EfilJournal VOLUME: 7 | ISSUE: 3 | Date of Submission: 15.05.2024 | Date of Acceptance: 20.09.2024
CİLT: 7 | SAYI: 3 | Başvuru Tarihi: 15.05.2024 | Kabul Tarihi: 20.09.2024
ISSN: 2619-9580

Research Article/Araştırma Makalesi

Core Idea Innovation Policy Perspective Methodology Based Practice: The Sector of Sectors

Ceyhan Öztürk, Department of Science and Technology Policy Studies, Middle East Technical University, Ankara, Türkiye ozturkc@metu.edu.tr, ORC-ID: 0000-0002-0766-2678.

Erkan Erdil, Department of Economics, Middle East Technical University, Ankara, Türkiyeerdil@metu.edu.tr, ORC-ID: 0000-0003-3091-2441.

Aysıt Tansel, Department of Economics, Middle East Technical University, Ankara, Türkiye Institute for the Study of Labor (IZA) Bonn, Germany, Economic Research Forum (ERF) Cairo, Egypt, Global Labor Organization (GLO) Essen, Germany atansel@metu.edu.tr, ORC-ID: 0000-0001-9556-2396.

Abstract

The international commitment to achieving a sustainable environment, health, and development needs to be accelerated. This study proposes an approach that has the potential to achieve a sustainable environment, health, and economic development based on each individual's sustainable development, which requires the necessary technical and institutional infrastructure to meet this need. Despite the uncertainties and disruptions of a constantly changing economic landscape, this approach emphasizes the importance of each individual's cognitive ability-skill development cycle without interruption, which will guarantee sustainability and shed light on scientific unknowns.

Keywords: *Health, Innovation Policy, Skills, Sustainable Economic Development.*

Jel Codes: *I00, J24, Q01, O3*

Temel Fikir Yenilik Politikası Perspektifi Metodolojisine Dayanan Uygulama: Sektörlerin Sektörü

Özet

Sürdürülebilir bir çevre, sağlık ve kalkınmaya yönelik uluslararası taahhüdün hızlandırılması gerekiyor. Bu çalışma, bu ihtiyacı karşılamak için gerekli teknik ve kurumsal altyapıyı gerektiren, her bir bireyin sürdürülebilir kalkınmasını temel alan sürdürülebilir bir çevre, sağlık ve ekonomik kalkınma elde etme potansiyeline sahip bir yaklaşım önermektedir. Sürekli değişen ekonomik manzaradaki belirsizliklere ve aksaklıklara rağmen bu yaklaşım, sürdürülebilirliği garanti edecek ve bilimsel bilinmeyenlere ışık tutacak olan, her bir bireyin bilişsel yetenek-beceri gelişim döngüsünün kesintisiz ilerlemesinin önemini vurgulamaktadır.

Anahtar Kelimeler*: Sağlık, İnovasyon Politikası, Yetenek, Sürdürülebilir İktisadi Kalkınma.*

Jel Kodları: *I00, J24, Q01, O3*

1. Introduction

The eco-health approach suggests that to promote the health and well-being of humans, animals, and ecosystems, it is essential to prioritize both environmental sustainability and socioeconomic stability (Lisitza & Wolbring, 2018). Notably, institutional design plays a significant role in achieving sustainability, as emphasized by Ruttan (2001, p. 424). Moreover, Meier and Stiglitz (2000, p. 389) argue that development goes beyond mere capital accumulation and involves a process of organizational change. Furthermore, Ruttan (2001, p. 620) highlights the importance of establishing vital institutional and technical capabilities to effectively handle any unpredictable circumstances that may emerge during the path toward sustainability.

According to Ruttan (2001, p. 620), there is an essential link between humanity and the natural order that must be established to develop the institutional and technical capacity required for achieving sustainability. It is imperative to establish vigorous institutions and advanced technologies to ensure sustainable human order on the planet. Furthermore, how can humanity establish the capacity to provide sustainability when problem areas lead to economic downturns and disruptions in growth and development? This is a crucial question that demands a clear answer.

Several factors can pose complicated issues to the development of these institutional and technical capacities, which can in turn impact sustainability. First, social issues can arise as a result of the transformative impact of innovation (Acemoglu & Restrepo, 2020; Berg et al., 2016; Brynjolfsson & McAfee, 2012; Chataway et al., 2014; Conway et al., 2010; Eloundou et al., 2023; Freeman, 2011; Fu et al., 2023; Hornstein & Lubik, 2015; Kattan et al., 2020; Mazzucato, 2016, 2021; Schot & Steinmueller, 2018; Stiglitz, 2012, 2020; R&D Management, n.d.). For example, Freeman (2011) states that if the current inegalitarian approach continues in the market, the structural adaptation period brought about by technological changes will cause unemployment and inequality problems, which will continue. Mazzucato (2016, 2021) draws attention to the market approach Freeman (2011) pointed out and suggests an approach that directly targets social issues. Acemoglu and Restrepo (2020) also confirm Freeman's (2011) determination with the results they present on today's developments. According to Acemoglu and Restrepo (2020), new technological developments like robots increase unemployment and wage inequality.

Second, the proposed innovation approaches (Chataway et al., 2014; Fu et al., 2023; Mazzucato, 2016, 2021; R&D Management, n.d.; Schomberg, 2015; Schomberg & Hankins, 2019; Schot & Steinmueller, 2018) aimed at solving societal challenges such as inequality, unemployment, and climate change are plagued by inadequacies and deficiencies in their foundations. One of the prominent shortcomings is that these innovation approaches are primarily based on macrolevel foundations instead of microlevel foundations (Brown, 2020; Eizagirre et al., 2017; Fagerberg, 2018; Giuliani, 2018; Geels, 2020; Haddad et al., 2022; Hanson & Bleckenwegner, 2022; Hanson et al., 2022; Hekkert et al., 2020; Jakobsen et al., 2019; Kokotovich et al., 2021; Pansera & Owen, 2018; R&D Management, n.d.; Schillo & Robinson, 2017; Schot & Steinmueller, 2018; Turnheim et al., 2020; Ulmanen et al., 2022; Weber & Rohracher, 2012; Yaghmaei & Van De Poel, 2020). According to our view, to effectively stimulate innovation for societal issues, it is imperative to establish clearer and more concise foundations in implementing business practices.

Third, it is crucial to recognize that most innovations inevitably lead to significant disruptions. These disruptions can range from environmental impacts such as climate change to market-related issues such as unforeseen shifts in market conditions and customer demands. Other disruptions can occur at institutional levels, for example, the growing competition in technology between the world's largest economies. Additionally, there can be technological disruptions, such as stepping into a new era defined by the fourth industrial revolution and all the associated technologies, such as artificial intelligence (Jahanshahi & Brem, 2019; Barclay et al., 2021; Brougham & Haar, 2020; Creed et al., 2014; Khanagha et al., 2018; Lam et al., 2010; Mihalache & Mihalache, 2021; R&D Management, n.d.; Rodner et al., 2019; Saghaei et al., 2020; Shekhar et al., 2020; Vith et al., 2019).

We remember Covey's (2004, 2009) leadership approach at this stage. According to Covey (2004, 2009), we must brace ourselves for this ever-changing and turbulent world that demands that we adapt to a dynamic and constantly shifting environment. In other words, the conditions of a rafting team are more applicable to this chaos than are those of a rowing team in stagnant water. It is of utmost importance that all team members internalize the principles of the conditions they are confronted with and act assertively. Both of these issues are possible if an unchanging reference is established based on valid principles and allows the creation of options (Covey, 2004, 2009).

To generate insightful responses to the latest developments, we consider Covey's (2004, 2009) leadership suggestions to benefit from the idea behind his work. The study conducted by Tansel et al. (2024) can be valuable resource for establishing a reference point based on valid principles that can guide us in this dynamically changing economic landscape.

This study contributes to the existing realm of knowledge with an approach that has the potential to realize the idea that the sustainable development of each individual is the path to achieving a sustainable environment, health, and economic development via obtaining the necessary technical and institutional infrastructure to meet this need despite the uncertainties and disruptions of a constantly changing economic landscape. From our point

of view, this approach emphasizes the importance of the uninterrupted progression of each individual's cognitive ability-skill development cycle, which will guarantee sustainability and shed light on scientific unknowns, even in these conditions. This study covers the emergence of our approach, its methodological basis and framework, its viable reflection and outputs, its byproducts, discussion, and conclusions.

2. The Study Investigating Sustainability Principles

Tansel et al. (2024) conducted an empirical study that examined several key economic indicators, including GDP per capita, overall and manufacturing productivity, savings, and schooling, from 1980 to 2009. According to Tansel et al.'s (2024) research, there are notable relationships between body mass index (BMI), nutritional status, cognitive ability, and time preference (impatience) based on the available literature. Thus, the researchers attempted to estimate the relationship between BMI and growth indicators using the cubic specification of the time preference rate developed from Azomahou et al.'s (2009) study.

The theoretical models developed by Tansel et al. (2024) involved basic mathematics with a few omissions. However, by simplifying the equations, the researchers aimed to reduce noise in macroeconomic activities and isolate the low-level signals of individuals. Tansel et al. (2024) used the strong connection between BMI, nutritional status, cognitive ability, and time preference (impatience) to focus on individuals with BMI thresholds in this macro context. Tansel et al. (2024) made valuable empirical contributions to the current field of knowledge by highlighting the significance of investing in health. Tansel et al.'s (2024) findings suggest that such investments can lead to sustainable growth, which is not accurately reflected by life expectancy, as noted by Husain et al. (2014, p. 141) in their study.

In their research, Tansel et al. (2024) used various estimation methods, such as the ordinary least squares (OLS) and the instrumental variable (IV) long difference estimations, and the fixed effect (FE) and the generalized method of moments (GMM) estimation methods (Arellano & Bond 1991; Baum et al., 2007; Roodman, 2009; Staiger & Stock, 1997; Wooldridge, 2001, 2012), with balanced panel data from 47 countries (Acemoglu & Johnson, 2007; Cervellati & Sunde, 2009, 2011; Desbordes, 2011). They found that the relationship between economic growth and development indicators and BMI is not linear; instead, it follows an inverted U shape. The study reveals that the relationship between the two variables proceeds nonmonotonously (Tansel et al., 2024).

In the study by Tansel et al. (2024), the quadratic specification suggested that the estimated turning point ranged from 23.13-29.77 kg/m^2. Another analysis using the GMM cubic specification indicates a possible cubic and convex-concave-shaped relationship between GDP per capita, overall and manufacturing productivity, and BMI. The results also showed that the estimated turning point-1 fell in the range of 19.88-20.75 kg/m^2, while the turning point-2 was 23.11-25.93 kg/m^2 (Tansel et al., 2024).

Tansel et al. (2024) remarked that the BMI thresholds estimated in their study's qu-

adratic and cubic specifications aligned with the findings of Dasgupta's function (1997, pp. 13–15). The association between the probability of an individual not having a health problem and BMI stays constant in the range of 18.5 to 25 kg/m^2 in Dasgupta (1997, pp. 13–15). Both before and after this interval, the probability decreases. According to the World Health Organization (2010), BMI cut-off points do not vary based on the genetic factors of any country or population.

Tansel et al. (2024) found a valid relationship at the country level. The consequences for individuals were also clarified and explained in their study. It is important to note that economics is a cognitive science (Davis, 2003), and cognitive abilities require a healthy supply of energy to function properly. According to Tansel et al. (2024), for monitoring the status of a healthy body energy source, BMI thresholds are critical (Dasgupta, 1997). Tansel et al. (2024) reported an intricate and complex relationship between economic indicators and BMI, revealing a nonlinear and nonmonotonic pattern. Hence, these findings allowed them to better understand the economic challenges faced by societies through cognition.

Tansel et al. (2024) proposed that cognitive ability and skill development should be considered ongoing cyclical processes crucial for each individual's growth and progress. Tansel et al. (2024) emphasized that any disruption or break in this cycle may impede an individual's overall development, leading to a decline in their cognitive ability and skill set. Therefore, it is crucial to maintain a continuous cycle of cognitive ability and skill development to ensure sustainable economic growth and development.

Tansel et al. (2024) suggested a framework that can boost economic sustainability by addressing the gaps in cognitive ability and skill development cycles. This framework proposes the creation of a structured social infrastructure and economic ecosystems. Such a system would help individuals develop their cognitive abilities and skills and, in turn, provide sustainable economic growth and development. Moreover, the approach suggested by Tansel et al. (2024) is consistent with the recommendations made by Hall and Jones (1999) and Bigsten and Levin (2004) for making macro and microlevel adjustments to address social and economic issues.

The conceptual infrastructure presented by Tansel et al. (2024) can aid the development of technical and institutional capacity for achieving sustainability transition, as proposed by Ruttan (2001, p. 424, 620).

3. Forming the Methodology of the Sector of Sectors as a Reference Center

3.1. General

We proposed the core idea innovation policy perspective, which involves the methodological development of the Defense Industrial Base Capabilities Study (DIBCS) (2004) as a civilian adaptation. This study can address areas of concern and challenges that may arise due to disruptions and uncertainties. The effectiveness of this approach depends on

the core idea content and the methodology of the core idea innovation policy perspective, which is primarily based on expert judgments.

According to our view, the core idea innovation policy perspective requires careful implementation frameworks for institutions and technology, along with peaceful coordination and cooperation among entrepreneurial states and world economy stakeholders and partners. From our point of view, acquiring technological and institutional capabilities at all levels through the core idea innovation policy perspective can offer excellent opportunities to manage areas of societal concern, as well as the need for sustainable health and economic development in uncertain and disruptive economic landscape.

We develop the "core idea" of the reference centre concept from their innovation policy perspective, inspired by Covey's (2004, 2009) leadership approach. We describe *the core idea* as "a specified reference for capability development".

According to view, the DIBCS (2004) industrial policy methodology links functional capabilities and technologies to evaluate industrial capacity for technology development and manufacturing. We plan to integrate their civilian purpose-oriented innovation policy with the industrial policy approach of DIBCS (2004) through core idea assignment.

We suggest that by assigning a core idea, it is possible to align the flow direction of the movement from the methodology of the core idea innovation policy perspective with the industrial policy methodology of DIBCS (2004). This connection between the two policies can achieve the desired outcomes from the core idea innovation policy perspective. Furthermore, we state that "the core idea functional concepts" can be derived from the assigned core idea and that "the core idea abilities" can be obtained from these concepts.

In this study, the core idea innovation policy perspective is established using some of the definitions adapted from Ruttan (2001) and the industrial policy approach of DIBCS (2004). In this manner, we aim to utilize Ruttan's (2001) foresight and experience along with all the methodological practices and functions of the DIBCS (2004) industrial policy approach. In addition, institutional concepts, processes, levers, and portals, as well as their interactions with technological ones, should be developed and added to the core idea innovation policy perspective since the methodology of DIBCS (2004) does not include them. We ensure the separation of our civilian purpose-adapted and developed innovation policy and DIBCS's (2004) industrial policy methodology.

In this study, we describe *the core idea functional concept* as "a specified concept based on the core idea" (DIBCS, 2004, pp. 1–16). There may be one or more core idea functional concepts. Then, we confine *the core idea ability* as "a specified capability based on the core idea functional concept" (DIBCS, 2004, pp. 1–16).

We express *technology* as "a technique that realizes any or more core idea abilities" (DIBCS, 2004, p. 16). Correspondingly, we depict *industrial ability* as "the capability of a producer to generate a technology" (DIBCS, 2004, p. 16).

Then, we clarify *institution* as "a scientific coordination method that realizes any or more core idea abilities" (Ruttan, 2001, p. 119). Moreover, we concur with Ruttan (2001, p.

119) that institution consists of organization as a subset in this definition. Even we characterize *social infrastructural ability* as "the capability of an authority/a council to generate an institution" (Ruttan, 2001, p. 119).

3.2. Critical Steps in the Methodology of the Core Idea Innovation Policy Perspective

We propose that the methodology of the core idea innovation policy perspective aims to connect the content of the core idea requirements with industrial and social infrastructural abilities. This is achieved by utilizing a civilian-adapted and developed form of the industrial policy approach of DIBCS (2004), as mentioned previously.

According to our point of view, ability-based decision-making conveys familiar and comprehensive language for all participants, such as industry, authority/council, government agencies, academia, and research centres. Increasing communication transparency and integrated vision improve planning, decision-making, and execution efficiency. The crucial industrial and social infrastructural abilities constitute a reference database. They specify the core idea ability gaps and concentrate on vital priority technologies and institutions that require improvements (DIBCS, 2004).

According to our view, the methodology of the core idea innovation policy perspective deems to concentrate on creative industrial and social infrastructural abilities via development support and procedures and implementation concepts and prioritization of core idea abilities, technologies, and institutions to make them real (DIBCS, 2004).

In this study, we suppose that all stakeholders and partners of the sectoral base will have an idea about the decision-making mechanism based on core idea abilities and use it for strategic planning and prioritization of investments according to the methodology of the core idea innovation policy perspective. The financial investment community is also expected to conduct this process (DIBCS, 2004).

According to our point of view, the methodology of the core idea innovation policy perspective diverges from its core idea abilities, which specify the preferred degree of innovation on a sectoral basis, into leadership objectives that are represented as "neutral," "equal," "be ahead," and "be way ahead." There are four priority levels in decreasing order of importance (DIBCS, 2004, pp. 1–16).

According to our view, based on the methodology of the core idea innovation policy perspective, the core idea abilities are categorized according to priority levels as follows: the core idea ability is given a "fourth-degree priority (neutral)" when its status is insignificant compared to that of competitors. A "third priority (equal)" means reaching at least the same level of excellence as competitors regarding core idea ability. A "second-degree priority (be ahead)" indicates a significant gap in core idea ability compared to that of competitors. A "first-degree priority (be way ahead)" is given for a substantial difference in core idea ability from that of competitors (DIBCS, 2004, pp. 1–16).

From our point of view, the core idea ability, which is ever present, typically has a

"fourth-degree" leadership objective. Having fourth-degree priority core idea abilities is assumed to require minimal innovation and be globally accessible, both in terms of industrial and social infrastructural ability. To develop "second-" or "first-degree priority" core idea abilities, the industrial and social infrastructural ability of industry and the authority/council for production and foundation must be highly creative. Similarly, it is necessary for technology suppliers and organizations to maintain a competitive edge (DIBCS, 2004, pp. 1–16).

According to our view, the core idea innovation policy perspective methodology uses three "levers" for critical technologies. They can serve as development aids to address situations where necessary industrial abilities are lacking. Three support channels are identified: "financial support innovations," "programme management optimization," and "implementation of corrective measures outside the industry" (DIBCS, 2004, pp. 1–16). From our point of view, critical institutions are expected to improve through policy "levers" of critical technologies or through the development of institution-specific policy "levers." These "levers" can be utilized when the required social infrastructural abilities are insufficient.

According to our view, based on the methodology of the core idea innovation policy perspective, critical technologies and corresponding industrial abilities are generated and sustained via five guiding "portals." These can be represented as development processes. These processes include "scientific and technological research procedures to establish specific technical innovations," "prototype transition procedures from laboratories to manufacturing fields," "system design procedures for particular purposes," "decision procedures to produce or purchase innovative products," and "execute innovative approaches to support the life cycle of products/systems utilized for defined purposes" (DIBCS, 2004, pp. 1–16). From our point of view, the critical institutions and corresponding social infrastructural abilities are envisioned to be enhanced and sustained via the resembling leading "portals" of industrial abilities or to be designed by social infrastructural ability-specific "portals."

According to our view, the primary procedure flow of the methodology of the core idea innovation policy perspective is as follows: The leadership objectives for core idea abilities are specified. At this juncture, core idea abilities are divided. In our view, the core idea functional concepts are used to identify technologies and institutions that enable core idea abilities (DIBCS, 2004).

From our point of view, the methodology of the core idea innovation policy perspective presumes the technologies and institutions that promote the inclusion of "second-degree" or "first-degree" priority core idea ability targets. Critical "technology" and "institution" lists are constructed. This phase prioritizes technologies and institutions for content and emphasis assessments. The priority of technology and institution is demarcated by the number of different critical core idea abilities to which it is involved and the degree to which it actuates a particular core idea ability (DIBCS, 2004, pp. 1–16).

According to our view, as the last step in the methodology of the core idea innovation

policy perspective, an assessment of primary industrial and social infrastructural abilities is executed for each critical technology and institution. In order to complete this transaction, an analysis of both technology and institutions is performed. This includes defining what technology and institutions are, their relevance to the core idea ability, and assessing the readiness of technology, institutions, business models, and leading industrial and social infrastructural abilities. Domestic and foreign manufacturers, organizations, markets, and technology and institutional leadership status will also be evaluated (DIBCS, 2004).

According to our point of view, from the methodology of the core idea innovation policy perspective, technology imports that facilitate core idea ability from foreign sources are evaluated based on three risk factors. The first is related to accessing industrial products when needed. The second evaluates the risk of controlling access to primary industrial abilities by potential competitors. The last factor involves assessing the risks based on a country's strategic interests and planning (DIBCS, 2004).

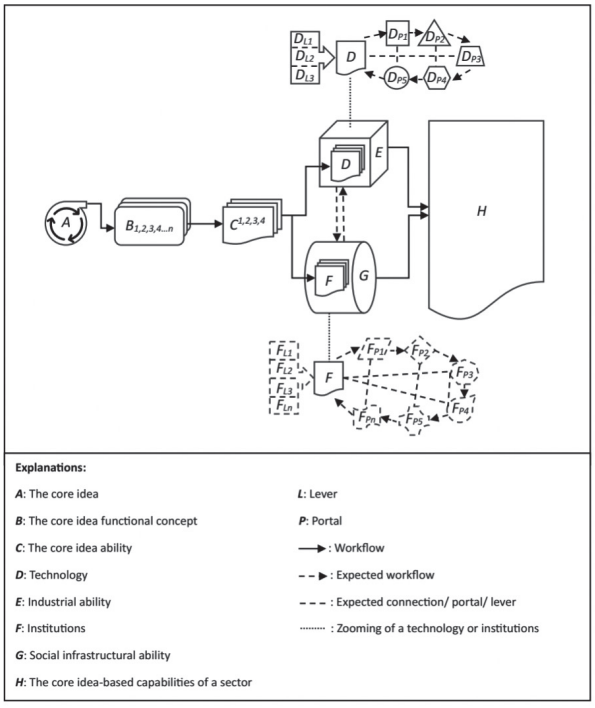
According to our view, in the methodology of the core idea innovation policy perspective, innovation work focuses on developing critical technologies and institutions for industrial and social infrastructural abilities with first- or second-degree priorities. All involved parties, including academia, laboratories, inventors, research and development centres, industry, the authority/council, and public organizations, must participate in development procedures earlier to achieve the intended purpose. Reduced participation of stakeholders and partners may hinder innovation potential in the methodology of the core idea innovation policy perspective during development procedures (DIBCS, 2004).

In our view, from the methodology of the core idea innovation policy perspective, technology and institutions are supposed to actualize industrial and social infrastructural ability depending on the scope of the core idea. The methodology of the core idea innovation policy perspective framework is illustrated in Figure 1.

4. The Foundation of the Sector of Sectors

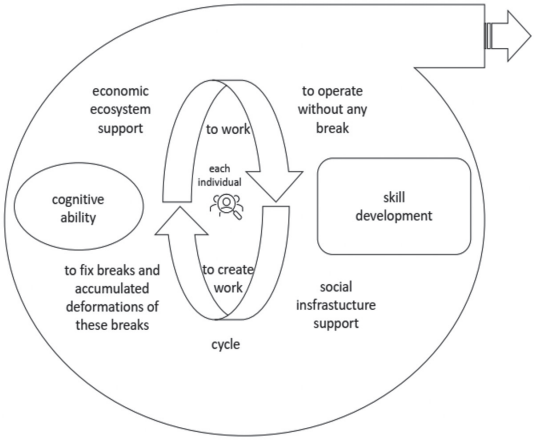
We propose that *the core idea* can be specified as "fixing the breaks in each individual's cognitive ability-skill-development cycle and these breaks' accumulated deformations via enabling the social infrastructure and economic ecosystem and supporting each individual's cognitive ability-skill-development cycle" (Tansel et al., 2024, p. 139) as displayed in Figure 2. According to our point of view, this core idea concept can establish a suitable link between humanity and the natural order, as noted by Ruttan (2001, p. 620). Moreover, we suggest that by implementing this core idea concept, we can develop suitable technologies and institutions that will ensure the sustainability of our planet.

Figure 1 Methodology of the Core Idea Innovation Policy Perspective Framework



Source: *Authors*

Figure 2 The Determined Core Idea



Source: *Authors*

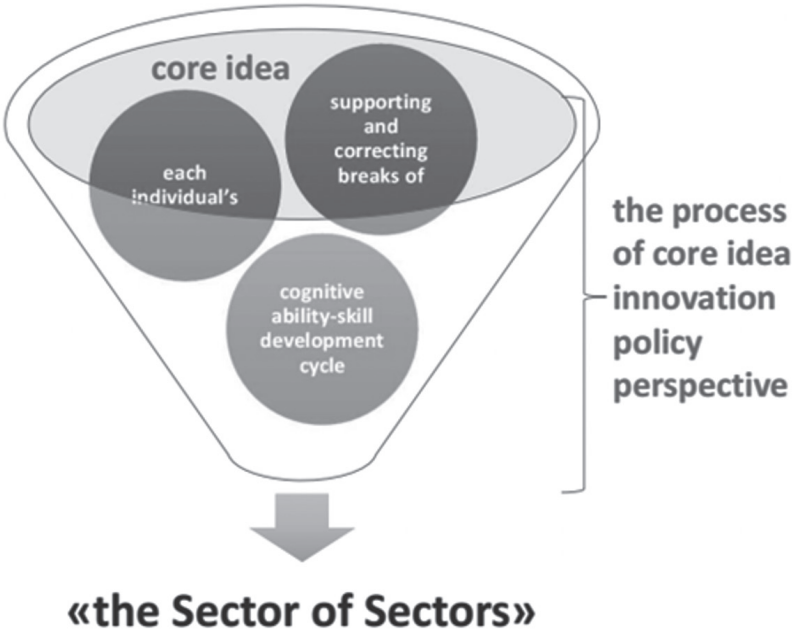
According to the assigned core idea and following the methodology of the core idea innovation policy perspective, we propose an exciting concept, a "sector of sectors," inspired by DeLaurentis and Callaway's (2004, p. 830) "system-of-systems" concept. However, it does not need to have exact functions of the "system-of-systems" concept. The process of forming the sector of sectors is shown in Figure 3. Technically, we can describe "the sector of sectors" as "the sum of the outputs resulting from the processing of the core idea determined from the study of Tansel et al. (2024) with the core idea innovation policy perspective methodology." We evaluate that this sum will create a new sector and that it will be appropriate to conceptually specify it as the sector of sectors, considering that this sector is based on the cognitive ability and skill development of each individual and the importance of the individual in the structural elements in Malerba (2002, 2005). Therefore, the practice of sector of sectors can integrate various sectors via its assigned core idea into a cohesive system that operates efficiently and effectively. This practice has the potential to revolutionize sectors and their interconnections. This potential can lead to higher levels of collaboration and innovation.

Philosophically, we can define the sector of sectors as "a practice based on the development of the institutions and technologies needed to enable the uninterrupted operation of each individual's working/creating work, cognitive ability and skill development cycle"(-Tansel et al., 2024, p. 139).

At this juncture, it would be helpful to understand which main contents of the technologies and institutions are to be developed by reference to the core idea and the industrial and social infrastructure abilities that may arise depending on these technologies and institutions. In addition, specifying the general framework of the economic ecosystem and social infrastructure to be created by industrial and social infrastructure abilities is appropriate. In this context, taking advantage of some of the definitions put forward in other studies may be helpful.

According to Gottfredson's (1997, p. 13) definition, *intelligence* encompasses a range of abilities, such as planning, complex ideas-comprehending, reasoning, problem solving, learning from experience, quick learning, and abstract thinking. In addition, VandenBos (2007) described cognitive ability as a set of skills that involve intuition, perception, memory, learning, reasoning, understanding, awareness, language, and judgement. The Global Skills Report (2023, p. 61) defines *skills* as the ability to apply knowledge and perform specific tasks that add value. Eloundou et al. (2023, Appendix B) suggested that *basic skills* are developed capacities that enable faster learning and knowledge acquisition. These definitions highlight the importance of possessing differentiated abilities and skills to succeed in various activities of the economy.

Figure 3 The Process of Forming the Sector of Sectors



Source: *Authors*

In a recent study conducted by Tansel et al. (2024, p. 139), the concept of *the cognitive ability-skill development cycle* of each individual was proposed. According to this concept, nutrient intake has a significant function in delivering the energy required to activate an individual's cognitive ability. This cognitive ability, in turn, interacts with the knowledge that is acquired through education, both formal and informal, which includes both explicit and tacit knowledge. The interaction between cognitive ability and knowledge leads to the development of skills. These skills are essential to work or create work. Additionally, these skills can be acquired through on-the-job training. Once skills are developed, they are transformed into productivity, income, savings, investment, and innovation. These future-oriented behaviours arise from the patience of cognitive ability and the skills that develop over time. The cognitive ability–skill development cycle proposed by Tansel et al. (2024, p. 139) highlights the importance of nutrient intake, education, and on-the-job training in developing essential skills. The cycle also emphasizes the importance of patience as future-oriented behaviour.

The economic ecosystem and social infrastructure are critical components that contribute to the growth and development of society, and they are mentioned in the assigned core idea of this study. Gould-Werth et al. (2023) argue that *social infrastructure* is vital to any economy because it encompasses policies, resources, and services that enable in-

dividuals to participate in productive social and economic activities. Social infrastructure includes healthcare, education, and social services (Gould-Werth et al., 2023). It can be helpful to examine an example interaction matrix of social infrastructure applications; programs are on the x-axis, and social infrastructure application instruments are on the y-axis. The programs included a list of sixteen program items, such as „K-12 public education," „supplemental nutrition assistance programs," „social service agencies (behavioural health, employment support, child welfare)," and „housing vouchers." According to Gould-Werth et al. (2023), social infrastructure instruments have four dimensions: „social services health, education," „care economy," „income support", and „social insurance." In addition, Gould-Werth et al. (2023) state that social infrastructure should not be designed as a transient band aid used in emergencies but rather as a necessary fundamental component that sustains individuals in their daily lives and the dynamic economic changes they interact with. This type of arrangement increases the resilience of the macroeconomy and promotes economic growth (Gould-Werth et al., 2023).

Similarly, Atluri and Dietz (2022, p. 187) explain the importance of an *ecosystem economy*, where businesses collaborate and work across traditional sector boundaries to offer comprehensive solutions that meet customer needs. Using an example of their ecosystem economy approach, Atluri and Dietz (2022, pp. 65–69) visualize a world where education, job opportunities, and entertainment are all obtainable on one platform. The education and skill ecosystems are at the front line of this change. It is dynamic, adaptable, and has the potential to revolutionize the way we learn and develop. With this system, individuals can skilfully complete their plans and progress in their professions via long-term education opportunities attached to the labour market. Retirees can benefit from this ecosystem through enrichment applications that foster their development. This integration institutes an uninterrupted shift from education to employment, making it easier to perform one's professional ideals (Atluri & Dietz, 2022, pp. 65–69). According to Atluri and Dietz (2022), we can design an environment that nurtures creativity, innovation, and sustainable economic growth and development by improving this approach.

At this stage, it would be helpful to share one of the core idea functional concepts in the workflow in Figure 1. We provide one of the core idea functional concepts based on the core idea specified. In our view, this core idea functional concept aims to develop "The Protection of Human Genetic Networks" (Gibson, 2009, p. 12). Based on Gibson's (2009) study, we provide examples of core idea abilities, categorized by their assigned core idea functional concept and priority, determined by our subjective considerations:

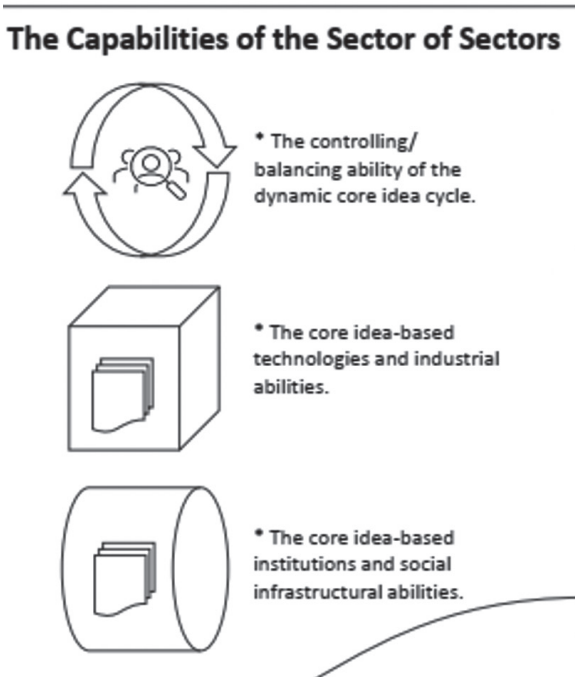
- *Protect human genetic networks against having holes* may have first-degree priority,
- *Increasing the resistance capacity of a buffering zone of genetic networks against any source of environmental pressure* may have second-degree priority,
- *Decreased pressure from environmental sources on genetic networks* may have second-degree priority,

• *Eliminating environmental sources of pressure on genetic networks* may have first-degree priority.

We propose that to move forward, one should follow the steps outlined in the determined methodology of the core idea innovation policy perspective. This involves utilizing civilian purpose adaptation and the developed form of the industrial policy approach of DIBCS (2004) for both technological and institutional frameworks, as shown in Figure 1. We suggest that the methodology of the core idea innovation policy requires further studies to specify its unique steps, including the development supports and processes illustrated in Figure 1.

Then, we suggest that the outputs resulting from implementing the core idea innovation policy—such as organizations, services, and products—can exemplify an appropriate relationship between humanity and the natural order, as Ruttan (2001, p. 620) proposed. Since it is impossible to propose all processes at this juncture, the evaluation of the workflow results will be appropriate through the examples given. However, we consider it helpful to show the simplified form of a general assessment of the sector of sectors' capabilities in Figure 4.

Figure 4 The Capabilities of the Sector of Sectors



Source: *Authors*

5. The Potential Byproducts of the Sector of Sectors

5.1. Interaction between the Sector of Sectors and the Skill-Task-Employment Nexus

The skill-task-employment nexus is increasing (Campus Skills Report, 2022; Dondi et al., 2021; Global Skills Report, 2023; The Future of Jobs Report, 2020). Notably, some people who cannot be included in this nexus may emerge; these people will face increasing job polarization, and regulations that balance this situation should be developed by public institutions (Stiglitz, 2012, 2020). The sector-of-sectors approach can mitigate the adverse effects that the skill-task-employment nexus may have on each individual, as it contains technologies and institutions that support the uninterrupted continuation of the cognitive ability-skill development cycle of each individual.

In this context, we foresee that the dynamic cycling capability of the sector of sectors can have a controlling and balancing effect not only on the technologies and institutions developed within the scope of the fourth industrial revolution but also on the technologies and institutions that may emerge after this revolution in the future.

5.2. The Uniqueness Level Cycle in the Sector of Sectors

Robert Sapolsky (Stanford, 2009) highlights the unique features that distinguish humans. He argues that a defining characteristic of an individual is their belief that individuals can gain the power and the desire to do something (X) from the indisputable evidence that X cannot happen. This demonstrates that humans possess the ability to hold two contradictory beliefs at the same time. Similarly, individuals tend to view more challenging tasks as more critical. This characteristic makes humans unique (Stanford, 2009).

The characteristics being discussed have significantly impacted the technological advancements we enjoy today. The sector-of-sector approach can support and advance each individual's cognitive ability–skill development cycle to a unique level, enabling them to contribute to scientific knowledge. This vast pool of scientific knowledge will enable more subject matter experts to address challenging problems, leading to faster and more effective solutions.

5.3. "Superposition" in the Sector of Sectors

We want to express the situation in which each individual has the possibility of both working and creating a job at the same time within the scope of the capability to be developed based on the core idea of the sector of sectors. We represent this concept using the term "superposition" (Rajasekar & Velusamy, 2022, p. 481), which we borrow from quantum mechanics. In our case, this situation means that each individual has the potential cognitive ability and skill development level to be both an employee and an employer simultaneously but needs to be encouraged to work in one of these positions.

This superposition of each individual can be designed as a policy measure that can be used to correct the parallelism between the unemployment rate and company profits

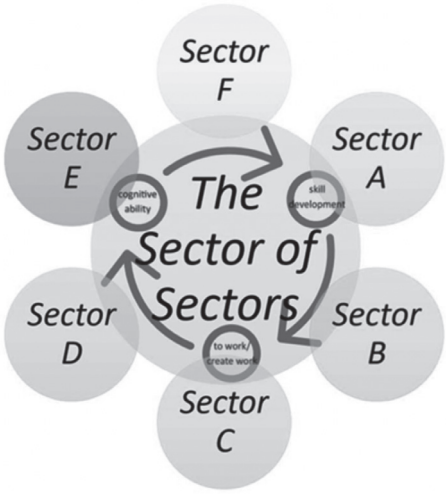
(Nitzan & Bichler, 2014, p. 146) in economies. In addition, we believe that if regulations can be made to enable each individual to become an employer during periods of increased unemployment, the recession effect on the economy can be overcome by increasing the potential of each individual to make long-term plans because the sectoral capability of the sector of sectors can include elements that can make creating a job for each individual as easy as working in a job.

5.4. The Sector of Sectors' Interactions with Other Sectors

We believe that the sectors can penetrate deeply into information and technologies, actors and networks, and institutions, which are the structural elements of sectoral systems (Malerba, 2002, 2005). In this context, the sectors significantly contribute to the development of other sectors by enabling technologies and institutions to support each individual's cognitive ability–skill development cycle without interruption. This situation is depicted in Figure 5.

Furthermore, we can theoretically and empirically establish the concept of the sector of sectors by drawing on the extensive research conducted by Malerba (2004), and Malerba and Vonortas (2009). This approach can be instrumental in improving overall capabilities by enabling effective coordination between different sectors. Moreover, the sector-of-sectors approach can also be leveraged to develop innovative paths through cross-sectoral cocreation, as Weber and Schaper-Rinkel (2017) noted. By adopting this approach, organizations can enhance their capacity to innovate and facilitate the creation of new ideas that span multiple sectors.

Figure 5 Interactions of the Sector of Sectors with Other Sectors



Source: *Authors*

In essence, the sector of sectors concept provides a powerful tool for humanity to navi-

gate the complex and uncertain challenges of transitioning to a sustainable future. By fostering inter- and cross-sectoral coordination, the sector can help us build a more integrated and resilient society. It has the potential to contribute significantly to our ability to address complex issues that cannot be solved by individual sectors alone. Ultimately, the sector of sectors can help us achieve a higher level of integrated capacity, enabling us to successfully navigate the challenges of the transition to sustainability.

5.5 Interaction between the Sector of Sectors and Artificial Intelligence

There are many different approaches, applications, and evaluations in artificial intelligence. The experts agree that artificial intelligence increases the productivity, profits, and efficiency of the work they engage in and opens many opportunities for their users (Amanpour and Company, 2023; Fox Business, 2023; Lex Fridman, 2023; Wolfram, 2023). However, Geoffrey Hinton (Amanpour and Company, 2023) warned that there is a possibility that, as future studies in the field of artificial intelligence progress, superintelligence may emerge, uncertainty may increase unpredictably for humanity, and artificial intelligence may become an existential threat. Although Stephen Wolfram (Lex Fridman, 2023) accepts this possibility, he states that he sees intelligence as a form of computation based on its constraints. Along with his explanation, he conveys that the issue at hand will face computational irreducibility, which implies that there is no way to simplify the computation process. This means that the outcome can be predicted only by carrying out every step of the computation. In other words, there is no shortcut or quick solution to the problem due to the complexity of the computation process. Michio Kaku (Fox Business, 2023) noted that artificial intelligence's most critical risk factors are the lack of a fact control tool developed for artificial intelligence and self-regulation. Hinton (Amanpour and Company, 2023) also stresses that there should be solid legal regulations dealing with artificial intelligence.

Phaedra Boinodiris (IBM Technology, 2023) noted that large language models pose several risks, such as disseminating and using false information and narratives, which can harm individuals, businesses, brands and society. Furthermore, these models can generate statistical errors, bias, security concerns, and consent-related issues, which are the main areas of risk mitigation for such models. The ability of large language models to predict the next syntactically correct word without comprehending it can result in false narratives or factually incorrect responses. In order to reduce the possibility of inaccuracy, it is necessary to provide factual data and datasets that can help us understand the logic and interpretability of the model. According to Boinodiris (IBM Technology, 2023), large language model outputs can be biased, and addressing this risk requires cultural awareness, diverse and multidisciplinary teams, and regular audits. Auditing and accountability through providing representative and ethically sourced data can help reduce the risks associated with consent. The security risks of large language models include their potential misuse of malicious activities, such as leaking private information or approving illegal activities. Therefore, education is vital for understanding the strengths, weaknesses, and responsible

development of artificial intelligence, including environmental impact and safety measures. Careful consideration of the relationship with artificial intelligence is necessary, and education must be accessible and inclusive to ensure the responsible use and advancement of human intelligence. Finally, Boinodiris (IBM Technology, 2023) emphasizes that individuals involved in addressing this crucial matter must possess diverse skill sets and be distinctive.

Webb's (2019) research revealed that introducing robots poses the most significant peril to low-skilled jobs. On the other hand, medium-skilled jobs are more likely to be impacted by software, while high-skilled jobs are most vulnerable to artificial intelligence. The study highlights that advanced technologies, particularly artificial intelligence, could have a more significant impact on older and highly educated workers. The findings indicate that high-paying jobs are more susceptible to artificial intelligence than low-paying jobs are. However, the study also suggested that individuals in the highest-paid occupations, such as chief executive officers (CEOs) and professionals, are less at risk. Despite the above findings, the impact of artificial intelligence on jobs with different skill levels remains uncertain (Webb, 2019). Kattan et al.'s (2020) study states that machines can replace individuals in many business fields but need to be improved against individuals in areas where creativity, social intelligence, and advanced perception skills are needed. A study by Eloundou et al. (2023) suggested that there is a complex relationship between exposure to artificial intelligence and various skills. According to Eloundou et al. (2023), exposure to artificial intelligence has less impact on critical thinking and scientific skills but more on programming and writing skills.

According to Wolfram (2023), although artificial intelligence has transformed various aspects of our lives, there is still a crucial function that only humans can perform—the defining goals. This is because once a computational system is set in motion, it operates according to its rules without any direction. Therefore, it is up to human beings to determine the direction in which the system should move. Automation has eliminated some jobs, but it has also created new jobs that require different skills. Although there may be a time lag between the obsolescence of an old job and the creation of a new job, there is always a vast range of jobs that are feasible but have yet to be automated. This is because many tasks necessitate human expertise, creativity, and intuition, which even the most sophisticated algorithms cannot predict. This is due to computational irreducibility, which applies not only to natural systems but also to social dynamics, economic systems, and other complicated phenomena. In other words, there will always be something unpredictable, something that automation cannot account for. As a result, while automation can increase efficiency and reliability, human beings will always be required to provide direction, creativity, and adaptability to the systems we create (Wolfram, 2023).

From our point of view, recent evaluations (Amanpour and Company, 2023; Eloundou et al., 2023; Fox Business, 2023; IBM Technology, 2023; Kattan et al., 2020; Lex Fridman, 2023; Webb, 2019; Wolfram, 2023) of artificial intelligence have revealed that individuals will interact with this technology extensively in various roles and conditions. Employers

follow productivity, profits and efficiency by assessing their investment, repair and maintenance costs. Workers have the joy of easing their tasks while considering its imposing impacts on their work. Artificial intelligence developers bear the responsibilities of their intelligence forms that are computationally irreducible while increasing their income. End-users use artificial intelligence to achieve their goals without having a fact-checking tool. Legislators try to maintain human existence on the planet while not wanting to stop this technological leap.

In addition, artificial intelligence offers opportunities to achieve all of the 17 Sustainable Development Goals (SDGs) of the United Nations, from eradicating poverty and hunger to reducing inequalities and building sustainable cities and communities. As of 2023, there are around 600 artificial intelligence-enabled use cases, and 82% of them have been implemented. For example, 128 of 165 use cases have been implemented for "SDG 3: Good Health and Well-Being," 38 of 40 use cases for "SDG 4: Quality Education," 17 of 27 use cases for "SDG 8: Decent Work and Economic Growth," and 19 of 21 use cases for "SDG 12: Responsible Consumption and Production" (Bankhwal et al., 2024, p. 4).

At this stage, we should also note the different evaluations of artificial intelligence from an economic perspective. Brynjolfsson et al. (2019) state that artificial intelligence carries technological optimism, but poor productivity performance is observed. They state that the benefits of artificial intelligence can be utilized by structuring the ability to adapt at individual, organizational and societal levels. Korinek and Stiglitz (2019) state that regardless of the long-term effects of artificial intelligence, it has the potential to disrupt labour markets even in the short and medium term, and the magnitude of this disruption will depend on the speed of transition to artificial intelligence and whether it provides labour-savings. Acemoglu and Restrepo (2019) draw attention to a newer factor in this context, the potential mismatch between the requirements of artificial intelligence tasks and the workforce's skills, emphasizing that this situation slows down the adjustment of labour demand, increases inequality and reduces productivity gains. They also state that despite increasing concerns about job losses, many business owners cannot find individuals with the necessary skills to perform the tasks. They also state that if the productivity gains that new technologies like artificial intelligence can provide in economic activities are not shared as welfare with a new approach, there is a risk that negative political approaches towards new technologies will be accepted by society and the development of such new technologies will be slowed down, or their development will be prevented (Acemoglu & Restrepo, 2019).

Therefore, it is crucial to ensure the sustainable growth and development of economies by explicitly operating cognitive ability–skill development cycles for each individual without interruption. We consider that the sector of sectors approach possesses the necessary capabilities to address these issues concerning artificial intelligence.

6. Discussion

Bankhwal et al. (2024) state that the United Nations 2023 global SDG update indicates that 85% of the SDGs could not be met. For this reason, a declaration was adopted by the UN to accelerate SDG efforts to reach the 2030 targets (UN General Assembly Adopts Declaration to Accelerate SDGs, 2023).

At this stage, the world has faced the risk of geopolitical and, consequently, geoeconomic fragmentation due to the increasing technological competition between countries, especially between the two largest economies (Creed et al., 2014; R&D Management, n.d.; Rodner et al., 2019; Shekhar et al., 2020). This situation may lead to decreased international cooperation and risk sharing and increase the severity of economic crises (Aiyar et al., 2023). Due to these developments, we are concerned that achieving SDGs targets will be further delayed.

For new technologies that are the subject of competition, it is argued that we need a new conceptual framework, a proper roadmap, necessary institutional changes, the design of improved institutions, and an industrial policy that fully addresses the adverse effects of innovation to solve the problems related to the mismatch between skills and technologies (Acemoglu & Restrepo, 2019; Brynjolfsson et al., 2019; Korinek & Stiglitz, 2019; Trajtenberg, 2019).

In addition, it is evaluated that the diversification approach can be adopted to increase economic resilience against shocks in the face of the risk of geopolitical and geoeconomic fragmentation globally. However, it is also stated that for mid-aligned country economies, institutional capability and individual skill development are needed in addition to diversification (Seong et al., 2024).

Further, based on empirical study results, Tansel et al. (2024) assess that the uninterrupted operation of each individual's cognitive ability and skill development cycle will positively impact macro and microeconomics.

From the perspective of sustainability, all the evaluations mentioned above have encouraged our search for how to create an institutional and technological infrastructure that can continuously support each individual's cognitive ability and skill development cycle. With this motivation, we evaluated that it would be possible to adapt and develop the DIBCS (2004) methodology, which is designed to develop and sustain technologies to protect each individual and ensure that they do their tasks in the highly uncertain nature of the battlefield for civilian use. At this point, although there are no direct criticisms made for the DIBCS (2004) industrial capabilities study, we would like to state that we have taken into consideration the criticisms of Mowery et al. (2010) and Mowery (2012) studies that military development studies cannot be an example for civilian applications. However, we believe this approach we have adapted and developed will contribute to the solution-seeking studies for the sustainability problem areas mentioned above.

Instead of the initial part of the DIBCS (2004) methodology, namely concept studies, we

adopted the principle of initiating the methodology processes by determining the scientific principles as the core idea by benefiting from the Covey (2004, 2009) study. In this way, we could include the inference of the Tansel et al. (2024) study and the inferences of other possible scientific studies in the proposed methodology processes. Subsequently, we decided to add the institutional infrastructure development processes that we saw as needing more in the DIBCS (2004) methodology to the approach as separate processes. The Core Idea Innovation Policy Perspective methodology was designed by adapting the DIBCS (2004) definitions for civil use and creating other necessary definitions. The new methodology we have developed for civilian use is based on a study with practical application results (OSD A&S Industrial Policy, 2020) such as DIBCS (2004). We acknowledge that there may be limitations in benefiting from the practical business experiences of these studies, but it is possible in terms of methodology.

For this reason, we evaluate that our approach has the opportunity to produce solutions suitable for macro, meso and micro levels. Among the limitations of the methodology we propose is that it is based on the demands and resources of a single customer (the public), and we evaluate that public development incentive funds can support this issue and that private enterprises can also be encouraged to participate in studies in this field with the regulations to be made. A prominent aspect of this approach is that it has the potential to develop new sector capabilities and renew and develop the capabilities of existing sectors through institutions and technologies to be revealed based on scientific principles to be determined as the core idea with this structure adapted and developed for civilian use.

The prominent feature of the sector of sectors practice is that instead of directly targeting social issues, it tries to develop solutions by including each individual in its core idea based on a scientific principle that is predicted to solve them. In addition, we foresee that the developing of leader sector capabilities will contribute to the mitigation of the impact of social issues on each individual first, then to the better management of the problems of acquiring new skills and adapting to innovations, and if possible, to the resolution of the mentioned problems before they arise in the process. We evaluate that the „sector of sectors" approach can offer proposals of solutions with institutional arrangements and technology developments by taking each individual into account through the core idea determined for issues such as monopolization, surveillance systems or the role of the regulatory state, and also that the possibility of starting new private/public/mix initiatives with the superposition by-product can be proposed.

In addition, we evaluate that both the core idea innovation policy perspective methodology and the practice of sector sectors have the potential to contribute to the applications in science diplomacy.

7. Conclusions

The eco-health approach highlights the significant impact of environmental and socioeconomic sustainability on human health, animal health, and the ecosystem as a whole (Lisitza & Wolbring, 2018). This study presents our views on the creation of technical and institutional infrastructure that is essential for society to achieve sustainable development and a healthy environment. Managing and balancing uncertainty and disruptions also play a crucial role in this process.

In this study, we cover the process of how our approach came to be, the methodology (DIBCS, 2004) we used, the potential outcomes, and how it interacts with artificial intelligence. First, we highlight the main problem areas we need to address, specifically those related to sustainability within our approach. Then, we present the empirical research findings of Tansel et al. (2024) study, which revealed a nonlinear relationship between the economic indicators determined and BMI. Finally, we introduce the core idea innovation policy perspective and its practice, the sector of sectors, which can help address societal concerns by linking BMI, nutritional status, cognitive ability, and time preference.

Tansel et al. (2024) found that the relationship between economic growth and development engines and BMI is not monotonous. The findings of Tansel et al. (2024) suggest that cognitive ability and skill development should constitute a continuous cycle for each individual. Therefore, we propose that the "core idea" of the core idea innovation policy perspective and the methodology of this perspective (DIBCS, 2004) are transforming and supporting the manifestation of the study of Tansel et al.'s (2024) findings into a technological and institutional infrastructure.

At this juncture, the sector of sectors aims to create a dynamic response by combining the „core ideas" of the core idea innovation policy perspective and the development of the economic ecosystem and social infrastructure necessary for the uninterrupted cognitive ability and skill development cycle of each individual. The practice has a dynamic structure, as it interacts with a core idea that supports an active cycle. These developments can help reduce inequality (Stiglitz, 2012, 2020) by decreasing rent-seeking activities (Bigsten & Moene, 1996; Seekamm, 2020) in society. Additionally, these advancements can have a positive effect on the sustainability of economic growth and development.

Hence, from the core idea innovation policy perspective, along with its emerging practice, the sector of sectors can significantly contribute to humanity's ability to cope with uncertain events related to sustainability in the future. Furthermore, this practice can help identify any technological and institutional shortcomings of society, recognize its industrial and social infrastructure capabilities for sustainability, and provide a way to have a higher level of integrated capacity than the production capabilities of all sectors separately.

In addition, we believe that if we support this practice with an understanding of human uniqueness (Stanford, 2009), each person can achieve the cycle of uniqueness by using the cognitive ability–skill development cycle of working/creating work (Tansel et al., 2024, p.

139). Thus, we believe that the cycle of uniqueness we propose for each individual can meet the need for "new levels of human skill and contribution," which Porter (1998) noted in the epilogue. This need remains as crucial as ever (Gehl & Porter, 2020, pp. 142, 185, 197).

To conclude, the sustainable development of each individual is the path to achieving a sustainable environment, health, and economic development. The study's approach supports this idea, highlighting the need to obtain the necessary technical and institutional infrastructure despite the uncertainties and disruptions of a constantly changing economic landscape. The uninterrupted progression of each individual's cognitive ability-skill development cycle will ensure sustainability and shed light on scientific unknowns, even in these conditions.

Acknowledgement

This paper is an output of the Postdoctoral Research (DOSAP-C) Project of the Middle East Technical University (METU), the Department of Science and Technology Policy Studies, Ankara, Türkiye, titled "Sustainable Health and Economic Development." Dr. Öztürk is grateful to the Research Center for Science and Technology Policies (METU-TEKPOL) for the graceful study environment provided to him.

This study was presented at the First Conference of Economics and Society, titled „The Sector of Sectors Industrial and Innovation Policy Perspective and its Frontiers with Artificial Intelligence on Sustainable Environment, Health, and Development," held on December 6-7, 2023, in Ankara, Türkiye. The study's abstract was published in the conference's abstract book, available as a supplemental file. The authors thank this conference's organizing and scientific committees for providing a collaborative presentation atmosphere.

Furthermore, the authors express their gratitude to the anonymous referees for their valuable critiques and comments for this paper. Any errors are our own.

Declaration of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT Authorship Contribution Statement

C. Ö. : Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Visualization. E. E.: Validation, Writing – review & editing, Supervision. A. T.: Writing – review & editing.

Funding

This article did not receive any specific grant from public, commercial, or not-for-profit funding agencies.

Data Availability Statement

Data sharing is not applicable to this article because the manuscript was based on the authors' evaluations via the references used.

References

Acemoğlu, D., & Johnson, S. (2007). Disease and Development: The effect of life expectancy on Economic growth. *Journal of Political Economy*, *115*(6), 925–985. https://doi.org/10.1086/529000

Acemoglu, D., & Restrepo, P. (2019). Artificial intelligence, Automation, and work. In *University of Chicago Press eBooks* (pp. 197–236). https://doi.org/10.7208/chicago/9780226613475.003.0008

Acemoğlu, D., & Restrepo, P. (2020). Robots and Jobs: Evidence from US Labor Markets. *Journal of Political Economy*, *128*(6), 2188–2244. http://dx.doi.org/10.1086/705716

Aiyar, S., Chen, J., Ebeke, C. H., Garcia-Saltos, R., Gudmundsson, T., Ilyina, A., Kangur, A., Kunaratskul, T., Rodriguez, S. L., Ruta, M., Schulze, T., Soderberg, G., & Trevino, J. P. (2023, January 15). *Geoeconomic Fragmentation and the Future of Multilateralism* (Staff Discussion Note SDN/2023/001). International Monetary Fund (IMF). https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2023/01/11/Geo-Economic-Fragmentation-and-the-Future-of-Multilateralism-527266

Amanpour and Company. (2023, May 9). *"Godfather of AI" Geoffrey Hinton warns of the "Existential threat" of AI | Amanpour and Company* [Video]. YouTube. https://www.youtube.com/watch?v=Y6Sgp7y178k

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies 58*(2), 277. https://doi.org/10.2307/2297968

Atluri, V., & Dietz, M. (2022). *The Ecosystem Economy*. John Wiley & Sons.

Azomahou, T., Boucekkine, R., & Diène, B. (2009). A closer look at the relationship between life expectancy and economic growth. *International Journal of Economic Theory*, *5*(2), 201–244. https://doi.org/10.1111/j.1742-7363.2009.00105.x

Bankhwal, M., Bisht, A., Chui, M., Roberts, R., & van Heteren, A. (2024, May). *AI for social good: Improving lives and protecting the planet.* In McKinsey & Company. Retrieved September 6, 2024, from https://www.mckinsey.com/capabilities/quantumblack/our-insights/ai-for-social-good

Barclay, L. J., Kiefer, T., & Mansouri, M. E. (2021). Navigating the era of disruption: How emotions can prompt job crafting behaviors. *Human Resource Management*, *61*(3), 335–353. https://doi.org/10.1002/hrm.22095

Baum, C. F., Schaffer, M. E., & Stillman, S. (2007). Enhanced routines for Instrumental Variables/Generalized Method of Moments Estimation and testing. *Stata Journal*, *7*(4), 465–506. https://doi.org/10.1177/1536867x0800700402

Berg, A., Buffie, E.F., and Zanna, L-F. (2016). Robots, Growth, and Inequality. *Finance and Development,*53 (3), 10–13. https://www.imf.org/external/pubs/ft/fandd/2016/09/pdf/berg.pdf

Bigsten, A., & Levin, J. (2004). Growth, Income Distribution, and Poverty: A review. In *Oxford University Press eBooks* (pp. 251–276). https://doi.org/10.1093/0199268657.003.0012

Bigsten, A., & Moene, K. O. (1996). Growth and Rent Dissipation: the Case of Kenya. *Journal of African Economies*, *5*(2), 177–198. https://doi.org/10.1093/oxfordjournals.jae.a020902

Brougham, D., & Haar, J. (2020). Technological disruption and employment: The influence on job insecurity and turnover intentions: A multi-country study. *Technological Forecasting and Social Change*, *161*, 120276. https://doi.org/10.1016/j.techfore.2020.120276

Brown, R. (2020). Mission-oriented or mission adrift? A critical examination of mission-oriented innovation policies. *European Planning Studies*, *29*(4), 739–761. https://doi.org/10.1080/09654313.2020.1779189

Brynjolfsson, E., & McAfee, A. (2012). *Race against the machine: how the revolution is accelerating inovation, driving productivity, and irreversibly transforming employment and the economy.* Lbdigital Frontier Press, Lc.

Brynjolfsson, E., Rock, D., & Syverson, C. (2019). Artificial intelligence and the modern productivity paradox. In *University of Chicago Press eBooks* (pp. 23–60). https://doi.org/10.7208/chicago/9780226613475.003.0001

Campus Skills Report. (2022). In Coursera. Retrieved November 2, 2023, from https://www.coursera.org/skills-reports/campus

Cervellati, M., & Sunde, U. (2009). *Life expectancy and economic growth: The role of the demographic transition* (IZA Discussion Papers, No. 4160). Institute of Labor Economics (IZA). http://ftp.iza.org/dp4160.pdf

Cervellati, M., & Sunde, U. (2011). Life expectancy and economic growth: the role of the demographic transition. *Journal of Economic Growth*, *16*(2), 99–133. https://doi.org/10.1007/s10887-011-9065-2

Chataway, J., Hanlin, R., & Kaplinsky, R. (2014). Inclusive innovation: an architecture for policy development. *Innovation and Development*, *4*(1), 33–54. https://doi.org/10.1080/2157930x.2013.876800

Conway, G., Delaney, S., & Waage, J.K. (2010). *Science and Innovation for Development*. UK Collaborative on Development Sciences (UKCDS).

Covey, S. R. (2004). *The 8th habit: from effectiveness to greatness*. Free Press.

Covey, S. R. (2009). *Principle-Centered leadership*. Rosetta Books.

Creed, W. E. D., Hudson, B. A., Okhuysen, G. A., & Smith-Crowe, K. (2014). Swimming in a Sea of Shame: Incorporating Emotion into Explanations of Institutional Reproduction and Change. *Academy of Management Review*, *39*(3), 275–301. https://doi.org/10.5465/amr.2012.0074

Dasgupta, P. (1997). Nutritional status, the capacity for work, and poverty traps. *Journal of Econometrics*, *77*(1), 5–37. https://doi.org/10.1016/s0304-4076(96)01804-0

Davis, J.B. (2003). *The Theory of the Individual in Economics*. Routledge.

Defense Industrial Base Capabilities Study: Battlespace Awareness. (2004, January). In *DTIC*. Retrieved August 2, 2023, from https://apps.dtic.mil/sti/citations/ADA431915

DeLaurentis, D., & Callaway, R. K. "CAB. (2004). A System-of-Systems Perspective for Public Policy Decisions. *Review of Policy Research*, *21*(6), 829–837. https://doi.org/10.1111/j.1541-1338.2004.00111.x

Desbordes, R. (2011). The non-linear effects of life expectancy on economic growth. *Economics Letters*, *112*(1), 116–118. https://doi.org/10.1016/j.econlet.2011.03.027

Dondi, M., Klier, J., Panier, F., & Schubert, J. (2021). *Defining the skills citizens will need in the future world of work*. In McKinsey & Company. Retrieved November 2, 2023, from https://www.mckinsey.com/industries/public-sector/our-insights/defining-the-skills-citizens-will-need-in-the-future-world-of-work#/

Eizagirre, A. E., Rodríguez, H., & Ibarra, A. (2017). Politicizing Responsible Innovation: Responsibility as inclusive governance. *International Journal of Innovation Studies*, *1*(1), 20–36. https://doi.org/10.3724/sp.j.1440.101003

Eloundou, T., Manning, S., Mishkin, P., & Rock, D. L. (2023). GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2303.10130

Fagerberg, J. (2018). Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, *47*(9), 1568–1576. https://doi.org/10.1016/j.respol.2018.08.012

Fox Business. (2023, May 8). *Physicist Michio Kaku exposes the "dangerous" side of AI chatbots* [Video]. YouTube. https://www.youtube.com/watch?v=EZRTSKCeXDE

Freeman, C. (2011). Technology, inequality and economic growth. *Innovation and Development*, *1*(1), 11–24. https://doi.org/10.1080/2157930x.2010.551062

Fu, X., Ghauri, P. N., Ogbonna, N., & Xing, X. (2023). Platform-based business model and entrepreneurs from Base of the Pyramid. *Technovation*, *119*, 102451. https://doi.org/10.1016/j.technovation.2021.102451

Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technological Forecasting and Social Change*, *152*, 119894. https://doi.org/10.1016/j.techfore.2019.119894

Gehl, K. M., & Porter, M. E. (2020). *The politics industry : how political innovation can break partisan gridlock and save our democracy*. Harvard Business Review Press.

Gibson, G. (2009). *It Takes a Genome: How a Clash between Our Genes and Modern Life Is Making Us Sick*. Pearson Education.

Giuliani, E. (2018). Regulating global capitalism amid rampant corporate wrongdoing—Reply to "Three frames for innovation policy." *Research Policy*, *47*(9), 1577–1582. https://doi.org/10.1016/j.respol.2018.08.013

Global Skills Report. (2023). In Coursera. Retrieved November 2, 2023, from https://www.coursera.org/skills-reports/global

Gottfredson, L. S. (1997). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence*, *24*(1), 13–23. https://doi.org/10.1016/s0160-2896(97)90011-8

Gould-Werth, A., Abbott, S., & Openchowski, E. (2023, January 26). *What is social infrastructure, and how does it support economic growth in the United States?* In Washington Center for Equitable Growth. Retrieved November 2, 2023, from https://equitablegrowth.org/what-is-social-infrastructure-and-how-does-it-support-economic-growth-in-the-united-states/

Haddad, C. R., Nakić, V., Bergek, A., & Hellsmark, H. (2022). Transformative innovation policy: A systematic review. *Environmental Innovation and Societal Transitions*, *43*, 14–40. https://doi.org/10.1016/j.eist.2022.03.002

Hall, R. E., & Jones, C. I. (1999). Why Do Some Countries Produce So Much More Output Per Worker Than Others? *The Quarterly Journal of Economics*, *114*(1), 83–116. http://www.jstor.org/stable/2586948

Hanson, A., & Bleckenwegner, C. (2022, March 22). *OECD Survey Says: What mission-oriented innovators really want*. In Observatory of Public Sector Innovation. https://oecd-opsi.org/blog/oecd-survey-says-what-mission-oriented-innovators-really-want/

Hanson, A., Bleckenwegner, C., Striegler, S.G., & Melander, C. (2022, January). *Mission-oriented*

innovation needs assessment survey: Highlights and insights on mission work. In Mission Action Lab-OECD. https://oecd-opsi.org/wp-content/uploads/2022/02/OECD-DDC_Results-Mission-Needs-Assessment-Survey-2022.pdf

Hekkert, M. P., Janssen, M. J., Wesseling, J., & Negro, S. O. (2020). Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, 76–79. https://doi.org/10.1016/j.eist.2019.11.011

Hornstein, A., & Lubik, T. (2015). The Rise in Long-Term Unemployment: Potential Causes and Implications. *Economic Quarterly*, *101*(02), 125–149. https://doi.org/10.21144/eq1010203

Husain, Z., Dutta, M., & Chowdhary, N. (2014). Is health wealth? Results of a panel data analysis. *Social Indicators Research*, *117*(1), 121–143. https://doi.org/10.1007/s11205-013-0337-4

IBM Technology. (2023, April 14). *Risks of Large Language Models (LLM)* [Video]. YouTube. https://www.youtube.com/watch?v=r4kButlDLUc

Jahanshahi, A. A., & Brem, A. (2019). Entrepreneurs in post-sanctions Iran: Innovation or imitation under conditions of perceived environmental uncertainty? *Asia Pacific Journal of Management*, *37*(2), 531–551. https://doi.org/10.1007/s10490-018-9618-4

Jakobsen, S., Fløysand, A., & Overton, J. (2019). Expanding the field of Responsible Research and Innovation (RRI) – from responsible research to responsible innovation. *European Planning Studies*, *27*(12), 2329–2343. https://doi.org/10.1080/09654313.2019.1667617

Kattan, R. B., Macdonald, K., & Patrinos, H. A. (2020). The role of education in mitigating automation's effect on wage inequality. *LABOUR*, *35*(1), 79–104. https://doi.org/10.1111/labr.12187

Khanagha, S., Zadeh, M. T. R., Mihalache, O., & Volberda, H. (2018). Embracing bewilderment: responding to technological disruption in heterogeneous market environments. *Journal of Management Studies*, *55*(7), 1079–1121. https://doi.org/10.1111/joms.12348

Kokotovich, A., Kuzma, J., Cummings, C., & Grieger, K. (2021). Responsible Innovation Definitions, Practices, and Motivations from Nanotechnology Researchers in Food and Agriculture. *NanoEthics*, *15*(3), 229–243. https://doi.org/10.1007/s11569-021-00404-9

Korinek, A., & Stiglitz, J. E. (2019). Artificial intelligence and its implications for income distribution and unemployment. In *University of Chicago Press eBooks* (pp. 349–390). https://doi.org/10.7208/chicago/9780226613475.003.0014

Lam, S. K., Ahearne, M., Hu, Y., & Schillewaert, N. (2010). Resistance to Brand Switching when a Radically New Brand is Introduced: A Social Identity Theory Perspective. *Journal of Marketing*, *74*(6), 128–146. https://doi.org/10.1509/jmkg.74.6.128

Lex Fridman. (2023, May 9). *Stephen Wolfram: ChatGPT and the Nature of Truth, Reality & Computation | Lex Fridman Podcast #376* [Video]. YouTube. https://www.youtube.com/watch?v=PdE-waSx-d8

Lisitza, A., & Wolbring, G. (2018). EcoHealth and the Determinants of health: perspectives of a small subset of Canadian academics in the EcoHealth community. *International Journal of Environmental Research and Public Health*, *15*(8), 1688. https://doi.org/10.3390/ijerph15081688

Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, *31*(2), 247–264. https://doi.org/10.1016/s0048-7333(01)00139-1

Malerba, F. (2004). *Sectoral Systems of Innovation*. Cambridge University Press.

Malerba, F. (2005). Sectoral systems of innovation: a framework for linking innovation to the knowledge base, structure and dynamics of sectors. *Economics of Innovation and New Technology*, *14*(1–2), 63–82. https://doi.org/10.1080/1043859042000228688

Malerba, F., & Vonortas, N. S. (2009). Innovation networks in industries. In *Edward Elgar Publishing eBooks*. https://doi.org/10.4337/9781848449275

Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation*, *23*(2), 140–156. https://doi.org/10.1080/13662716.2016.1146124

Mazzucato, M. (2021). *Mission economy: A moonshot guide to changing capitalism*. Harper Business.

Meier, G.M., & Stiglitz, J.E. (2000). *Frontiers of development economics : the future in perspective*. World Bank.

Mihalache, M., & Mihalache, O. (2021). How workplace support for the COVID-19 pandemic and personality traits affect changes in employees' affective commitment to the organization and job-related well-being. *Human Resource Management*, *61*(3), 295–314. https://doi.org/10.1002/hrm.22082

Mowery, D. C., Nelson, R. R., & Martin, B. R. (2010). Technology policy and global warming: Why new policy models are needed (or why putting new wine in old bottles won't work). *Research Policy*, *39*(8), 1011–1023. https://doi.org/10.1016/j.respol.2010.05.008

Mowery, D. C. (2012). Defense-related R&D as a model for "Grand Challenges" technology policies. *Research Policy*, *41*(10), 1703–1715. https://doi.org/10.1016/j.respol.2012.03.027

Nitzan, J., & Bichler, S. (2014). Can Capitalists Afford Recovery? Three Views on Economic Policy in Times of Crisis. *Review of Capital as Power, 1* (1), 110–155. https://capitalaspower.com/2014/10/can-capitalists-afford-recovery/

OSD A&S Industrial Policy. (2020, June 23). *Fiscal Year 2019 Industrial Capabilities*. In *Business Defense*. Retrieved September 07, 2024, from https://www.businessdefense.gov/docs/resources/USA000954-20_RPT_Subj_FY19_ICR_07092020.pdf

Pansera, M., & Owen, R. (2018). Framing inclusive innovation within the discourse of development: Insights from case studies in India. *Research Policy*, *47*(1), 23–34. https://doi.org/10.1016/j.respol.2017.09.007

Porter, M. E. (1998). *The competitive advantage of nations : with a new introduction*. Free Press.

Rajasekar, S., & Velusamy, R. (2022). *Quantum Mechanics I*. CRC Press. https://doi.org/10.1201/9781003172178

R&D Management. (n.d.). *R&D Management under disruption and uncertainty*. In Call for Papers. Retrieved January 12, 2023, from https://onlinelibrary.wiley.com/pb-assets/assets/14679310/CFP_RD%20Effect%20Of%20Radical%20Uncertainties-1645543028.pdf

Rodner, V., Roulet, T. J., Kerrigan, F., & Lehn, D. V. (2020). Making Space for Art: A spatial perspective of disruptive and defensive institutional work in Venezuela's art world. *Academy of Management Journal*, *63*(4), 1054–1081. https://doi.org/10.5465/amj.2016.1030

Roodman, D. (2009). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *Stata Journal*, *9*(1), 86–136. https://doi.org/10.1177/1536867x0900900106

Ruttan, V.W. (2001). *Technology, growth, and development : an induced innovation perspective*. Oxford University Press.

Saghaei, M., Dehghanimadvar, M., Soleimani, H., & Ahmadi, M. H. (2020). Optimization and analysis of a bioelectricity generation supply chain under routine and disruptive uncertainty and carbon mitigation policies. *Energy Science & Engineering*, *8*(8), 2976–2999. https://doi.org/10.1002/ese3.716

Schillo, R. S., & Robinson, R. M. (2017). Inclusive Innovation in Developed Countries: the Who, what, why, and how. *Technology Innovation Management Review*, *7*(7), 34–46.

Schomberg, V.R. (2015). Responsible Innovation. In A. Bogner, M. Decker, & M. Sotoudeh

(Eds.), *Responsible Innovation* (pp. 47–70). *Nomos*. https://doi.org/10.5771/9783845272825-47

Schomberg, V.R., & Hankins, J. (2019). *International Handbook on Responsible Innovation: A Global Resource*. Edward Elgar Publishing.

Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*(9), 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011

Seekamm, V.K. (2020). Rent seeking and human capital. In *Routledge eBooks*. https://doi.org/10.4324/9780429329166

Seong, J., White, O., Birshan, M., Woetzel, L., Lamanna, C., Condon, J., and Devesa, T. (2024, January). *Geopolitics and the geometry of global trade*. In McKinsey & Company. Retrieved September 7, 2024, from https://www.mckinsey.com/~/media/mckinsey/mckinsey%20global%20institute/our%20research/geopolitics%20and%20the%20geometry%20of%20global%20trade/geopolitics-and-the-geometry-of-global-trade-vf.pdf

Shekhar, S., Manoharan, B., & Rakshit, K. (2020). Going cashless: Change in institutional logic and consumption practices in the face of institutional disruption. *Journal of Business Research*, *114*, 60–79. https://doi.org/10.1016/j.jbusres.2020.04.010

Staiger, D. O., & Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica*, *65*(3), 557. https://doi.org/10.2307/2171753

Stanford. (2009, June 17). *Class Day Lecture 2009: The Uniqueness of Humans* [Video]. YouTube. https://www.youtube.com/watch?v=hrCVu25wQ5s

Stiglitz, J.E. (2012). *The price of inequality. How today's divided society endangers our future.* W.W. Norton and Company.

Stiglitz, J.E. (2020). *People, power, and profits: Progressive capitalism for an age of discontent*. Penguin Press.

Tansel, A., Öztürk, C., & Erdil, E. (2024). The nonlinear effect of body mass index on economic growth, human capital, productivity, and savings: A cross-country study. *METU Studies in Development*, *51*(1), 127-144.

The Future of Jobs Report. (2020, October). In World Economic Forum. Retrieved November 2, 2023, from https://www.weforum.org/publications/the-future-of-jobs-report-2020/

Trajtenberg, M. (2019). Artificial Intelligence as the next GPT: A Political-Economy Perspective. In *University of Chicago Press eBooks* (pp. 175–186). https://doi.org/10.7208/chicago/9780226613475.003.0006

Turnheim, B., Asquith, M., & Geels, F. W. (2020). Making sustainability transitions research policy-relevant: Challenges at the science-policy interface. *Environmental Innovation and Societal Transitions*, *34*, 116–120. https://doi.org/10.1016/j.eist.2019.12.009

Ulmanen, J., Bergek, A., & Hellsmark, H. (2022). Lost in translation: Challenges in creating new transformative innovation policy practices. *PLOS Sustainability and Transformation*, *1*(10), e0000031. https://doi.org/10.1371/journal.pstr.0000031

UN General Assembly adopts declaration to accelerate SDGs. (2023, September 18). UN News. https://news.un.org/en/story/2023/09/1140857

VandenBos, G.R. (Ed). (2007). *APA dictionary of psychology*. In American Psychological Association. https://psycnet.apa.org/record/2006-11044-000

Vith, S., Oberg, A., Höllerer, M. A., & Meyer, R. E. (2019). Envisioning the 'Sharing City': Governance strategies for the sharing economy. *Journal of Business Ethics*, *159*(4), 1023–1046. https://doi.org/10.1007/s10551-019-04242-4

Webb, M. (2019). The impact of artificial intelligence on the labor market. *Social Science Rese-*

arch Network. https://doi.org/10.2139/ssrn.3482150

Weber, M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change. *Research Policy*, *41*(6), 1037–1047. https://doi.org/10.1016/j.respol.2011.10.015

Weber, M., & Schaper-Rinkel, P. (2017). European sectoral innovation foresight: Identifying emerging cross-sectoral patterns and policy issues. *Technological Forecasting and Social Change*, *115*, 240–250. https://doi.org/10.1016/j.techfore.2016.09.007

Wolfram, S. (2023, March 15). *Will AIs Take All Our Jobs and End Human History—or Not? Well, It's Complicated. . ..* In Writings. Retrieved April 9, 2023, from https://writings.stephenwolfram.com/2023/03/will-ais-take-all-our-jobs-and-end-human-history-or-not-well-its-complicated/

Wooldridge, J.M. (2001). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Wooldridge, J.M. (2012). *Introductory Econometrics: A Modern Approach* (5th Ed). Cengage Learning Press.

World Health Organisation. (2010, May 6). *A healthy lifestyle - WHO recommendations*. World Health Organisation. https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations

Yaghmaei, E., & Van De Poel, I. (2020). Assessment of responsible innovation. In *Routledge eBooks*. https://doi.org/10.4324/9780429298998