energy depletion rising. Over the period of time the difference between pc gdp and SEWI is increasing which indicates that in case of Pakistan the welfare of people is not increase as much as the PC gdp is increasing. In case of Pakistan still the Threshold theory perceiving the period in which the conventional measure Economic boom brought betterment in the life quality of the resident up to a certain point which known as threshold and after that point higher growth start harming and deteriorating wellbeing Max (1995) is not conformed because GDP pc, total ISEW, basic layer and solid layer moving in same direction but up to somehow due to increase in solid layer the livings of people affected.

3.7 Environmental Performance Index

The Environmental Performance Index (EPI) ranks countries' performance on high-priority environmental issues in two areas, protection of human health and protection of ecosystems. Within these two policy objectives the EPI scores country performance in nine issue areas comprised of 20 indicators. In this work we used data from (EPI) from 2005 to 2018 and the findings are discussed below.

Figure 9

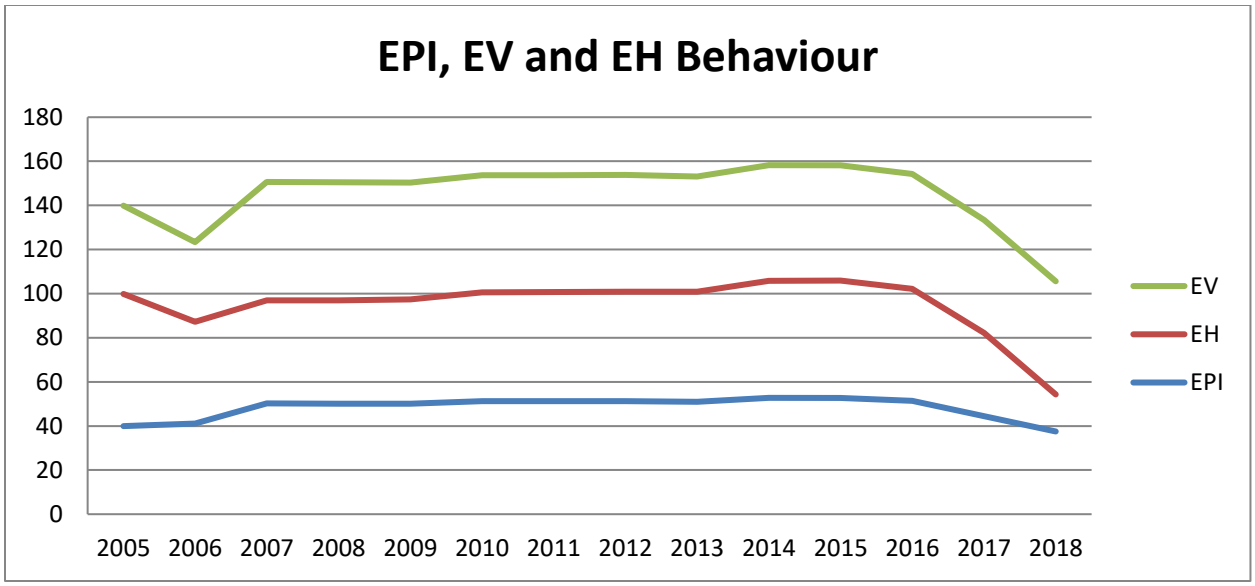


Figure 9 provide us the behavior of environmental performance in Pakistan during the study period. We clearly understand that the value of EPI increases from 2006 to 2015 and after that we see a decline in the value of environmental health and ecosystem volatility. This indicates that in Pakistan the environmental health value which consists of (health impacts, Air quality and Water &sanitations) decline and Pakistan is under tremendous pressure of environmental issues. Pakistan is suffering a loss of 1 billion Rs in every passing day due to the degradation in environmental resources and it is 6% of GDP. These environmental changes lead to following issues, air pollution for premature deaths and illness, water pollution for typhoid and diarrheal diseases and soil degradation for agricultural productivity loess. So in Pakistan the performance of environmental index suggest that Pakistan is under stress in environmental sustainability. These outcomes are coinciding with (Ali et al. 2015), (Dogan and Seker 2016) and Shahbaz et al. 2014).

4 CONCLUSIONS

This paper shows the finding of seven different indicators for measuring multi-dimensional sustainable development in Pakistan with help of secondary data from 2000 to 2018. The findings suggest that during the study period, Pakistan performance about Sustainable Development has been mixed. The value of GNNP and GS which are economic parameters are increasing during the period and predicts the weak sustainability similar to SHDI and SEWI they also suggest improvement is social sustainability and performance. The environmental parameters like EF, EPI and HDPI indicating the declining in environmental performance which is important concern for Pakistan economy for future.

Finally, there is no contrast in the findings of both economic indicators, GNNP and GS which are based on the neoclassical theory of growth, predicts the weak sustainability, because both are increasing over the time. We understand that GNNP provide the information about production out flows where the GS indicates the total worth of capital stock which is mixture of natural and human made capital. These two indicators based on same theory so there is no rigorous basis lies behind them. These different indicators provide the different indication regarding the sustainable development in Pakistan, is due to different reasons. In sense of every indicator and measure the definition of sustainable development is unique. As we understand SD according to GNNP it measures the SD in terms of Hicksian income, where the GS

mean SD as not decline in aggregate capital stock. The SEWI and Sustainable HDI also have their own perceptions. The EF, HPDI and EPI also based on their own definition and parameters for sustainability.
From the previous discussion we come to the point that in Pakistan the, social and economic progress is moving in right direction where the environmental component is under stress. To achieve the sustainable development these are the challenges which Pakistan is suffering and needs to tackle these issues. Pakistan is suffering a loss of 1 billion Rs in every passing day due to the degradation in environmental resources and it is 6% of GDP. These environmental changes lead to following issues, air pollution for premature deaths and illness, water pollution for typhoid and diarrheal diseases and soil degradation for agricultural productivity loess.
In Pakistan, the use of domestic material per capita consumption increase to 3.8 tons in 2015 which was 2.8 tons in 1970 and per capita material footprint consumption 2.7 in 2015 which was 2.5 in 1970. Pakistan is less efficient in use of Oil 3.1 kg for production of US$ GDP to other Asian pacific economies 0.7 kg oil. In Pakistan the value of GHG footprint is also increasing. The main sectors which contribute to GHG are energy 51% and agriculture, livestock 39% which these two sectors jointly consist of 90% of total GHG emissions. So for environmental sustainability's fowling are policies interventions needed, and some are short run and some are long run. So for environmental sustainability there is need to decrease the pollution emission like GHG and CO_2 by using the following suggestions. Efficient uses of oil, multi-cropping in agriculture for high yield, imposing restrictions on consumption of oil, shift from private to public source of transportation, population control and environmental friendly energy production. A holistic basket of policies are better than isolated policies across various sectors of the economy.

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