Rethinking Happiness: The Economics of Well-being in the Digital Age

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Abstract

This study explores the determinants of Gross National Happiness (GNH) in Egypt from 2000 to 2024, focusing on the roles of Sustainable Development Goals (SDGs), GDP per capita, digital transformation, and governance quality, particularly corruption perception. Utilizing secondary data from reputable international sources, the analysis employs an Autoregressive Distributed Lag (ARDL) model and Vector Autoregression (VAR) techniques to examine both short-run and long-run relationships among these variables. The findings reveal significant effects of digital technology adoption and perceived corruption on enhancing national well-being, while progress in certain SDGs shows a complex, sometimes negative association with happiness in the short term. The study confirms a stable long-term equilibrium linking economic, technological, institutional, and developmental factors to GNH. These results underscore the importance of a multidimensional approach to national happiness, highlighting the interplay between economic growth, sustainable development, technological access, and governance in shaping societal well-being in Egypt.

Keywords: GNH, Digital economy, GDP, SPI, ICT, HDI, CPI.

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إعادة التفكير في السعادة: اقتصاد الرفاه في العصر الرقمي

الملخص

تهدف هذه الدراسة إلى تحليل محددات السعادة الوطنية الإجمالية (GNH) في جمهورية مصر العربية خلال الفترة من عام 2000 حتى عام 2024، من خلال استكشاف تأثير مجموعة من العوامل الاقتصادية والمؤسسية والتكنولوجية والتنموية على مستوى الرفاه الوطني. كما تسعى إلى تحليل العلاقات قصيرة وطويلة الأجل بين هذه العوامل وGNH، بهدف تقديم توصيات مبنية على الأدلة لصناع السياسات تدعم التنمية الشاملة وتعزز رفاه المواطنين.

اعتمدت الدراسة على بيانات ثانوية موثوقة مستمدة من مصادر دولية، منها البنك الدولي، تقارير التنمية العالمية، مؤشر مدركات الفساد، ومؤشرات التنمية المستدامة للأمم المتحدة. وتم توظيف أدوات النمذجة الاقتصادية القياسية، وتحديدًا نموذج الانحدار الذاتي للفجوات الزمنية الموزعة (ARDL) لتحليل العلاقات القصيرة والطويلة الأجل بين GNH والمتغيرات المستقلة، بما يتيح التعامل مع سلاسل زمنية ذات درجات تكامل مختلفة، كما استُخدم نموذج الانحدار الذاتي الهيكلي (VAR)لفهم الديناميكيات الزمنية بين المتغيرات وتحليل تأثير الصدمات المتبادلة بينها. وشمل التحليل اختبار وجود توازن طويل الأمد بين العوامل المدروسة والسعادة الوطنية، بما يسهم في بناء فهم أعمق للعوامل المحددة للرفاه المجتمعي في السياق المصري.

وتؤكد الدراسة وجود توازن طويل الأمد مستقر يربط بين العوامل الاقتصادية والتكنولوجية والمؤسسية والتنموية مع .GNH وتبرز هذه النتائج أهمية اتباع نهج متعدد الأبعاد لتحقيق السعادة الوطنية، من خلال تسليط الضوء على التفاعل بين النمو الاقتصادي، والتنمية المستدامة، والوصول إلى التكنولوجيا، وجودة الحوكمة في تشكيل الرفاه المجتمعي في مصر.

الكلمات المفتاحية :السعادة الوطنية الإجمالية ، الاقتصاد الرقمي، الناتج المحلي الإجمالي، ، مؤشر التقدم الاجتماعي، مؤشر التنمية البشرية، مؤشر مدركات الفساد.

1- Introduction

Happiness is a multidimensional concept shaped by economic, social, environmental, psychological, and technological influences. Although nations with high Gross Domestic Product (GDP) often experience improved healthcare, education, and standards of living, GDP alone cannot fully account for life satisfaction and emotional well-being. In response, scholars and policymakers have increasingly shifted focus toward more holistic measures of societal progress such as the Gross National Happiness (GNH) index and the Human Development Index (HDI) which better reflect human experiences.

Seminal works, including Richard Easterlin's 1974 study that introduced the Easterlin Paradox, challenged the linear association between income and happiness. These findings reveal that beyond a certain income threshold, happiness levels plateau, emphasizing the role of non-economic factors such as mental health, political freedom, environmental quality, and social equity. Contemporary research has further examined how digitalization contributes to happiness through increased access to services, connectivity, and innovation, while also raising concerns about equity and digital divides.

This manuscript critically evaluates the transformation in economic thinking from income-centric models toward well-being-focused approaches. It investigates key indicators of happiness including the Gallup World Poll, Social Progress Index (SPI), and Happy Planet Index (HPI) and how they relate to sustainable development goals. Furthermore, it explores the role of digital transformation in enhancing societal well-being, particularly in the context of emerging economies like Egypt. The objective is to analyze the policy implications of these dynamics and propose recommendations for creating inclusive, resilient, and happy societies.

While GDP has long been the gold standard in measuring economic output, happiness studies suggest that income alone does not ensure well-being. The Easterlin Paradox, for example, suggests that although higher income may be linked to greater happiness at a specific moment, it does not consistently lead to increased happiness as time progresses. Alternatives such as GNH, HDI, SPI, and HPI reflect a broader, people-centric development philosophy.

Happiness is influenced by various factors, including income, employment, health, education, social trust, environmental quality, and democratic freedoms. Studies by Rojas (2007), Easterlin (1995), and others highlight the complex relationship between economic inputs and subjective well-being. Trust in government, freedom of expression, and equality are equally vital components.

Digital transformation promotes happiness by improving connectivity, simplifying services, and encouraging innovation. However, it also raises concerns about inequality, overreliance on technology, and the digital divide. Balanced digitalization—through policies that foster inclusion, accessibility, and education—is critical for maximizing positive outcomes. The SDGs promote an integrated vision of prosperity that includes social equity and environmental sustainability. Measures like the HPI and SPI offer insights into how well countries balance economic output with ecological and social health. Happiness thrives in contexts that promote inclusion, freedom, and environmental responsibility.

Despite substantial infrastructure investment, Egypt faces challenges in education, healthcare, and equitable income distribution. While GDP per capita has increased, happiness indices show inconsistency, reflecting socio-political disruptions and disparities. Egypt's 2030 Vision aligns with the SDGs and emphasizes digital transformation and sustainability, yet gaps remain in execution and access.

2- Literature Review: The Relationship Between Income, Inequality, and Happiness

The relationship between income and happiness has been widely examined in the economics of well-being. A foundational contribution to this discourse is the work of Easterlin (1995), who analyzed post-World War II data from nine European countries and found that despite rising per capita disposable income, there was no consistent increase in reported happiness. This paradox, later termed the *Easterlin Paradox*, posits that while happiness is positively correlated with income at a specific point in time, long-term increases in income do not necessarily result in sustained increases in overall happiness (Easterlin et al., 2011).

Building on this, Verme (2007) conducted a comprehensive cross-country analysis involving 84 nations from 1981 to 2004. His findings indicated that income inequality, rather than absolute income alone, plays a critical role in reducing average happiness and life satisfaction. This supports the growing body of literature suggesting that societal comparisons and perceptions of fairness significantly influence subjective well-being.

Zagorski et al. (2014) further contributed to this understanding through a study of 28 European countries, concluding that higher levels of income inequality are associated with lower levels of life satisfaction. The research also highlighted that inequality undermines trust and social cohesion, which are key components of national well-being, especially in Northern European contexts.

The complex interplay between absolute and relative income is underscored by Yang and Zhang (2016), who observed that while income increases can raise happiness levels, relative income (i.e., how one’s income compares to others') tends to have a stronger impact on subjective well-being. Similarly, Ball

and Chernova (2008) argue that income inequality not only reduces life satisfaction but also erodes overall well-being. Moreover, they note that information media consumption can offset some of the adverse effects of inequality by enhancing individuals' sense of awareness and connectedness.

Studies conducted in developing countries further emphasize the detrimental effects of inequality. For instance, Brockmann et al. (2009) and Wu (2009) examined data from China and found that rising inequality leads to increased pessimism and diminished trust in the future, thereby reducing overall happiness. Alesina et al. (2004) also found that income inequality correlates negatively with happiness in Western societies, particularly when individuals perceive limited social mobility or fairness in income distribution.

Li and Xie (2020) contended that income inequality continues to be a significant barrier to achieving higher levels of happiness. However, they also discovered that access to digital technologies can moderate this effect by providing new opportunities for education, communication, and income generation. Their results support the idea that technology access can partially offset the negative psychological effects of income disparity, especially in rapidly developing economies.

The literature underscores that happiness is not solely an economic construct but also a social and psychological one. Subjective well-being—often measured through self-reported happiness or life satisfaction—encompasses dimensions beyond income, such as health, family life, and meaningful social relationships (OECD, 2020). These dimensions are consistently recognized across diverse cultures and socio-economic contexts.

Access to education, healthcare, and social inclusion are critical to improving happiness. According to the OECD (2020), well-being is significantly influenced by good physical and mental health, access to clean water, and strong social networks. Poor

health, on the other hand, restricts daily activities and fosters a pessimistic life outlook, especially among the elderly and working-age populations facing employment challenges.

Research indicates that while income contributes to happiness, its impact is often overshadowed by health status. Clark et al. (2017) found that in countries like the USA, Australia, Britain, and Indonesia, health status had a more significant effect on happiness than income, emphasizing the paramount importance of mental and physical well-being.

In sum, the determinants of happiness are multifaceted. While income and material conditions are important, their impact is mediated by psychological adaptation, social comparisons, and institutional factors. Reducing income inequality and promoting social equity—through education, healthcare, and inclusive policies—are essential for enhancing societal well-being.

Determinants of Happiness

Happiness and subjective well-being are influenced by a wide range of social, economic, environmental, and technological factors. Scholars have increasingly emphasized a holistic view that integrates personal, institutional, and structural variables. The literature reviewed below presents key determinants of happiness and the ways they interact to shape individual and collective well-being.

1. Education, Governance, and Environmental Sustainability: Interconnected Drivers of Holistic Well-being

Education is widely regarded as a cornerstone of individual and societal happiness, not only enhancing economic outcomes but also contributing to improved health, social awareness, and psychological fulfillment. Bhutan's model of *Educating for Gross National Happiness* exemplifies a transformative approach to education—one that integrates traditional Buddhist values with modern pedagogy to promote compassion, ecological mindfulness, and global citizenship. This holistic

framework, as highlighted by Yangka and Newman (2018), seeks to cultivate both cognitive development and emotional well-being, positioning education as a multidimensional tool for sustainable happiness.

Beyond this philosophical approach, empirical evidence also underscores the practical benefits of education. Hartog and Oosterbeek (1998) found that individuals in the Netherlands with non-vocational intermediate education reported significantly higher levels of health, wealth, and life satisfaction. In alignment, Hashem et al. (2024) argue that improvements in education and healthcare are particularly vital for enhancing happiness in developing countries, where foundational services often remain under-resourced. These findings collectively suggest that investment in inclusive and quality education plays a critical role in advancing well-being through both material and non-material channels.

Governance and institutional quality further shape well-being by influencing the social and political environment in which individuals live. Democratic systems that encourage participation, accountability, and transparency create a sense of purpose, security, and collective agency. Studies by Helliwell and Huang (2008), Inglehart et al. (2008), and Frey and Stutzer (2000) consistently demonstrate that political freedom and civic engagement are positively associated with life satisfaction. In contrast, corruption is a significant impediment to happiness. Tay, Herian, and Diener (2014) found that perceived corruption erodes subjective well-being, particularly in societies with low institutional trust, as it fosters feelings of helplessness, inequality, and injustice. Thus, trustworthy institutions and democratic freedoms are essential psychological anchors in a society's pursuit of happiness.

Environmental sustainability and infrastructure development constitute another critical dimension of well-being. Yangka and Newman (2019) emphasized Bhutan's strategy of aligning

environmental protection with cultural and economic goals. Their work illustrates how clean air, public green spaces, and natural environments reduce stress, enhance physical health, and increase life satisfaction. On a broader scale, nations such as China, Malaysia, and Singapore have demonstrated that strategic infrastructure investments—including improvements in housing, transportation, and public amenities—contribute directly to better living conditions and economic mobility, thereby amplifying societal happiness.

When viewed collectively, these domains—education, governance, and environmental infrastructure—form a tightly woven fabric of interdependence. Education fosters civic awareness and social capital, which strengthen democratic engagement and institutional accountability. In turn, transparent governance enables equitable policy implementation, fostering trust and enabling investments in both human capital and sustainable infrastructure. Meanwhile, ecological stewardship and urban development enhance the everyday experience of citizens, reinforcing the psychological and physical foundations of well-being.

This integrated perspective supports a systems-based approach to happiness, where social, political, and environmental elements work synergistically to promote enduring well-being. Public policies designed to enhance happiness must therefore be multi-dimensional, addressing not only economic indicators but also the quality of education, the integrity of institutions, and the sustainability of environments. Societies that commit to this holistic vision—investing simultaneously in human development, democratic values, and ecological integrity—are best positioned to achieve resilient and equitable forms of happiness.

2- Economic Structures, Digital Transformation, and Social Capital: Interlinked Determinants of Well-being

While economic growth is often seen as a direct path to increased happiness, research shows that the distribution, quality, and context of that growth matter just as much-if not more than growth alone. Ram (2009) argues that government spending, unless effectively allocated, may fail to improve subjective well-being. Complementarily, Buryi et al. (2016) warn that excessive taxation, particularly when not met with tangible public returns, can not only reduce life satisfaction but in extreme cases be correlated with negative mental health outcomes, such as elevated suicide rates. These findings point to the necessity of balanced fiscal policies that promote both equity and efficiency to optimize happiness outcomes.

On the productive side of the economy, technological investment and industrial modernization also play a growing role in shaping well-being. Wang (2022), in examining China's Made in China 2025 strategy, demonstrates that digital and technological advancements in the manufacturing sector not only enhance economic output but also improve working conditions such as workplace safety and job satisfaction thereby positively affecting overall life satisfaction. This shows how innovation driven growth, when aligned with human-centered workplace policies, can enhance both economic and psychological well-being.

However, digital transformation is a double-edged sword. On one hand, it drives economic opportunities and infrastructure improvements. Si (2023) and Rosário & Dias (2022) found that digitalization in tourism and public services in China and Europe created new employment avenues and elevated community satisfaction by aligning with sustainable development goals. Similarly, Kaur and Singh (2021) highlight the role of digital tools in India's financial and educational sectors in improving access and raising life satisfaction. Lee

(2020) also reported higher workplace happiness among South Korean employees where digital communication and workload management tools were implemented effectively.

Yet, this digital evolution is not without risks. Twenge, Martin, and Spitzberg (2018) present compelling evidence from the U.S. showing that increased smartphone use especially after 2012 was accompanied by a significant decline in adolescent mental health, particularly among girls. By contrast, Deng, Li, and Wang (2020) found that in China, moderate social media use could foster social connectedness and enhance happiness, suggesting that the cultural and behavioral context mediates the psychological impact of digital engagement.

At the core of these varying outcomes lies social capital—the web of trust, networks, and community participation that sustains social well-being. Tanaka and Tokimatsu (2020) emphasized that in nations like Denmark, Finland, and Singapore, strong civic engagement and community ties are significantly associated with higher happiness levels. These findings suggest that the positive effects of technological and economic development are amplified when embedded within socially cohesive environments.

This intertwining of social capital and economic opportunity is further reinforced in the realm of employment. Beyond income, employment provides individuals with purpose, routine, and a social identity. Di Tella et al. (2001) and Chadi (2010) have shown that unemployment leads to a marked decline in happiness, driven not only by financial instability but also by social isolation and loss of self-worth. Therefore, job creation policies that foster both economic participation and community integration can serve as powerful levers for enhancing national well-being.

Taken together, these studies illustrate that economic structures, digital innovation, and social capital are deeply interconnected

in determining happiness. Digital transformation and economic modernization offer substantial benefits, but only when accompanied by inclusive policies, supportive communities, and thoughtful management of social and psychological risks.

The integration of artificial intelligence, particularly machine learning (ML) and neural networks (NNs), has significantly advanced the study of happiness—commonly referred to as subjective well-being (SWB). Traditionally examined within the disciplines of psychology and social sciences, happiness encompasses emotional states, cognitive evaluations, and overall life satisfaction (Diener et al., 1985). With the rise of big data and computational tools, researchers now apply supervised ML techniques—such as decision trees, support vector machines, and random forests—to predict happiness levels based on variables including demographics, health indicators, income, and digital behavior. More advanced deep learning models, including recurrent neural networks (RNNs), convolutional neural networks (CNNs), and transformer-based architectures, have been particularly effective in analysing complex, multimodal data such as text, speech, and facial expressions (Liu et al., 2020). Social media platforms provide rich sources of behavioral data, allowing for large-scale sentiment analysis, while structured surveys like the World Happiness Report and the Gallup-Sharecare Index offer standardized data for training and validating predictive models. These computational approaches have been applied in various domains, such as public policy—where ML tools support the design of well-being-oriented interventions (OECD, 2018)—and mental health, where AI-driven applications like Replika and Woebot deliver personalized emotional support through natural language processing. Despite their potential, these technologies raise ethical concerns, particularly related to data privacy, algorithmic fairness, and the lack of transparency in neural network decision-making. Consequently, scholars such

as Zhou and Wang (2021) emphasize the need for explainable and culturally sensitive AI models. Overall, the convergence of ML and NNs with happiness research presents valuable opportunities for understanding and enhancing well-being, provided that ethical, methodological, and practical challenges are adequately addressed.

3- Discussion

Egypt's Vision 2030 represents a comprehensive framework aimed at overcoming persistent obstacles to economic happiness and sustainable development. Despite recent strides in political stability and major investments in infrastructure—exemplified by the construction of the New Administrative Capital—substantial gaps remain in key social and economic indicators. This disconnect is particularly concerning given Egypt's rich cultural legacy and strategic geopolitical position. The Sustainable Development Strategy (SDS), aligned with the United Nations' Sustainable Development Goals (SDGs), as well as the National Climate Change Strategy, underscores the government's commitment to inclusive development. Additionally, Egypt's alignment with the World Bank's Country Partnership Framework reflects a desire to integrate international best practices into national policy.

However, data from the Human Development Index (HDI) and Social Progress Index (SPI) indicate a downward trend in several core dimensions of human development. The education sector, a fundamental pillar of human capital formation, continues to underperform due to outdated pedagogical methods, inefficient resource allocation, and underinvestment in higher education. These structural weaknesses have led to poor educational outcomes and hindered efforts to cultivate a competitive and productive workforce. Similarly, life expectancy and overall health outcomes have been negatively impacted by the deterioration of public health infrastructure.

Egypt's healthcare system faces chronic underfunding, inadequate service quality, and a shortage of medical personnel and equipment. Notably, government health expenditure constitutes only about one-third of total health spending, with more than 60% of healthcare costs being borne by individuals through out-of-pocket payments. This financial burden disproportionately affects low-income households and exacerbates inequality in access to healthcare services.

In parallel, economic indicators such as per capita income, unemployment, and poverty reflect deep-rooted socioeconomic challenges. With approximately 2.8 million Egyptians currently unemployed, the psychological toll of joblessness, including stress and mental health disorders, is contributing to a broader decline in subjective well-being. Rural areas are particularly affected by rising poverty rates, highlighting regional disparities in economic development. These conditions are incompatible with the goals of Vision 2030, which aims to promote inclusive and equitable growth.

Another critical issue undermining economic happiness in Egypt is income inequality. Numerous studies have established a strong inverse relationship between income inequality and happiness, emphasizing that economic disparities fuel social discontent and political instability. The concentration of wealth and limited redistribution mechanisms hinder both individual utility and collective economic performance. This inequality was a major factor leading to the January 25, 2011 revolution, demonstrating the socio-political risks associated with economic exclusion. As empirical evidence suggests, even marginal increases in income can significantly boost life satisfaction, particularly when individuals can access essential goods and services.

The implications of unequal income distribution extend beyond subjective well-being to influence national productivity and growth. Inequity in the distribution of financial support and

limited access to opportunity undermine worker morale, reduce economic efficiency, and ultimately constrain long-term development. The interplay of these socioeconomic determinants helps explain Egypt's consistently low performance in global happiness rankings, revealing the need for multidimensional policy responses.

In conclusion, the discussion highlights that while Egypt has outlined ambitious strategic goals, significant structural challenges persist—particularly in education, healthcare, income distribution, and employment. Addressing these issues through equitable policy reform, increased investment in human capital, and improved institutional performance is essential for translating economic growth into meaningful and sustained improvements in national well-being.

Digital Transformation and Economic Happiness in Egypt

In recent years, many economies—particularly in the developing world—have faced stagnating growth despite the availability of both material and human resources. This paradox highlights underlying structural challenges such as weak private sector performance, persistent unemployment, low investment levels, and increasing economic imbalances. Traditional economic models, built on the logic of scarcity, have proven inadequate in addressing the complex and evolving needs of sustainable development. In response, a growing consensus is forming around the need to transition toward a digital economy that leverages abundance through technology, innovation, and connectivity.

The global shift to a digital economy represents a transformational moment, often compared to the industrial revolution in its scale and impact. Unlike the traditional economy, the digital economy is driven by the seamless integration of digital technologies such as artificial intelligence, cloud computing, and high-speed internet into economic,

commercial, and financial activities. This transformation enables millions of real-time transactions among individuals, private enterprises, and public institutions, supporting quicker trade processes, faster payments, and more data-informed decision-making.

The benefits of digitalization for economic growth and well-being have become particularly evident during the COVID-19 pandemic. With the decline in face-to-face interactions, remote work and digital services experienced rapid growth, creating new opportunities for both employment and leisure activities. However, this shift has also introduced challenges, including increased screen dependency, cybersecurity vulnerabilities, and growing mental health concerns associated with excessive social media use. These mixed outcomes highlight that while digital technologies can enhance economic happiness, they must be managed carefully to avoid exacerbating social inequalities or psychological distress.

In the context of Egypt, the transition to a digital economy holds significant promise but also requires strategic alignment with infrastructure, policy, and institutional reform. Although the country has seen recent investments in infrastructure especially in transportation and energy—there remains a critical need to modernize digital infrastructure and ensure universal internet access. As observed in other developing countries, the rapid adoption of mobile phones has improved basic communication, but the expansion of meaningful internet usage, particularly for e-commerce, education, and financial services, lags behind. The internet in many areas is still predominantly used for social media rather than for empowering economic activity.

This gap in digital access highlights deeper inequalities in economic development. Countries with more developed industrial sectors and robust infrastructure are better positioned to integrate digital tools into their economies. For Egypt to

catch up, policies must prioritize digital inclusion, expand internet coverage, and promote digital literacy among all demographic groups. Initiatives such as regional digital hubs and national innovation programs can help build the capacities of youth, support entrepreneurship, and bridge the technology gap with more advanced economies.

Furthermore, the broader policy environment must adapt to the realities of the digital era. As Sonam Tobgye and Kinley (2022) note, the successful transition to a digital economy requires reforms across several dimensions: competition policy, labor market frameworks, tax systems, innovation ecosystems, and social protection mechanisms. These reforms are essential not only for economic performance but also for ensuring that digital transformation contributes positively to the happiness and well-being of citizens.

Digital transformation, when properly harnessed, offers a pathway to "economic happiness"-a state where increased productivity, innovation, and employment opportunities lead to greater life satisfaction. However, this outcome is not guaranteed. If the benefits of digitalization are unevenly distributed or fail to reach marginalized communities, it could worsen inequality and discontent. As such, efforts to achieve economic happiness through digital means must be inclusive, equitable, and attentive to the social dimensions of technological change.

A progressive recommendation for making happiness a central policy goal is the proposal to establish a Ministry of Happiness in Egypt. This ministry could be tasked with assessing citizen satisfaction levels across all government sectors, benchmarking against international happiness indicators, and identifying areas for improvement. By systematically measuring and addressing the gaps in well-being, such a ministry could contribute to long-term national development strategies aimed at enhancing

quality of life. Offices embedded within each government ministry could ensure cross-sectoral coordination and integration of happiness goals into everyday policy decisions.
In conclusion, digital transformation presents Egypt with a significant opportunity to not only modernize its economy but also improve the happiness and well-being of its citizens. This requires a comprehensive approach that balances technological progress with social equity, strong institutions, and citizen engagement. By aligning national digital strategies with inclusive development goals and investing in the well-being of its population, Egypt can leverage the digital economy as a cornerstone of sustainable prosperity and holistic happiness.

4- Research methodology

This section outlines the structure of the empirical research, detailing the data sources and collection methods used. It also defines the dependent and independent variables, citing relevant references, and describes the model specification and estimation techniques applied to fulfil the study's objectives.

Data collection:

This study explores the impact of Sustainable Development Goals (SDGs), GDP per capita, digital transformation, and governance quality on Gross National Happiness (GNH) in Egypt, covering the period from 2000 to 2024. The analysis utilizes secondary data sourced from reputable international organizations including the World Bank's World Development Indicators (2023), the Gross National Happiness Centre Bhutan, the United Nations SDG platform, and Transparency International.

To enhance data properties and achieve normality, all variables were transformed using natural logarithms. This step stabilizes variance and facilitates clearer interpretation of the model coefficients, as summarized in Table 1.

Model Specification and Research Design:

This research examines the influence of corruption measures (CM), information and communication technology (ICT), GDP per capita, sustainable development goals (SDGs), and the Human Development Index (HDI) on Gross National Happiness (GNH). These variables are selected to capture a broad range of economic, technological, institutional, and developmental factors that may shape national well-being.

- Corruption Measures (CM): Representing the extent of corruption, this variable is crucial for evaluating institutional trust and governance quality, both of which can significantly affect societal happiness.

- Information and Communication Technology (ICT): The adoption and accessibility of digital technologies play a vital role in improving public services, connectivity, and opportunities, thereby enhancing quality of life.

- GDP per Capita: As an indicator of average income, this variable reflects the economic well-being of individuals and is often linked to higher satisfaction levels.

- Sustainable Development Goals (SDGs): These reflect a country's progress in key development areas such as health, education, equality, and environmental sustainability—all essential contributors to happiness.

- Human Development Index (HDI): A composite measure encompassing education, income, and life expectancy, HDI offers a broader view of human progress that goes beyond economic metrics alone.

By incorporating these multidimensional factors, the study seeks to construct a comprehensive analytical model that explains variations in national happiness across time.

Table 1: Variable descriptions

Variable Name	Symbol	Definition	Source
Gross National Happiness (Y)	GNH	involves assessing well-being beyond economic indicators.	https://www.gnhcentrebhutan.org
Gross Domestic Product (x1)	GDP	is a monetary measure that represents the total market value of all final goods and services produced within a year by a country or multiple countries.	https://data.worldbank.org
GDP per capita $ (x2)	GDP per Capita	Egypt's GDP per capita, which represents the average income per person in the country is calculated by dividing the total GDP by the population size	https://data.worldbank.org
Sustainable Development Goals (x3)	SDGs	These 17 goals serve as a collective framework for promoting peace, prosperity, and environmental conservation. They tackle issues such as poverty, health, education, inequality, economic growth, and climate change.	https://sdgs.un.org/
Human Development Index (x4)	HDI	The Human Development Index (HDI) integrates the three component indices through the use of a geometric mean. . It provides a summary of human development, reflecting aspects such as longevity (Health), education, and economic well-being.	https://hdr.undp.org/data-center/human-development-index
International communication Technology (x5)	ICT	The proportion of ICT service exports relative to total service exports (Balance of Payments) is a crucial metric that reflects a country's involvement in information and communication technology services.	https://data.worldbank.org

Internet Users (x6)	N of users	In Egypt, approximately 75.66 million people were internet users as of January 2022, representing a 71.9% penetration rate among the population.	https://data.worldbank.org
Computer, communications and other services (% of commercial service exports) (x7)	CM	The computer, communications, and other services indicator reflects the proportion of commercial service exports associated with a range of activities.	https://data.worldbank.org
Corruption Perceptions Index (x8)	CPI	Corruption is a persistent and evolving global challenge that affects far more than just economic progress. It plays a central role in weakening democratic institutions, fuelling political unrest, and enabling human rights violations. For both nations and the global community, prioritizing the fight against corruption is essential. Confronting this issue is vital to countering authoritarian trends and building a future grounded in peace, freedom, and sustainability.	https//www.transparency.org

5-Findings and Results

The Augmented Dickey-Fuller (ADF) test was conducted to evaluate whether each variable is stationary in its first-differenced form. The table below displays the corresponding p-values, t-statistics, and the 5% critical value for each variable examined.

(ADF) Table (2)

Variables		t-statistic	Critical value at 5%	p-value
D(LOGGNH_Y_)	first	-8.260	-2.903	0.0000
DLOGGDP_PER_CAPITA__X_1		-29.377	-2.893	0.0001
SDG_X_3		-10.161	-2.892	0.0000
DLOGHDI_X_4		-28.160	-2.897	0.0001
ICT_X_5		-9.451	-2.894	0.0000
DLOGNO_OF_PEOPLE_USING_INTERNET_X_6		-13.870	-2.895	0.0001
COMPUTER_COMMUNICATION_X_7		-9.388	-2.894	0.0000
CORRUPTION_PERCEPTIONS_INDEX x_8		-9.875	-2.891	0.0000

Eviews results

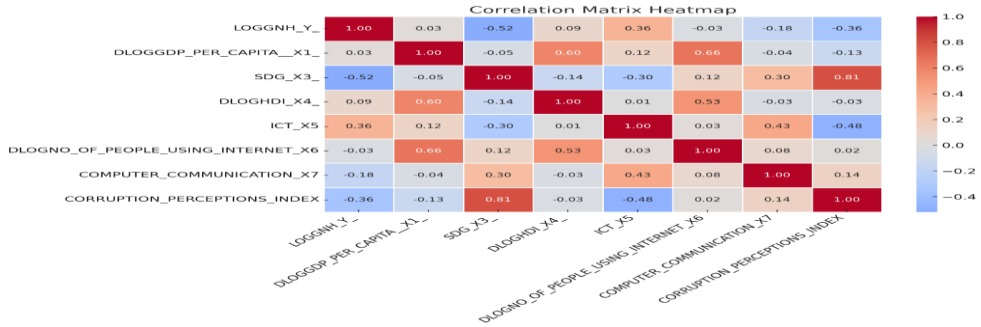
Lag Order Selection Summary

To identify the optimal lag length for the VAR model, several statistical criteria were employed, including the Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ). The table below summarizes the results:

Table (3) lag length

Lag	LogL	LR	FPE	AIC	SC	HQ	Decision
0	59.93541	NA	2.72e-11	-1.622982	-1.353121	-1.516670	Rejected
1	396.9118	579.1782	5.46e-15	-10.15349	-7.724751	-9.196690	Selected based on SC
2	417.4762	30.20386	2.32e-14	-8.796130	-4.208503	-6.988832	Rejected
3	506.6670	108.7014	1.35e-14	-9.583344	-2.836835	-6.925553	Rejected
4	691.2336	178.7989	5.28e-16	-13.35105	-4.445658	-9.842767	Preferred by LR, FPE, AIC, and HQ

Based on the strong support from several selection criteria, the VAR model with four lags (Lag = 4) is deemed the most appropriate. This lag length is likely to effectively represent the dynamic interrelationships among the variables and is well-suited for further econometric procedures, including cointegration analysis, impulse response assessment, and variance decomposition.



The heatmap displayed below provides a visual interpretation

of the correlation matrix for the variables included in the model. Below is a summary of the main observations:

1. **Strong Positive Association Between Perceptions of Corruption and Sustainable Development (r = 0.81):**

The high correlation between the Corruption Perceptions Index and the Sustainable Development Goals indicator (SDG_X3_) suggests that improved perceptions of governance integrity are closely linked to advancements in sustainable development initiatives.

2. **Economic Growth and Internet Usage are Closely Linked (r = 0.66):**

The correlation between the growth in GDP per capita and the number of internet users highlights a strong relationship, implying that as economic conditions improve, access to and usage of the internet tend to increase significantly.

3. **Human Development and Internet Penetration Move Together (r = 0.53):**

The positive correlation between the Human Development Index (HDI) and internet usage indicates that enhancements in education, health, and income (as captured by HDI) are accompanied by a broader diffusion of internet access among the population.

4. **Gross National Happiness and Sustainable Development Goals (r = -0.52):**

The negative correlation between GNH(a proxy for Gross National Happiness) and the $SDGX_3$ indicator suggests a potential inverse relationship. This may imply that improvements in specific sustainable development targets do not always align with higher national well-being, possibly due to trade-offs or differing development priorities.

5. **ICT Services and Perceived Corruption (r = -0.48):**

The inverse relationship between ICT X_5 (information and communication technology indicators) and the Corruption Perceptions Index indicates that greater access to or investment in ICT may contribute to lower levels of perceived corruption, possibly through enhanced transparency, governance, and information dissemination.

These findings highlight important interactions between socio-economic and technological dimensions. Recognizing such relationships is crucial for guiding subsequent econometric modelling and policy analysis.

Statistical Summary: ARDL Long-Run Model and Bounds Test

Model Overview:

An Autoregressive Distributed Lag (ARDL) model with 4 lags (ARDL (4)) was estimated to examine the long-run and short-run dynamics between the dependent variable Δ log (GNH) and a set of explanatory variables, using quarterly data from 2000Q1 to 2024Q4 (N=64). The model includes a restricted constant with no deterministic trend.

The ECM regression results, as summarized in Table 4 present the short-run coefficients along with their standard errors, t-statistics, and p-values.

Table(4)ECM Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Log GNH_Y_(-1))	0.235	0.128	1.84	0.0718
D(Log GNH_Y_(-2))	0.235	0.128	1.84	0.0718

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Log GNH_Y_(-3))	0.235	0.128	1.84	0.0718
D Log GDP per capita X_1	-0.858	0.921	-0.93	0.3557
$SDGX_3$	-0.035	0.008	-4.16	0.0001
D Log $HDIX_4$	-3.057	2.309	-1.32	0.1913
$ICTX_5$	0.014	0.005	2.60	0.0120
D Log No of people Using Internet X_6	0.239	0.194	1.24	0.2221
Computer communicatioX_7	-0.022	0.010	-2.15	0.0362
Corruption index X_8	0.002	0.0009	2.62	0.0114

-$SDGX_3$ has a negative and significant short-run effect, indicating that higher progress in certain SDG indicators may be associated with a reduction in GNH in the short term.

-$ICTx_5$ and $CPIx_8$ both exhibit positive and significant relationships with GNH, suggesting that improvements in ICT and reduced perceived corruption contribute positively to well-being.

-Computer CommunicationX_7 has a negative significant effect, possibly indicating digital overload or inequality in access.

Long-Run Equilibrium Adjustment

The coefficient on the error correction term (CointEq(-1)) is -0.480 and is highly significant (p-value = 0.0001). This negative sign confirms the existence of a stable long-run relationship between the dependent and independent variables. It implies that approximately 48% of any deviation from the long-run equilibrium is corrected each quarter, confirming a relatively rapid speed of adjustment.

Model Fit and Diagnostics

-R-squared: 0.304, suggesting that about 30.4% of the variability in GNH is explained by the model in the short run.

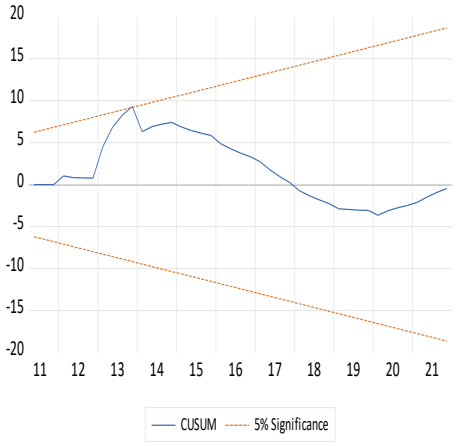
-Adjusted R-squared: 0.172, reflecting a moderate fit after adjusting for degrees of freedom.

-Durbin-Watson statistic: 1.95, which is close to 2, indicating the absence of serial correlation.

F-Bounds Cointegration Test

The F-statistic value is 8.684, which exceeds the upper bound critical value at the 1% significance level (6.44). Therefore, we reject the null hypothesis of no long-run relationship, confirming that a stable cointegrating relationship exists among the variables.

1. CUSUM Test: Model Stability Evaluation



To assess the structural stability of the econometric model, the CUSUM (Cumulative Sum) test was applied. The plot begins at the origin, indicating no initial accumulation of residuals. Early in the observation period, the path shows a slight upward trend, implying a minor tendency of the model to underpredict actual values. However, this deviation remains well within the 5% confidence boundaries, which serve as critical limits for stability assessment.

As the time series progresses, the trajectory of the cumulative sum remains largely stable, with only slight fluctuations that do not breach the confidence bounds. This reflects a relatively consistent relationship among the model's variables over the study period. Towards the end of the timeline, a mild downward drift is observed, suggesting a possible overestimation bias in the model's predictions. Nevertheless, the cumulative path stays within the acceptable range, indicating no significant structural breaks or parameter instability.

These results confirm that the model maintains a high degree of stability over time. Still, ongoing monitoring is recommended to detect any future shifts in model behavior that may compromise its reliability.

2. Breusch-Pagan-Godfrey Test: Assessment of Heteroskedasticity

To verify the assumption of constant error variance (homoskedasticity) in the regression model, the Breusch-Pagan-Godfrey test was conducted. Under the null hypothesis, the residuals are expected to exhibit a constant variance across observations. The test yielded the following results:

- **F-statistic: 2.311 (p-value = 0.0215)**
- **Obs*R-squared: 21.016 (p-value = 0.0332)**
- **Scaled explained sum of squares: highly significant (p-value < 0.001)**

Since all p-values are below the 5% significance level, the null hypothesis of homoskedasticity is rejected. This provides strong statistical evidence of heteroskedasticity in the residuals, indicating that the variance of the errors varies across the sample. Such a condition can lead to inefficient coefficient estimates and biased standard errors, ultimately compromising the validity of hypothesis testing in the model.

Review of Relevant Literature Supporting the Current Study

This paper investigates the key determinants influencing Gross National Happiness (GNH) in Egypt, focusing on GDP per capita, digital transformation, progress toward sustainable development goals (SDGs), and perceptions of governance, particularly regarding corruption. A wide range of scholarly contributions support the inclusion of these diverse factors in constructing a comprehensive framework for assessing national well-being.

A core theme in the literature is the nuanced relationship between economic development and happiness. Traditional economic theories suggest that increased income enhances personal well-being. However, Easterlin's Paradox (Easterlin, 1995; Easterlin et al., 2011) offers a counterpoint, proposing that while income may boost happiness in the short term or at a specific point in time, sustained economic growth does not necessarily yield continuous improvements in life satisfaction. This insight has prompted a broader inquiry into alternative contributors to happiness—such as digital infrastructure, institutional quality, and environmental sustainability.

Despite this paradox, several empirical studies challenge its universality. Guriev and Zhuravskaya (2009) and Sacks, Stevenson, and Wolfers (2010, 2011) argue that long-term data from numerous countries demonstrates a positive correlation between economic growth and happiness. These authors emphasize that while populations in post-transition economies may initially exhibit lower levels of subjective well-being despite growth, over time, consistent improvements in income, employment, and living standards may lead to increased life satisfaction. However, methodological limitations—such as differences in survey design or the mismatch between aging

populations and evolving economic structures—complicate these findings.

Other researchers also affirm the value of economic indicators in promoting well-being. Diener et al. (2014) find that rising incomes are frequently associated with improved quality of life, especially when they enable better access to education, health care, and housing. Nonetheless, Inglehart et al. (2008) and Di Tella and MacCulloch (2008) suggest that this relationship weakens under certain conditions, particularly where inequality increases or social cohesion erodes. This perspective is echoed by data from the Pew Global Attitudes Survey (2014), which shows that people in lower-income nations often report higher satisfaction when income distribution is perceived as fair and stable, even if absolute incomes are modest.

Cultural and societal factors further influence the impact of income on happiness. In high-income Asian economies, for instance, Zagorski et al. (2011) observe a stronger connection between income and well-being than in comparable Western countries. This suggests that cultural norms and expectations can mediate the extent to which financial gains translate into perceived happiness.

The effects of income inequality are also well-documented. Verme (2007) asserts that subjective perceptions of inequality often reduce overall happiness more than actual income levels, while Ball and Chernova (2008) argue that although inequality dampens well-being, expanded access to information and communication technology (ICT) can help alleviate some of these adverse effects. These findings substantiate the inclusion of digital transformation as a variable in this study, as improved digital access can enhance inclusivity, service delivery, and psychological connectivity.

The contribution of digital technologies to societal happiness is increasingly acknowledged in recent literature. Wang (2022) demonstrated how China's technological reforms under the "Made in China 2025" strategy led to improvements in both productivity and employee satisfaction. Likewise, Kaur and Singh (2021) documented how digital tools expanded access to financial and educational services in India, with noticeable benefits for life satisfaction. In South Korea, Lee (2020) found that digital communication platforms significantly improved workplace well-being. These studies affirm the transformative role of digitalization in shaping national happiness.

The role of governance particularly trust in institutions also emerges as critical. Tay, Herian, and Diener (2014) show that perceptions of corruption are strongly linked to lower well-being, especially where confidence in public institutions is low. Similarly, Helliwell and Huang (2008) and Inglehart et al. (2008) emphasize that democratic accountability, transparency, and civic participation correlate with higher levels of national happiness. These studies provide strong justification for the inclusion of perceived corruption in this research framework.

Environmental sustainability, often linked to the SDGs, is another major driver of happiness. Yangka and Newman (2019), drawing on the Bhutanese GNH model, emphasize the interplay between environmental stewardship, cultural values, and socio-economic progress in promoting sustained well-being. Their findings advocate for the integration of sustainability indicators into national happiness assessments, supporting the multidimensional approach of the present study.

Finally, recent advancements in computational analytics have opened new avenues for happiness research. Studies by Liu et al. (2020) and Zhou and Wang (2021) explore how artificial

intelligence and machine learning can be used to analyze complex, nonlinear patterns in well-being data. These methods enhance the precision and predictive power of happiness metrics, though they are not directly applied in this study. Nevertheless, they underscore the growing importance of data-driven methodologies in understanding subjective well-being.

To summarize, happiness is shaped by a confluence of economic, technological, political, and environmental factors. While economic growth can influence well-being, its effect is often mediated by inequality, cultural context, institutional quality, and digital access. This study contributes to a more comprehensive understanding of GNH by integrating these variables into a unified analytical framework tailored to Egypt's unique socio-economic context.

Conclusion

This study investigated the complex factors influencing Gross National Happiness (GNH) in Egypt, focusing on GDP per capita, digital transformation, advancements toward the Sustainable Development Goals (SDGs), and governance, with particular attention to perceptions of corruption. Grounded in extensive empirical evidence and theoretical insights, the results indicate that although economic growth plays an important role in enhancing happiness, its effect is neither straightforward nor sufficient on its own.

The findings emphasize that a comprehensive understanding of national well-being must go beyond purely economic measures to incorporate the quality of institutions, equitable access to digital technologies, and sustainable development efforts. Digital transformation stands out as a crucial driver of well-being by expanding access to vital services and fostering

broader social and economic inclusion. At the same time, perceptions of corruption and trust in institutions significantly influence citizens' subjective well-being, highlighting the critical role of transparent and effective governance.

Furthermore, embedding progress toward the SDGs within the GNH framework underscores the vital contribution of environmental stewardship and social sustainability to enduring happiness. As Egypt advances through economic reforms and digital innovation, adopting development policies that are inclusive, fair, and transparent will be essential to improving overall life satisfaction.

In summary, GNH is best conceptualized as the product of intertwined economic, technological, governance, and sustainability factors. This research adds to the growing understanding that promoting national happiness requires a multidimensional policy approach that prioritizes human well-being at the core of development strategies.

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