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Role of economic, and social parameters affecting life satisfaction and happiness during pre and post Covid era: a study with Marx's perspective

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ABSTRACT

A cognitive, objective, and subjective evaluation of the judgment of one's perspective of looking at life defines as life satisfaction and happiness. There is a strong association between life satisfaction, joy, and external parameters, including environmental and socioeconomic factors and green innovation technologies. Marx's theory on life satisfaction provides an exciting insight and defines that economic resources are necessary to live comfortably. The core objective of this paper is to examine the effects of contributing parameters concerning life satisfaction and happiness (LSH) in China from 2005 to 2020. For this purpose, data collected for the dependent variable collect World Happiness Index and World Bank official website. Nine independent variables related to LSH discuss freedom to make life choices (FMLC); GDP growth; Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ). The maximum LSH value is 5.77, with a mean value of 5.13. The highest coefficient correlation value with LSH is CO2, with a positive correlation coefficient value of 0.80, followed by GDPG, with a negative coefficient value of 0.80. PC1 explains 76.74% of results, whereas MLR produces 0.91 R2 (p-value: 0.093, Residual standard error: 0.181). There is a need to understand correlates and determinants in further detail to set up a framework that enables policy-makers to incorporate well-being and life satisfaction measures in carving new public policies.

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1. Introduction

Climate change has become one of the most pressing issues in the contemporary world, with unprecedented levels of global warming. Climate change is generally associated with industrialization and economic activities (Mgbemene et al., 2016). Green innovation, therefore, strives for creating products and services that are environment friendly as they are less energy-consuming. Green innovation aims at reducing the

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negative impact of economic activities on the environment without compromising on the values aspect of the businesses (Sun & Sun, 2021). A fundamental impetus that is provided by green innovations is the growth in productivity while keeping the macro-economic aspects growing simultaneously (Huong et al., 2021). Another aspect of green innovation is the knowledge spillover that promotes horizontal diffusion and adoption of green technologies throughout the world enabling collective efforts zeroing on preventing environmental degradation (Gao et al., 2018). External environment construction is incredibly important in encouraging entrepreneurs to take up the path of green innovation zealously. Enterprises are not aloof from the social realities as efforts are being made to ensure that businesses must only go down a green innovation path in a bid to achieve productivity targets (Abbas & Sağsan, 2019).

As enterprises are socially embedded, their role in paving way for development has never been this important as it is today. The link between development and happiness is but an obvious phenomenon. However, the level of satisfaction and happiness tailing development is still a subject of research. The complexity of the concept of 'happiness and life satisfaction are needless to highlight. A plethora of research, both subjective and aim, has been directed towards understanding the concept of happiness and satisfaction. One of the objective dimensions of well-being, happiness, and satisfaction is associated with financial stability, economic growth, physical fitness, better education, a healthy living environment, and energy (Voukelatou et al., 2021). On the other hand, subjective personal happiness has been associated with sustainable financial growth amid technological advancement (Goodman et al., 2018).

For instance, in case of breakneck development particularly in the past decade, China has not been able to become a source of uniform happiness across all segments of Chinese society (Zhu et al., 2021). On the other hand, a never-seen-before economic uptick in China has caused severe damage to the environment throughout its lightning-fast economic activities in the recent past. It is direly needed for China to shun its extensive factor input growth model to make way for a green growth model (Fan et al., 2019). It has been forecasted that the carbon dioxide emissions of China are going to peak even before 2030, therefore, the Chinese government is in a race against time to slow down the process of environmental degradation via planting more trees, conserving energy, and reducing its emission rates (An et al., 2019). The ambitious target that China has set itself is that of reducing its carbon dioxide emissions to zero by 2060 (An et al., 2019). This can only be achieved by green technology innovation which relies on high investment and the willingness of the communities to prioritize the preservation of the environment (Yahya et al., 2021). Funds for green innovation are needed in abundance, however, in the wake of this period of economic transition and uncertainty, the acquisition of funds is not convenient for enterprises. This deficiency and vacuum are filled by informal institutions for the essential provision of resources (Rochman et al., 2021).

The research exploring the impact of the environment on well-being and happiness is mostly pinned upon the 'bads' such as pollution rather than the 'goods' such as green spaces (Lauwers et al., 2021). However, a study reiterated that the impact of pollution on subjective happiness was not significant (Mouratidis, 2021). Nevertheless, there has been an increased level of evidence brought out by numerous studies that this correlation between environment and happiness has significant importance. Such

as a study concluded that a negative relationship existed between environmental issues and general life satisfaction (Li & Managi, 2022).

Happiness, satisfaction, and well-being can be aptly assessed by keeping into consideration several variables that may include political scenarios like GDP growth, economic conditions like financial statuses and coverage of social support, cultural factors, and not forget environmental factors like air pollution, environmental disasters, and their risk management and social variables like freedom of choice and social support (Intelisano et al., 2020). Therefore, abstract concepts such as happiness, general satisfaction, level of stress, personal relationship, contours of one's mental and psychological orientation, and general perspective about the meaning of life are the factors that are subjectively included in assessing happiness. It is mostly assessed through perception and self-assessment regarding life satisfaction in individuals (Wenzel et al., 2021). However, the nature of the assessment cannot be ruled as a concrete assessment since emotional states are sometimes short lasting and the temporality of such assessment impedes researchers from reaching a conclusive point. That is one of the reasons why studies concerning happiness produced regularly contradictory results. A study gauged this temporal stability at 0.5 for a period of six years, and 0.54 for four years (Bialowolski et al., 2021). However, there remains a likelihood that even this temporal stability would be affected by some subjective life events or other traits such as personality biases and/or age (Goodman et al., 2018). Nevertheless, the assertion has increasingly grown that subjective well-being should be used in the realm of public policy. One study revealed the decoupling between GDP and self-reported level of satisfaction (Dwyer, 2020). On the contrary, studies with data regarding microlevel suggest that a significant relationship exists between self-reported satisfaction and financial income (Pretty et al., 2016).

As far as air pollution is concerned, the literature on its impact on general well-being is limited but a lot of work is being done in this respect. Such a study conducted in London about the relationship between air pollution in London and its impact on life satisfaction revealed that there was a negative correlation between these variables (Brook & King, 2017). Another research using statistical data concluded that there was a robust and significant negative effect of air pollution on general life satisfaction (Luechinger, 2010). Another study about Germany reached the same conclusion that air pollution had a negative impact on life satisfaction (Petrowski et al., 2021). Furthermore, a study revealed how the concentration of nitrogen dioxide detrimentally affected overall happiness (Welsch, 2006). An important study given its comprehensive method of using daily data to ascertain the role of pollution on satisfaction contended that the reported level of satisfaction and happiness by respondents of the study on the days of higher air pollution was lower (Liu et al., 2021).

Recently, many studies have started to take the initiative to explore the role of green innovation as it has been learned how green innovation has been beneficial for enhancing economic growth while at the same time enabling sustainable climate preserving policies. Given the unprecedented challenge about the deterioration of the environment as a result of industrialization, awareness at the general public level has increased significantly. This awareness enables the consumer base to pose significant pressure on the enterprises to take into consideration the matter of preserving the environment. This consumer pressure has been crucial in pushing the cause of green

innovation. Research suggests that businesses tend to adopt green technologies while still staying on their growth path as green innovation methods are able to ensure that economic value is not lost during the process of protecting the environment (Carpa & Matinez-Zarzoso, 2022; Darnall et al., 2008; Novitasari & Agustia, 2021).

The inevitability of green innovation as a choice is still undeniable as far as sustainable social and economic development is concerned. Nevertheless, it has not been known yet how green innovation affects the process of happiness and life satisfaction. Therefore, this research attempts to formulate an analytical framework that includes happiness and life satisfaction as dependent variables and various economic, social, and environmental factors as independent variables and tries to explore the role of these parameters as influencing factors vis-a-vis green innovation. The traditional understanding that environmental betterment comes on the back of green innovation would shift the general focus away from economic aspects, therefore, the implementation of green innovations tends to face many bottlenecks.

1.1. Research objectives and contributions

This study contributes to the literature in the following way. Firstly, the study is one of the few research projects that have included green innovation technologies as one of the factors that can affect happiness and life satisfaction among individuals. Furthermore, the study also focuses on the role of social, environmental, and economic parameters along with green technologies in assisting the process of green innovation Secondly, the study aims at highlighting the relationship between happiness, life satisfaction and various social, economic and environmental parameters which could play a role in bringing happiness and life satisfaction. The study measures the impact of the factors like environmental air pollution, environmental disaster risk reduction, environmental hazards, availability of fresh water, coverage of social safety social contribution, social support, freedom of choice, life expectancy, GDP growth and green technology innovation on the happiness and life satisfaction. Thirdly, the study strives to highlight how effective it has been to advance green innovation not only from the environmental perspective from the point of view of social and human psychology. Moreover, empirical evidence comes to the surface in the study that suggests an increasingly important and effective role of green innovation technologies in enabling green innovation. In the end, the study gives a detailed impact of how happiness and life satisfaction tend to interact with other factors of in the realm of green technology innovation (Depeursinge et al., 2010).

2. Literature review

One's assessment of life and general feeling regarding life is defined as life satisfaction (Amati et al., 2018). This assessment is a cognitive and evaluative impression of an individual that how they perceive their life. This assessment also forms a subjective evaluation of one's self-reported well-being. Several studies have highlighted that the level of life satisfaction suggests the state of one psychological well-being as well (Rathi & Lee, 2021). It is not only psychological health that has an association with

life satisfaction but physical health along with mortality and morbidity are also associated with the level of life satisfaction. The measurement of life satisfaction has been operationalized in studies using single as well as multiple item measures such as asking respondents to rate their life satisfaction using a numerical scale (Voicu, 2014).

The body of work on the factors that influence life satisfaction has primarily examined the role that 'internal' factors like family income, occupation, and relationship status play (Wolfe & Patel, 2018). It has been understood that external circumstances may contribute to differences in subjective well-being, but these 'external' aspects have typically only been taken into account when it comes to social comparisons (Papi & Cheraghi, 2021). This argument suggests that evaluations of subjective well-being rely on being compared with other benchmarks such as peers. A straightforward prediction is contented that respondents will not look to say they were not happy particularly when others are doing substantially well. And there is robust scientific evidence to support the idea that in developed countries, 'relative' income matters more for people's well-being than 'absolute' income (Quispe-Torreblanca et al., 2021).

Although, there is no dearth of consensus regarding the impact of environmental factors on the level of life satisfaction in general, however, individual environmental factors such as level of air pollution, availability of green space, nature of the urban environment, availability of fresh water etc. do not present a uniform set of finding in different results and respondents perceive these individual environmental aspects in an overwhelmingly subjective fashion (Bradley et al., 2014). As far as weather is concerned, some studies have shown that it has a consistent impact on life satisfaction such as the level of self-satisfaction on sunny days was mostly found higher as compared to gloomy, cloudy, or rainy days (Lucas & Lawless, 2013). This depicts a positive association between sunny weather and general life satisfaction. At the same time, another study concluded that the link between weather conditions and life satisfaction was not that obvious and does not depict weather conditions have that much of a profound impact on general life satisfaction. Research studies have shown that there is a consistent pattern between weather conditions and life satisfaction. Such as the levels of precipitation or the number of sunshine hours have an association with life satisfaction (von Möllendorff & Hirschfeld, 2016). Environment and particularly the green environment have an impact on happiness and life satisfaction. Research shows that green credit policies have a favorable and considerable influence in promoting green innovation, particularly with businesses that were involved in causing pollution on a large scale (Shen et al., 2021). Current research interest concerning green technology innovation and the external environment is deeply focused on figuring out the level of happiness and life satisfaction with a particular emphasis on environmental factors and green innovation. However, there still has not been a consensus regarding if green innovation and environmental factors have a positive relationship with life satisfaction or not (Wang et al., 2021a).

Green innovation has a deep link with social trust. As far as informal social institutions are concerned, social trust has been suggested by the research as one of the most important informal institutions. Social trust is still one of the most effective external driving forces that can encourage enterprises to adopt themselves according

to green innovation. Research has also wrote down that there are certain cultural factors also that work as a driving force for the enterprise to adapt to green technology. Resultantly, despite the realization that green innovation ensures sustainable development, many enterprises shy away from implementing green innovation agenda with as much vigor as needed. The hesitation exhibited by enterprises through foot-dragging can effectively be given respite if governments step in with institutional constraints (Tolliver et al., 2021). The official tool of environmental protection can be used by governments to harness the determinantal impact that would be caused by the delay in the implementation of green innovation in enterprises. However, there has not been a unified view of the research that has focused on green innovation and environmental regulations. A study highlighted that environmental regulations remain significantly crucial in the promotion of green innovation in business (Meng et al., 2020).

A study has concluded that the implementation of mandatory environmental regulations enforced by the governments had positively impacted the process of green innovation (Wang et al., 2021b). There is an alternative view as well that highlights that such implementations have drastic restraints on economic growth (Feng & Chen, 2018).Researchers also found that the impact and influence of consumer pressure and regulatory pressure were drastically different as far as the process of green innovation was concerned (Lestari et al., 2021). Although green innovation is different from general innovation, however, the theory of general innovation could also be used to explain enterprise behavior (Yezersky, 2007). According to the general innovation theory, the key to innovation lies in the nature of the available resources and the effective use of those resources (Stauffer, 2015). Therefore, the process of green innovation is extraordinarily complex from the enterprises' point of view as it compasses a complex process of integration of the required resources. The process of enhancing the technological abilities of an enterprise rests on its ability to invest in the same which is one of the main driving forces that provide an impetus to the enterprises to pursue green innovation (Fernandes et al., 2021).

Paradoxically, the 'de-growth' movement, which links environmental degradation and GDP together, has in some ways joined the economists who place a focus on growth. In other words, promoting growth as well as de-growth preserve the emphasis on GDP. Alternatively, the moment has arrived, and the resources are available to assess what matters the most – ignoring GDP and focusing more on well-being and its impact on the climate. Other than GDP it is also important that how the quest to upgrade criteria for development and socioeconomic success is still often described. When used as a gauge of advancement, life happiness diverges significantly from GDP in many ways. A meager increase in income for a well-off family has a measurably negligible impact on life satisfaction compared to a family that is not rich. These findings suggest that families may not become happier even after getting rich to some degree. The psychological value of having a trustworthy government, the emotional cost of being unemployed, which is significantly more than the money disturbance alone, and other important sensations are all quantified by life satisfaction data. The benefits of imparting social and emotional skills to individuals of all ages, the lifetime non-monetary value of safeguarding children from harmful

situations, and other investments in overall quality of life can all be evaluated using data on life satisfaction.

However, given the factors that affect life satisfaction, it is possible to envision a civilization that has a prominent level of life satisfaction but is depleting the resources for the upcoming generations. There are restrictions about decisions that can be tackled in a framework that is driven by well-being, even if government decision-makers are equipped with sufficient information. There is another shortcoming as well which is the indicators of development or well-being which are frequently developed that mix several, unrelated outcomes (Eberts, 2019). Like focusing on GDP, combining lifestyle quality and environmental outcomes measurements serves to reinforce concerns about a conflict between development and sustainability. Conversely, to ensure the political viability of sustainable development, these goals need to be separated both in terms of rhetoric and conceptualization. The likely start of an explanation mentions economic development inside a country as it is clearly linked to psychological changes that conveniently affect the happiness of the people (Pugno, 2019).

According to Inglehart's theory, economic growth leads to a shift in society's priorities from maximizing wealth creation to maximizing well-being (Inglehart, 2017). Many analyses of different countries reveal that there is a wide variance in happiness. Furthermore, economic progress and happiness are closely linked: Inglehart discovered a .67 association between per capita gross national product (GNP) and life happiness after analyzing data from 24 nations with a wide spectrum of economic development (Inglehart, 2017). This implies that increased happiness is a result of economic growth. This explanation has not yet received dedicated support from longitudinal data. By showing that the reason for happiness was wealth in 14 of the 21 countries for which data were available from 1972 to 1994, Hagerty and Veenhoven concluded that economic development promotes greater happiness (Hagerty & Veenhoven, 2003).

Nevertheless, a study stated that their findings with regard to particular nations could not be considered reliable since they were based on several happiness measures applied to various sorts of samples and did not take into account seasonal influences (Easterlin, 2005). Although they showed an increase in the number of years that were considered 'happy' across all countries, this result was due to increased life expectancy rather than an actual increase in the level of happiness. Another research showed statistically significant improvements in social well-being in countries with high incomes (Veenhoven & Hagerty, 2006).In the U.K., a lot of money is going toward lowering the geographical indicators of social marginalization, like high crime rates, poor health, and limited access to services that are supposed to be provided to the public. Numerous empirical research has shown that life satisfaction is substantially correlated with good health defined in subjective terms, but the correlation with the health markers that are defined objectively is weaker (Steckermeier, 2021).

Social comparisons, which make average increases ineffectual, and the ability of an individual to adapt in accordance with the changing scenarios are the main causes of the weak income-happiness link. These variables suggest that the straightforward policy conclusion drawn from the individual-level research – that an increase in average

wages would make people happier – is unlikely to have an impact on overall happiness. Since people often adjust very rapidly to a greater living standard and the level of social comparisons stays unchanged, therefore, the level of happiness at the macro level becomes irrelevant as it does not alter. In theory, a similar contradiction may apply to the link between happiness and health. First, adaption to a longer predicted lifespan may impair any feedback from objective health to happiness (Lutz et al., 2021). A lot of other studies using various research methodologies, such as the bigger cross-sectional data, which serves as an example, offer more proof of a causal relationship. One of the most compelling results in the research regarding happiness shows that despite the fact wealthy people experience greater happiness than not-so-wealthy people, the strong relationship between wealth and happiness does not persist across different countries and across different time spans as well (Easterlin, 2005).

Happiness and the conviction that one has free will and control over one's life are tightly related and this connection appears to be widespread (Wolfe & Patel, 2018). In all major cultures, the sense of freedom of people is correlated with happiness (Welzel & Inglehart, 2005). People appreciate their freedom of choice as highly as they value their economic security in many societies (Inglehart et al., 2008).A transformation in society is related to changes in individual values, which have moved away from prioritizing participation, freedom of speech, and life's quality in favor of self-expression ideals that stress economic and physical security. The overarching goal of this change in the strategies of life minimizes dependence on external authority and increases personal freedom. According to this paradigm, human development focuses less on pursuing happiness by accumulating wealth and more on expansive efforts to maximize the level of free will in all aspects of life.

In a similar spirit, research supports a link between biodiversity and well-being The relationship between well-being, biodiversity, and the environment is being studied by an increasing number of authors, who demonstrate how endangered human well-being is in the absence of biodiversity.(Jimenez-Valverde et al., 2010) In turn, a study examines the connection between biodiversity and the subjective well-being of urban residents and comes to the conclusion that exposure to plants has a favorable impact on happiness (Koay & Dillon, 2020). The findings of some other studies reiterate this notion and add that a higher occupation of vegetation promotes psychological health (Egerer et al., 2018). Climate change and air and noise pollution indicators are also harmful to health and well-being (Li et al., 2019). Some findings indicate that individuals are more satisfied when the air quality is improved or that air pollution has a detrimental impact on the level of satisfaction (Duflo et al., 2008). Contrarily, noise has a detrimental influence on well-being and because it spreads more quickly than air pollution, it has a greater detrimental effect on the quality of life (Goines & Hagler, 2007). Sustainability of the environment and well-being are therefore linked. Climate change, which affects the oceanic ecology, rising sea levels, fast-melting glaciers, and increasing temperatures are elements to consider. Mortality rates will rise due to cardiovascular or respiratory disorders as a result of frequent and prolonged heat waves (Huynen et al., 2001). Climate change will result in environmental changes that will affect people's subjective well-being since it will affect how ecosystems function and how much water is available, both in terms of shortage and surplus.

Environmental, social, and economic factors are the emphasis of the circular economy (Velenturf et al., 2019)The circular economy is a tool to combat this environmental degradation by preventing the exhaustion of natural resources and the emission of greenhouse gases (Velenturf & Purnell, 2021). Currently, nations with high GDPs like Austria, Germany, Belgium, Luxembourg, the Netherlands, Denmark, Finland, Ireland, Sweden, and the United Kingdom have invested a lot to ensure that recycling and reuse of materials become easy and efficient without rupturing the economic growth pattern (Mulvaney et al., 2021). Environmental benefits have an effect on life pleasure. For example, being exposed to noise, pollution, and greenery seems to have a measurable and long-lasting impact on satisfaction (Li et al., 2019). The opportunity to affect lives through monetary means is relatively constrained, whereas the opportunity to improve or even worsen the human experience without spending anything at all is immense (Barrington-Leigh & Behzadnejad, 2017). Although the data is consistent across all levels, it may seem counterintuitive as far as underdeveloped economies are concerned. Different projections indicate that by 2050, an increase in the expectancy of healthy life and GDP per capita is not likely to affect the average level of satisfaction globally by even 1 point on an 11-point scale (Barrington-Leigh & Galbraith, 2019). The other argument in favor of precautionary restraints is that innovation partially makes up for supply constraints on a short-term basis. Markets react appropriately innovating and substituting in the wake of material restrictions.

Although it won't hold true everywhere, the theory that these restrictions can encourage innovation so strongly that it is beneficial even in the near run finds support in a number of scenarios (De Santis et al., 2021). Although innovation follows in the wake of restrictions on particular materials and the needs are fulfilled innovatively. For example, we can be sure that if oil had become expensive 100 years ago, alternative energy sources such as renewable energy technology and the infrastructure for electric mobility would have grown considerably more quickly than they have. Therefore, instead of overly emphasizing the opportunities lost because of the limits, policy should concentrate on maximizing well-being while incorporating an environmentally motivated paradigm. Based on this paper's literature and aim, the conceptual framework is presented in Figure 1.

3. Material and methods

3.1. Data collection

For this research project, data were retrieved from the world happiness report 2020 and the World Bank (WB) data portal. The data portal of the World Bank makes data available to the general public without charge and unrestrictedly. The data collected by the World Systems division at the WB are made accessible to the general public, and new datasets are regularly added. One of the most attractive features is that they offer this as a free service, making it unrestricted for users to use (Zhongming et al., 2020). In addition, some pages explain how the data was compiled, acquired, and organized, among other things. On the website of the WB, users may get a great amount of statistical data on various topics, including human

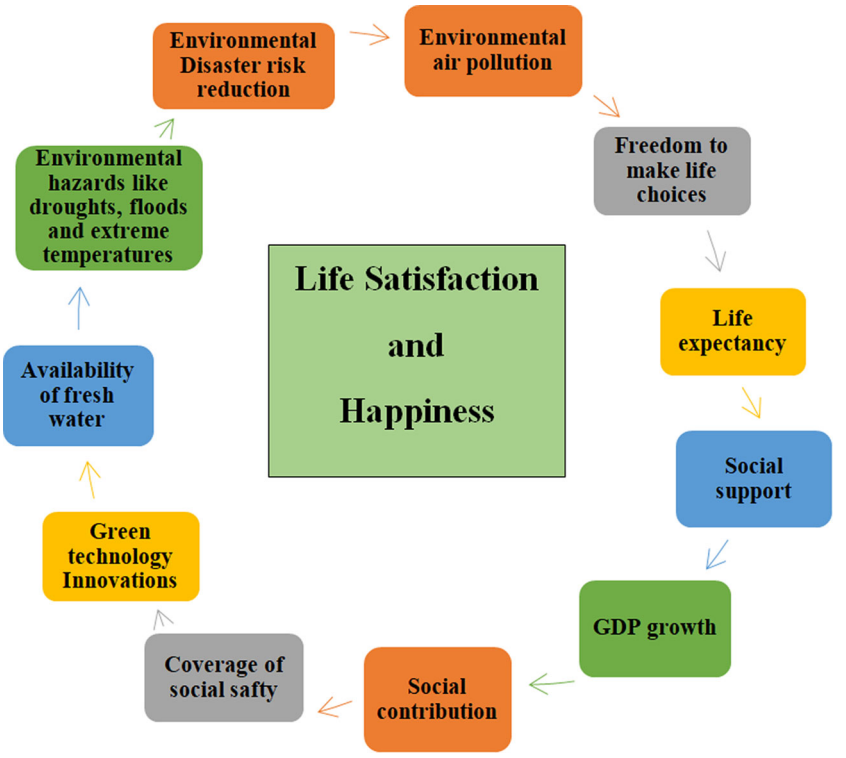

Figure 1. Conceptual model.
Source: Authors Construction.

development, health, and environmental situations. The many countries' profiles on this website include socioeconomic information such as total population, population density, literacy rates, life expectancy at birth, and enrollment in primary schools (Business, 2020). In addition to that, it provides international comparisons of several other variables. A summary of the data acquisition that was done to calculate LSH is presented in Table 1.

3.2. Methodology, time series plot

Data that occurs over time can be visualized using a time series plot. The time series graphic is an excellent choice for viewing lengthy data sequences (Boniol & Palpanas, 2022). The human brain is remarkable in its ability to process such a large quantity of data, identify patterns within the data (such as sinusoids, spikes, and the onset of a trend), and then filter out the noise. On the temporal axis, it depicts a narrative. The graph formed by the displayed dots allows us to examine any patterns within the data (Blázquez-García et al., 2021; Boniol & Palpanas, 2022).

The time series plot is useful in many different statistical contexts. Reporting values of the same component over a longer period can make it hard to identify any trend or pattern. However, certain functions appear immediately when the same data points are shown visually. Time series graphs help identify patterns (Souza, 2001). These designs are important since they can be implemented in the future (Blázquez-

Table 1. Summary of data acquisition that was collected for LSH analysis.

Sr. No.	Data	Dependent/ Independent (DV/IV)	Duration	Source	Data Collection
1	Life satisfaction and happiness (*LSH*)	DV	2005–2020	World Happiness Index (WHI)	Yearly
2	Freedom to make life choices (*FMLC*)	IV	2005–2020	World Happiness Index (WHI)	Yearly
3	GDP growth (GDPG)	IV	2005–2020	World Bank (WB)	Yearly
4	Social contribution (SC)	IV	2005–2020	World Bank (WB)	Yearly
5	Employment rate (ER)	IV	2005–2020	World Bank (WB)	Yearly
6	Social support (SS)	IV	2005–2020	World Happiness Index (WHI)	Yearly
7	Innovation and development (ID)	IV	2005–2020	World Bank (WB)	Yearly
8	Life expectancy (LE)	IV	2005–2020	World Bank (WB)	Yearly
9	Coverage of social safety (CSS)	IV	2005–2020	World Bank (WB)	Yearly
10	High qualification (HQ)	IV	2005–2020	World Bank (WB)	Yearly

Source: Author Estimations.

García et al., 2021; Boniol & Palpanas, 2022; Souza, 2001). Time series plots can provide valuable insights into the data one is analyzing. By plotting the values of a variable over time, patterns in the data can become more apparent. Time series plots can be used to identify trends in data, which can then inform the decision-making process. Time series plots can help to identify seasonality or cyclicality in the data. This information can help determine the best time to release products and services and help understand the behavior of customers and other stakeholders over time (Boniol & Palpanas, 2022). Time series plots can also help to forecast future trends, allowing you to plan and prepare for any changes in your industry. Time series plots can also help identify outliers and anomalies in your data, making decisions based on more accurate information. Identifying anomalies in the data can help to find solutions to problems faster, as well as allow to take corrective action quickly. Finally, time series plots can help compare data points over time, providing a clearer picture of how data points change (Souza, 2001).

3.3. Correlation analysis

Correlation coefficients between groups of variables can be displayed in a matrix. There is a one-to-one correspondence between the rest of the numbers in the table and each random variable (Xi) (Xj). Looking closely, you can tell which combinations are most strongly correlated. In this matrix, each of the diagonal entries is 1. When the units of measurement are different, or the standard deviations of the variables are large, a correlation matrix is utilized (Sheng et al., 2019).

Correlation analysis refers to a set of methods for determining the degree of association between two variables. A correlation analysis's core purpose is to reveal the similarity between two variables. By calculating their correlation coefficient, researchers can assess how strongly two variables are related linearly (Gauthier et al., 2020). The Pearson correlation coefficient is used to determine the degree of the linear relationship between two variables, with $r = 1$ indicating a perfect positive correlation and $r = -1$ indicating a perfect negative correlation.

$$R = \frac{\Sigma(xy) - (\Sigma x)(\Sigma y)/n}{\sqrt{\Sigma x^2 - (\Sigma x)^2/n)\left(\Sigma y^2 - (\Sigma y)^2/n\right)}} \quad (1)$$

In the above equation, n is the sample size, and x and y are individual sample points.

3.4. Principal component analysis (PCA)

Principal component analysis (PCA) is a statistical method that uses many interconnected variables to reduce the dimensionality of a dataset while preserving as much variation as possible. Principal components (PCs) that cannot be combined are rearranged to preserve a large portion of the original variables' variability (Zou & Xue, 2018). Principal component analysis (PCA) is a statistical method that reduces a large set of variables to a smaller set of theoretically independent variables. As much information as possible about the variables is packed into the first primary component, with the remaining information built up in subsequent components. A square symmetric matrix is typically used for the PCA (Ejaz et al., 2019; Santos et al., 2019; Zou & Xue, 2018).

Similar to principal component analysis is another multivariate method known as Factor Analysis. There is a great deal of misunderstanding among researchers on the distinction between the two approaches. Keep in mind that the primary goal of the principal component analysis is to discover computational representations of big numeric data sets and that this is typically done through 2 D displays. The data cloud is hidden when the initial spaces used to describe mathematical units and variables are very large (Ejaz et al., 2019; Granato et al., 2018). For this reason, we seek out places with minimal footprints, i.e., those that cloud-save the optimal starting point. The equation (Eq. (2)) for PCA is as follows:

$$X = t1a1T + t2a2T + \ldots. + tvavT + E = TAT + E \quad (2)$$

The above-written equation X represents the M x N data matrix, T represents the M x V scores, A represents the N x V loadings, and E represents M x N residuals. Here, i is the number of principal components of X.

Principal components are derived from linear combinations of original components or unique blends to create new variables. These transformations are executed so that new variables (such as principal components) are uncorrelated, and most data is packed into the original variables' first components (Santos et al., 2019). Assuming that your data is in ten dimensions, principal component analysis (PCA) will attempt to squeeze as much information as possible into the first component, the next, and so on. When we begin with p-dimensional vectors, we hope to reduce them to a q-dimensional subspace vector. We shall give a description based on the projection of the starting vectors into q directions, that is, the principal components that completely span the subspace (Zou & Xue, 2018). There are other mathematically comparable approaches to determining the primary components. Maximizing the variance in your estimates is the best option. It's important first to consider the spatial direction where the projections vary the most. The second essential property is the

direction that maximizes the sum of the directions orthogonal to the first (Santos et al., 2019; Zou & Xue, 2018).

For this reason, a symmetrical square matrix is a standard tool for principal component analysis. A Covariance (scaled sums) Matrix, Correlation Matrix, or SSCP Matrix could be used (sum of square and cross products from consistent data). Determining the Eigenvectors and Eigenvalues of the covariance matrix is the linear principle in algebra that allows us to define the primary components of the data. They always appear in pairs, and every eigenvector has its eigenvalue. There are as many of them as there are dimensions in the data. For a three-dimensional dataset, for instance, there are three variables and three eigenvectors and eigenvalues (Ejaz et al., 2019; Granato et al., 2018; Santos et al., 2019; Zou & Xue, 2018).

Assuming Y is the dependent variable and X is the set of independent variables, we can ask whether or not the p independent variables exhibit collinearity. Principal component analysis is performed with 'p' independent variables (Gewers et al., 2021). It is also used to reduce many correlated variables to their uncorrelated principal components and display the amount of information for different principal components. Now we can set up an equation for standardized principal components regression by computing p standardized independent variables and p principal components.

$$y' = (\mathrm{Y} - \overline{Y})/\mathrm{SY} \tag{3}$$

$$\mathrm{Xi'} = (\mathrm{Xi} - \overline{Xi})/\mathrm{SXi} \quad (\mathrm{i} = 1 \ldots \mathrm{p})$$

$$\mathrm{Ci} = \mathrm{ai1X1'} + \mathrm{ai2X2'} + \mathrm{ai3X3'} + \ldots\ldots + \mathrm{aipXp'} \quad (\mathrm{i} = 1, \ldots, \mathrm{p})$$

In the above equation, Y' and Y are standardized dependent and dependent variables, respectively. S_Y is the standard deviation of Y. Similarly, X_i' and X_i are 'i'th standardized independent and ith independent variables, respectively, and S_X is the ith standard deviation of X_i. $\overline{Y}$ is the mean of the dependent variable and $\overline{Xi}$ is the mean of the 'i'th independent variable. C is the principal component, and 'a' is the coefficient of the principal component. The standardized principal component regression equation is as follows:

$$\hat{y}\mathrm{j'} = \sum \mathrm{Bi'Ci} \ (\mathrm{j} = 1, \ldots, \ \mathrm{m} \ \leq \mathrm{p}; \ \mathrm{i} \ = 1, ., \mathrm{K} \leq \mathrm{p}) \tag{4}$$

where $\hat{y}_j$' is the estimate of the jth standardized principal component regression equation, and Bi' is the coefficient of ith standardized partial regression. Now, after sorting out the:

$$\hat{y}\mathrm{j'} = \sum \mathrm{bi'Xi'} \ (\mathrm{i} = 1, ., \mathrm{K} \leq \mathrm{p}) \tag{5}$$

here, bi' is the coefficient of ith standardized partial regression. The below equations are used to compute partial regression constants and coefficients.

$$\mathrm{bi} = \ \mathrm{bi'}/(\mathrm{Lyy}/\mathrm{Lxixi})^{1/2} \quad (\mathrm{i} = 1, ., \mathrm{K} \leq \mathrm{p}) \tag{6}$$

$$b_0 = \overline{Y} - \sum \mathrm{bi}\overline{\mathrm{X}}\mathrm{i} \qquad (\mathrm{i} = 1, ., \mathrm{K} \leq \mathrm{p})$$

$$\hat{y} = \mathrm{bo} - \sum \mathrm{biXi} \qquad (\mathrm{i} = 1, ., \mathrm{K} \leq \mathrm{p})$$

where b_i is the 'i'th partial regression coefficient of the general linear regression equation. L_{yy} is the sum of squares of the dependent variable Y. L_{xixi} is the sum of squares of the 'i'th independent variable X_i, and b_o is the constant of the general linear regression equation (Gewers et al., 2021; Santos et al., 2019; Tripathi & Singal, 2019; Zou & Xue, 2018).

3.5. Regression analysis

The approach used to create the equation and generate the forecasts is called regression analysis. Finding the most optimal Y-X relationship is at the heart of regression analysis (Wang et al., 2018; Zhu et al., 2019). The regression equation is found using the least-squares method, which minimizes the squared difference between observed and predicted Y values.

$$y = a + mX \tag{7}$$

where 'm' is the slope and 'a' is the intercept.

Both linear and multiple regression analysis can be used for regression purposes. Simple linear regression is commonly used as a synonym for linear regression. A straight line defines the relationship between two variables. Finding the slope that determines the line and eliminating regression errors to a minimum is the goal of linear regression (Rasp et al., 2020; Rustam et al., 2020; Wang et al., 2018; Zhu et al., 2019).

3.6. Multiple linear regression (MLR) analysis

MLR is the type of regression used when there are multiple explanatory variables, and the dependent variable has a linear connection with each of them. Multiple regressions involve an array of independent variables and a single dependent one (Dimitriadou & Nikolakopoulos, 2022; Wong et al., 2020). It can be expressed mathematically as:

$$\mu\mathrm{y} = \beta\mathrm{o} + \beta 1\mathrm{X}1 + \beta 2\mathrm{X}2 + \beta 3\mathrm{X}3 + \ldots\ldots\ldots + \beta\mathrm{iXi} \tag{8}$$

In the preceding equation, y is the mean response, and 'i' is a variable that causes y to fluctuate. To be consistent with the same standard deviation, we suppose that the observed values of y deviate from their means y by the same amount.

Only one dependent variable is often described. Multiple regressions are used here because it is more likely that more than one independent variable will help explain the dependent variable. The various regressions will be both linear and non-linear. The assumption of linearity between the dependent and independent variables underlies all multiple regression analyses. Similarly, this indicates a lack of correlation between the independent variables (Bery, 2021; Dimitriadou & Nikolakopoulos, 2022;

Scala et al., 2022). The slope of the regression line can be calculated using the following:

$$A = r\frac{sx}{sy} \tag{9}$$

Standard deviations for X and Y are denoted by Sx and Sy, respectively; r denotes the correlation coefficient.

Several presumptions must be made before linear regression can be used effectively (Dimitriadou & Nikolakopoulos, 2022; Scala et al., 2022; Wong et al., 2020).

- A range of Y values exists, one for each X. These values fall within the usual range.
- These normal distributions account for most of the variation in the outcomes.
- The standard deviations of these normal distributions are the same.
- As a statistical matter, the Y values can be considered separate.

Also, the following are examples of assumptions made in multiple regression analysis:

- Many relationships between independent factors and the dependent variable can be described as linear.
- One can never have a discrete dependent variable.
- The deviation from the predicted value for each fitted Y value is the same.
- Later measurements of the dependent variable show no association with one another.
- Autocorrelation occurs when this rule is broken.

4. Results

4.1. Life satisfaction and happiness (LSH) trend

Figure 2 contains temporal trends of life satisfaction and happiness (LSH) in China since 2005. One can observe that LSH increased after 2006; however, LSH trends have had several ups and downs from 2010 to 2020. According to the world happiness report of 2020, life satisfaction and happiness trends continuously increased after 2019 and still increase even after 2020. According to the report, several indicators measure life satisfaction and happiness in any country, including economic, social, environmental, and education-related (Gao, 2020; Helliwell et al., 2020). Data for China is provided for the indicator analysis for the years 2005 through 2020. From 2006 to 2018, the average points for China were 5.14, with the lowest at 4.48 in 2006 and the highest was 5.77 in 2018. The most recent value in 2020 was 5.60, placing it at position #94 worldwide that year. In 2021, based on data from 141 nations, the global average is projected to be 5.57 points (Gao, 2020; Helliwell et al., 2021)

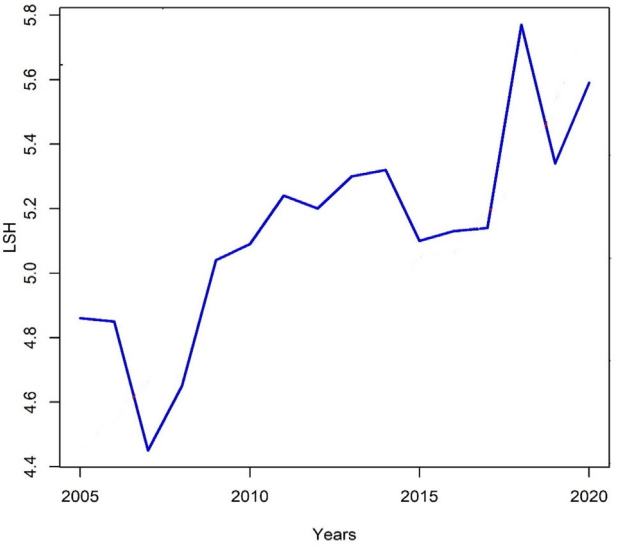

Figure 2. Temporal trends of life satisfaction and happiness (LSH) in China since 2005.
Source: Authors Construction.

Table 2. Statistical summary of the dependent variable (LSH) and independent parameters.

Statistics	LSH	CSS	LE	SC	GDPG	SS	FMLC	CO_2	GTI	EDRR	AFW	EH
Min.	4.45	56346	73.41	28.45	2.24	0.74	0.77	4.50	38.50	8.00	85.00	3.79
1st Qu.	5.00	93727	74.19	29.47	6.93	0.76	0.80	5.70	40.40	11.75	87.75	14.92
Median	5.14	102626	75.17	30.11	7.82	0.79	0.81	7.06	45.03	22.50	90.50	68.55
Mean	5.13	130004	75.20	31.09	8.53	0.78	0.84	6.55	45.68	27.50	89.88	70.00
3rd Qu.	5.31	157859	76.28	30.77	9.90	0.80	0.88	7.23	51.08	39.75	92.25	121.16
Max.	5.77	263542	77.10	37.86	14.23	0.82	0.93	7.61	54.80	63.00	94.00	180.66

Note: Life satisfaction and happiness (LSH); Freedom to make life choices (FMLC); GDP growth (GDPG); Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ).
Source: Author Estimations.

4.2. Statistical summary

Using summary statistics in descriptive statistics is to express the most information with the least effort by summarizing a group of data. The 5-number summary is occasionally expanded to the 7-number summary, and the accompanying box plot is two commonly used collections of order statistics for use as summary statistics (Piazza et al., 2013; Prangle, 2018). Table 2 presents a statistical summary of the dependent variable (LSH) along with selective independent parameters that indicate the level of happiness with their influence and the relationship status with LSH. The maximum LSH value is 5.77, with a mean value of 5.13. The different independent parameters have different units, like numbers and percentages. For instance, the CSS has the number unit, whereas many independent parameters have percentage unit light SC, GDPG, and LE.

4.3. Correlation matrix plot (correlogram)

A correlogram is shown in Figure 3. The correlation matrix is graphically represented as the correlogram. Drawing attention to the variables in a data table that are most

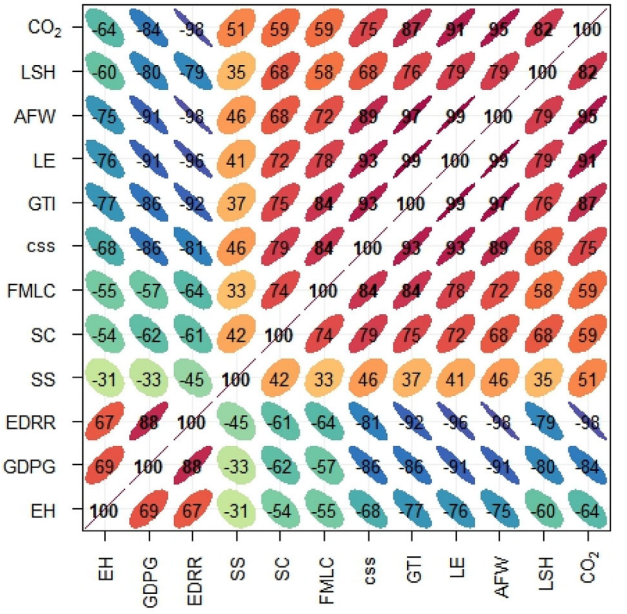

Figure 3. Correlogram of selective variables which shows positive/negative association among each other. *Note:* Life satisfaction and happiness (LSH); Freedom to make life choices (FMLC); GDP growth (GDPG); Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ).
Source: Authors Construction.

strongly associated can be quite instructive. The correlation coefficients are color-coded by their respective values in Figure 3. The correlation matrix can also be rearranged based on the strength of the connections between the variables. The correlation matrix was computed with the help of the 'corrplot' package, available in R programming. The given Figure 3 correlogram reveals that the highest coefficient correlation value with LSH is CO_2 which has positive intensity with a correlation coefficient value of 0.80, followed by GDPG with a negative coefficient value of −0.80. The lowest coefficient value is 0.35, which is associated with SS.

4.4. PCA analysis

PCA uses the R programming language to examine the linear relationships between all available characteristics. The result is a principal component when a dataset's original predictor is transformed into a linear combination (orthogonal transformation). To better display the fluctuations contained in a dataset with multiple variables, this technique is helpful for EDA (Exploratory data analysis).

It is most effective with cold, hard numbers. Data change of basis is carried out by calculating the primary components of the data and then using those components (often just the first few components) in the analysis. PCA can be considered a linear data modification when applied to specific data spaces. Each successive orthogonal coordinate has less variation than before, and the first coordinate has the most

Table 3. PCA analysis statistics.

Parameters	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
CSS	0.32	0.00	0.23	0.04	−0.07	−0.55	−0.34	0.64	−0.01	0.09	−0.07
LE	0.34	−0.11	−0.06	0.06	0.04	−0.03	−0.26	−0.16	0.01	−0.58	0.66
SC	0.27	0.12	0.54	0.02	−0.64	0.45	0.00	−0.01	−0.06	0.00	−0.01
GDPG	−0.31	0.17	0.24	−0.07	0.45	0.49	−0.52	0.28	−0.04	0.05	0.12
SS	0.17	0.94	−0.07	−0.16	0.08	−0.16	0.01	−0.17	0.03	−0.05	−0.01
FMLC	0.28	−0.06	0.57	0.12	0.57	−0.05	0.47	−0.09	−0.15	−0.02	0.00
CO_2	0.31	0.09	−0.35	0.22	0.08	0.39	0.37	0.51	0.39	0.04	0.11
GTI	0.34	−0.14	0.07	0.03	0.16	0.05	−0.36	−0.37	0.64	0.08	−0.38
EDRR	−0.33	0.01	0.30	−0.23	−0.10	−0.22	0.18	0.00	0.57	0.26	0.52
AFW	0.34	−0.04	−0.18	0.07	0.05	0.05	−0.15	−0.21	−0.28	0.76	0.35
EH	−0.27	0.18	0.09	0.92	−0.07	−0.12	−0.09	−0.11	0.07	0.03	0.05

Note: Freedom to make life choices (FMLC); GDP growth (GDPG); Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ).
Source: Author Estimations.

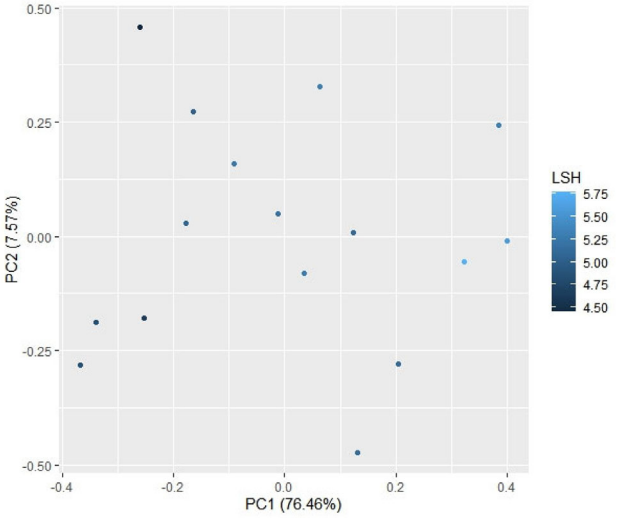

Figure 4. Contribution of PC1 and PC2 in PCA analysis.
Source: Authors Construction.

volatility once this transformation is applied to the data. For this work, we receive eleven fundamental components, PC1 through PC11 (Table 3). A certain amount of data variance can be attributed to each of these. For example, PC1 accounts for about 76.64% of the total variance, suggesting that it captures 75% of the information in the dataset. PC2 accounts for 7.57 percent, and so on.

A scatter plot of PC1 and PC2 is the standard method for visualizing a PCA (Figure 4). Non-linearity and out-of-the-ordinary behavior in the data is made clear by these charts. For each sample vector, PC1 and PC2 are calculated and displayed graphically. PCA plots can be generated quickly and easily in R using the 'autoplot ()' function of the 'ggfortify' package.

After completing PCA, the object can be plotted using the plot () function to find the most justifiable features. If you look at a scree plot, you will notice that the 'arm-bend' indicates a decline in cumulative contribution. The second principal component

Table 4. PCA diagnostic statistics.

Statistics	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
SD	2.90	0.91	0.88	0.66	0.53	0.45	0.20	0.14	0.09	0.05	0.02
Proportion of Variance	0.76	0.08	0.07	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.00
Cumulative Proportion	0.76	0.84	0.91	0.95	0.98	0.99	1.00	1.00	1.00	1.00	1.00

Note: Standard Deviation (SD).
Source: Author Estimations.

Table 5. MLR model statistics.

Parameters	Estimate	Std. Error	t-value
(Intercept)	40.660	16.80	2.42***
CSS	−0.010	0.00	−9.49***
LE	0.300	0.03	3.00***
SC	0.430	0.03	4.57***
GDPG	−0.197	0.09	−12.18***
SS	3.031	1.45	2.09***
FMLC	4.146	3.11	1.33***
CO_2	0.210	0.02	10.48***
GTI	0.064	0.03	2.12***
EDRR	−0.035	0.01	−3.50***
AFW	−0.486	0.21	−2.31***
EH	−0.010	0.00	−3.73***

Note: Freedom to make life choices (FMLC); GDP growth (GDPG); Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ).
Source: Author Estimations.

curves upwards in the above plot. Table 4 presents the PCA diagnostic statistics of PCA analysis.

4.5. Multiple linear regression (MLR)

We also computed MLR to ass the influence of contributing parameters in LSH. Results of the MLR model are presented in Table 5, in which estimated coefficients, Std. Error and t-value are given. The Residual standard error for this model is 0.018 on 4 degrees of freedom along with R^2 of 0.918, F-statistic 14.07, and p-value of 0.009. The R^2 of 0.91 states that the contributing parameters explain 91% variation in this model.

4.6. Variable importance (VI score)

Variable importance evaluation functions can be split into groups: those that use the model information and those that do not. The advantage of employing a model-based method is that it is more related to the model performance and may be able to incorporate the correlation structure between the predictors into the important calculation. No matter how weight is assigned: For most classification models, each predictor will have separate variable importance for each class (the exceptions being classification trees, bagged trees, and boosted trees) (the exceptions are classification trees, bagged trees, and boosted trees). All measures of significance are scaled to have a maximum value of 100 unless the scale argument of 'varImp.train' is set to FALSE. Based on the t-value of the regression model, the VI score plot is presented in

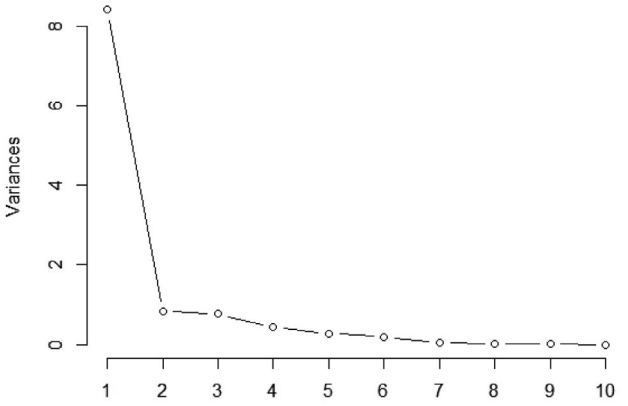

Figure 5. Contribution of 10 PCs in PCA analysis.
Source: Authors Construction.

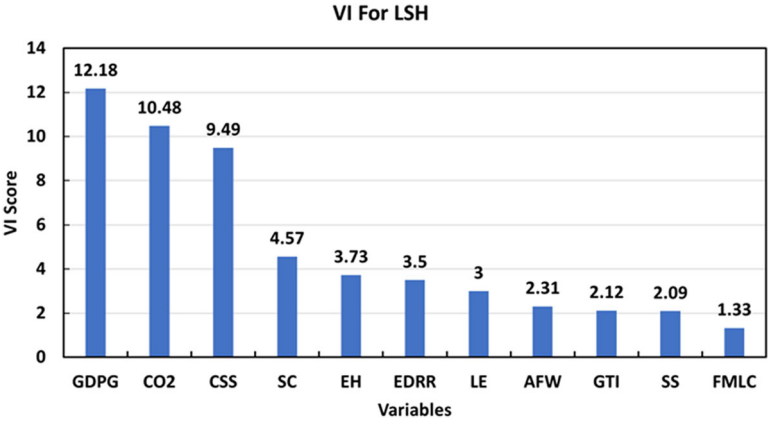

Figure 6. VI score plot of regression model.
Note: Freedom to make life choices (FMLC); GDP growth (GDPG); Social contribution (SC); Employment rate (ER); Social support (SS); Innovation and development (ID); Life expectancy (LE); Coverage of social safety (CSS); High qualification (HQ).
Source: Authors Construction.

Figure 6. According to the model, the most important variable is GDGP, followed by CO_2, while the third is CSS.

5. Discussion, theoretical and practical implementation

Social science researchers have been hard at work, trying to find the secret to happiness and life satisfaction. While no one has yet discovered it, they have come up with some interesting ways to maximize your happiness when faced with the overwhelming number of economic, social, and environmental factors that affect your day-to-day life (Mohammadi Mehr et al., 2019; Naseem, 2018).

The economic factors related to an individual's life satisfaction and happiness are income levels, employment status, social class, and being raised in a single-parent family. Income levels directly correlate with life satisfaction and happiness because as income level increases, so do one's feelings of happiness (Aboalshamat et al.,

2018; Ruggeri et al., 2020). A person who has a low income or is unemployed will find it much more difficult to keep the same level of happiness than someone who is employed or has a higher level of income. Comparing people from different social classes shows that lower-class people report lower life satisfaction and happiness (Mohammadi Mehr et al., 2019; Ruggeri et al., 2020). One reason could be that people living in poverty often experience weak satisfying relationships with others (such as friends and family) due to not having enough time or money to devote to them. Another reason could be a lack of resources which might make them feel less secure about their future. Being raised by only one parent also affects these aspects. These children often grow up without the experience of how families function differently, depending on if only one parent is present (Aboalshamat et al., 2018; Naseem, 2018).

The study found that income was the most important determinant of happiness among the social factors studied. Wealthier respondents were happier than poorer ones, but there was no unambiguous evidence of a happiness plateau, after which wealth offers a little additional benefit in terms of well-being. Residents of countries with better environmental conditions, such as those in Scandinavia, tended to be more satisfied with their lives than those in less fortunate areas, such as the Middle East (Elkis-Abuhoff et al., 2022; Porzoor, 2022). Certain economic policies also significantly affected life satisfaction: respondents who lived in countries with higher levels of inequality (measured by Gini coefficients) tended to have lower life satisfaction than residents in countries with more equal distributions (Porzoor, 2022).

Life satisfaction and happiness are terms that often get confused but are quite different. Life satisfaction describes how one evaluates their life overall, while happiness describes the emotional state one feels in the moment based on their current situation. There's no set way to make your life more satisfying or happy, but there are certain factors that you can use as inspiration when making decisions about where you want your life to go next (Aydogdu et al., 2021; Sujarwoto et al., 2018).

This study revealed a significant correlation between life satisfaction, happiness, and contributing parameters. The variables that most contributed to the correlation were family life, social relationships with friends or neighbors, financial situation, physical health, and self-rated health. It is important to note that these correlations are not causal; therefore, it cannot be concluded from the data what causes one's life satisfaction or happiness. The research does provide evidence for the importance of certain factors in influencing life satisfaction and happiness (Mohammadi Mehr et al., 2019; Ngamaba & Soni, 2018; Porzoor, 2022).

The research also found evidence for another aspect that needs to be considered when discussing the impacts on people's lives: ecological factors. In addition to those already mentioned, issues such as environmental pollution (especially in large cities), natural disasters, changes in nature due to global warming as well as anthropogenic activities (e.g., air pollution) significantly impact an individual's quality of life on both an emotional level and through their direct effects on human health (Mert et al., 2021; Sirgy et al., 2021).

A study was conducted to find the correlation between social, economic, and environmental factors with happiness. The study found a high correlation between

life satisfaction in general and social factors (Olawa & Idemudia, 2021). When it comes to economic factors such as unemployment or inflation rate, it is not necessarily correlated but depends on how people are feeling about their situation. There also seems to be a negative correlation with environmental factors such as CO_2 emissions or water pollution levels. To conclude, the study found that life satisfaction is more closely correlated to social than any other factor studied (Mert et al., 2021; Olawa & Idemudia, 2021; Sirgy et al., 2021). With this information, policy-makers can consider what makes for an overall happy community and, thus, a happy nation. While positive steps forward, green technology innovations should also consider these findings when deciding which technologies will be implemented at which rates. More research should be done to see if certain innovations have a better effect on society (such as wind power) versus others (such as coal mining) (An et al., 2020). It would also be beneficial to understand the correlations. For example, does money cause social ties to dissolve? Does money make people less likely to care about their environment? Is it possible that changes in climate due to environmental degradation affect mental health? Before making conclusions, future studies and policies must investigate why these correlations exist. However, based on current evidence, happiness varies by socioeconomic status, and income level is one of the main indicators. It also varies by region: some countries are still recovering from large disasters like Hurricane Katrina or Hurricane Maria; some are experiencing violence-based conflicts like Syria or Ukraine; some countries experience natural disasters often, while others live in relative safety, like Singapore. Understanding these parameters allows us to tailor green innovation strategies to meet best each country's needs (An et al., 2020; Mert et al., 2021; Olawa & Idemudia, 2021; Sirgy et al., 2021).

Life satisfaction and happiness are the most important indicators of a person's well-being. Multiple factors suggest a strong link to life satisfaction, such as being employed, educated, married, and financially stable (Di Fabio & Gori, 2016). Studies exploring life satisfaction along these individual lines are limited in scope. However, the research that is more in line with exploring the role of external factors such as an environment, economy, and social setup is more apt in helping assess the impact of these factors on happiness and life satisfaction. An interplay between environmental, socioeconomic, and green technology innovation influences human happiness and life satisfaction in society.

Karl Marx famously stated that life is not about being happy but satisfied with what you have. Marx believed that economic, social, and environmental parameters drove satisfaction. According to Marx, the economic system of a country determines whether people will be content and happy. Marx argued that people are driven by their need to survive, so if they are in a society where their basic needs are not met, their levels of life satisfaction will suffer (Aboalshamat et al., 2018; Al-Musalli, 2019; Amati et al., 2018). He also pointed out that social and environmental factors play an important role in how people perceive their lives. For example, he argued that if a person lives in a community with high unemployment and poverty, then their levels of life satisfaction would be low due to the lack of opportunities for advancement (Aydogdu et al., 2021; Bai et al., 2004).

Similarly, Marx argued that environmental factors such as air pollution and inadequate resources could lead to dissatisfaction and unhappiness. This can be especially

true for those living in rural areas, which often lack access to clean water and other necessary amenities. Overall, it is clear that economic, social, and environmental parameters have a significant impact on life satisfaction and happiness (Barrington-Leigh & Galbraith, 2019; Cook & Davíðsdóttir, 2021; Di Fabio & Gori, 2016). If society provides its citizens with secure employment, safe and clean environments, and the means to live comfortably, people are more likely to be satisfied with their lives. On the other hand, if these conditions are absent or inadequate, people may feel disconnected from their environment and dissatisfied with their quality of life (Easterlin, 2005; Eberts, 2019; Egerer et al., 2018; Ejaz et al., 2019).

For this reason, governments must prioritize meeting their citizens' basic needs. Governments can work towards this goal through programs to reduce poverty rates. Although progress has been made over time, some countries still struggle with extreme income inequality (such as Brazil) and high unemployment rates (such as South Africa). Governments should invest more in education programs, healthcare initiatives, and vocational training programs to promote life satisfaction among their citizens. Investing in these types of initiatives-especially ones that emphasize sustainability governments, can promote self-sufficiency among its citizenry while simultaneously boosting national GDPs (Fasihi Harandi et al., 2017; Gao, 2020; Ghose & Etowa, 2022; Goodman et al., 2018).

A study was conducted to measure the impact of social, economic, and environmental factors on happiness and life satisfaction. The subjects were asked to rate their happiness on a scale of one to ten. The results showed that the subjects with jobs reported being happier than those without jobs (Ghose & Etowa, 2022). Furthermore, those with higher incomes also reported being happier than those with lower incomes.

The study also found that people living in countries with higher GDP (gross domestic product) per capita were happier than those with lower GDP per capita. However, when looking at individualistic cultures that promote values such as self-reliance or achievement on an individual basis, happiness levels did not change much based on GDP level (Ghose & Etowa, 2022; Seo et al., 2018). One of the reasons for this is that most people are satisfied with basic needs met even in countries with low GDP per capita. On the other hand, when looking at collectivist cultures where people place greater value on relationships and belonging, it does make a difference in how satisfied they are (Mert et al., 2021; Sirgy et al., 2021). For example, although Japan has a lower GDP per capita, its citizens report feeling very content about their lives. Whereas South Korea has a higher GDP per capita, its citizens are less content. Another principal factor affecting life satisfaction and happiness is physical health, which impacts both aspects. For instance, people who experience chronic pain have lower levels of happiness: emotional well-being and life satisfaction. And these can be attributed to the mental toll that chronic pain takes on someone's physical state: creating feelings of hopelessness and depression (Ghose & Etowa, 2022; Mert et al., 2021; Olawa & Idemudia, 2021; Seo et al., 2018; Sirgy et al., 2021).

The current research provides enough evidence that green innovation and environmental factors affect individuals' happiness and life satisfaction in society. The research also highlights the impact of socioeconomic factors that have an impact on life satisfaction and happiness. The current research gives a thorough oversight and

motivates management to implement green innovation (Mert et al., 2021; Sirgy et al., 2021). Our research work has multiple practical and managerial implications. It provides a guideline to the policy-makers, managers, and stakeholders to implement green technologies to improve the environment, preserve the environment, and enhance the socioeconomic conditions in favor of people and their well-being, happiness, and satisfaction. It is suggested that government agencies compensate the enterprises' costs during the green innovative process implementation. This will lead to implementing environmental regulations effectively binding enterprises to bring green technological innovations (Seo et al., 2018; Sirgy et al., 2021). Most enterprises lack the human resources to implement green innovation agendas. However, this deficiency can be overcome through building networks based on cooperation with universities, research institutes, peers, and customers to receive help from the collaborative network established to promote and help implement innovative green agendas. This research calls for all stakeholders to agree on a comprehensive range of human happiness and life satisfaction aspects (Mert et al., 2021; Olawa & Idemudia, 2021).

The current research explores the impact of economic policies and GDP on the happiness and satisfaction of human beings. Therefore, it is advised that policy-makers should reconsider significant U.N. Sustainable Development Goals (SDGs). A total of one hundred figures are all given equal weight and cover the many concepts covered by the SDGs. According to a study, there is an imperfect correlation between well-being and the SDG indicators for targets (Cook & Davíðsdóttir, 2021). The study concludes that, as a result, policy-makers may find it even more challenging to pursue. There is a need to understand correlates and determinants in further detail to set up a framework that enables policy-makers to incorporate well-being and life satisfaction measures in carving new public policies (Ghose & Etowa, 2022; Sirgy et al., 2021).

6. Conclusion, policy decisions and recommendations for future research

Many individuals believe that they are happy and satisfied with their lives. However, research states that many other factors outside our control can impact life satisfaction and happiness. Our social relationships with friends, family, and coworkers can increase or decrease levels of happiness; our economic status can figure out the level of quality of life we can afford; even the environment around us- such as air quality- can have a significant effect on how well we sleep at night. These findings show how important it is for people to understand how these external factors affect their day-to-day lives to work towards increased contentment. People need to know that if they feel dissatisfied with any aspect of their lives, there may be something they can do about it. If someone feels unhappy at work, they might try talking to their boss about adjusting their responsibilities or taking a different role within the company. If someone feels lonely after moving into a new city and has trouble making friends, joining clubs or volunteering would help them meet new people who could become lifelong connections.

The impact of economic, social and environmental parameters on life satisfaction and happiness is an increasingly important topic of discussion. Governments worldwide are working to create policy decisions that foster a healthy environment for citizens. Economically, it is widely accepted that higher-income individuals generally experience greater life satisfaction. In addition, access to education, healthcare, and other public services can positively impact one's quality of life. Social parameters, such as community safety and social integration, are also essential in determining one's level of life satisfaction. Finally, environmental parameters, including air quality, water resources, and natural beauty, are often overlooked when discussing happiness and life satisfaction (Mert et al., 2021; Sirgy et al., 2021).

Ultimately, policy makers must consider the economic, social and environmental parameters when crafting policy decisions that will positively impact life satisfaction and happiness. By doing so, governments will ensure that citizens live in healthy and secure environments that provide them with the resources needed for a meaningful life. For example, Germany has some of the most progressive laws on recycling waste and green energy production. These efforts have paid off, as Germany has been ranked #1 in sustainability by the World Wildlife Fund. However, while these policies may be well-intentioned, they can sometimes take away from a society's GDP, leading to lower life satisfaction levels (even though GDP is not always related to well-being) (Ghose & Etowa, 2022; Seo et al., 2018).

Furthermore, developing countries do not always have access to these same luxuries or policy choices; this leaves people in those countries less satisfied than those with wealthier economies. As a result, government leaders need to make conscious decisions about their policies to increase their country's productivity while maintaining its population's quality of life. Continuing with the example of Germany, their policies seem to work well because their income per capita growth rate exceeds the average across all OECD countries. Their strong labor market also supports growth through job creation and high employment rates, especially among women and youth. It is true that due to these regulations, many jobs were eliminated. Still, Germany maintained a high unemployment rate even during the global financial crisis because of compensatory reforms like lowering dismissal costs and providing more generous unemployment benefits – all policies made possible through their strong economy (An et al., 2020; Sirgy et al., 2021).

Economic growth often comes at the cost of environmental degradation. Burning fossil fuels and industrial activities can result in air and water pollution, harming the health of humans, animals and plants. Poor land use can lead to soil erosion and desertification. Climate change resulting from carbon emissions can also have catastrophic effects, such as extreme weather patterns, rising sea levels and disruption of ecosystems. These can greatly impact our quality of life directly and indirectly (An et al., 2020; Mert et al., 2021).

Social factors such as poverty, inequality and lack of access to education can also have a negative effect on our environment. For instance, poverty can lead to people relying on unsustainable forms of energy, such as burning wood for cooking or heating, which leads to deforestation. Inequality can mean that certain groups cannot access resources necessary for a healthy lifestyle or participate in activities that could

help protect their environment. Inadequate access to education can mean that people are unaware of how their actions affect the environment. Ultimately, economic, social and environmental parameters are all interconnected and need to be addressed for us to live sustainably and experience true happiness and life satisfaction. We must work together to create a more sustainable future through policies to reduce the negative effects of these parameters and initiatives that promote a healthier relationship with our environment (Olawa & Idemudia, 2021; Sirgy et al., 2021).

This study used yearly data on contributing parameters and green technology innovations in China over time. The findings cannot be generalized to other countries due to different economic, social, and environmental settings. Future research could focus on other populations or sectors, such as consumers, to better understand what these factors mean for them. In addition, future studies could include objective measures of life satisfaction instead of subjective measurements, which would provide more insight into how specific factors affect life satisfaction and happiness. Along with secondary data, researchers should explore the issues through different methods, including quantitative surveys and qualitative interviews with participants. They must also investigate whether this effect varies across cultural contexts by recruiting subjects from diverse backgrounds. Finally, they must explore whether there is any correlation between well-being and outcomes like mental illness, physical health, and social functioning.

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