FUTURE OF THE GLOBAL ECONOMY

Global strategy in the age of disruption

Scientific editing:

OLA BAREJA-WAWRYSZUK • REGINA DEMIANIUK • AGATA MARCYSIAK

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FOREWORD

The global economy is undergoing a period of profound transformation. Disruptions driven by technological innovation, geopolitical tensions, climate change, and shifting consumer behaviors have redefined the very foundations of economic and social systems. The age we live in demands a rethinking of traditional models of growth, strategy, and cooperation as well as the philosophical and ethical frameworks that guide decision-making. Today's business landscape is unpredictable and disruption is the new norm. Rapid technological advancements and Generative AI, shifting consumer expectations, regulatory changes, and global crises have redefined the way organizations operate. In this era of uncertainty, the ability to develop adaptive strategies, build flexibility into plans, and identify disruptive threats and opportunities will be fundamental for both thriving and struggling companies.

The present monograph entitled *"Future of the Global Economy. Global Strategy in the Age of Disruption"*, brings together contributions that address these pressing challenges from a variety of perspectives. The opening chapter explores normative approaches to development, offering a philosophical lens through which to reconsider the direction of global progress. The following studies examine strategies for building resilience in a fragile and unpredictable world, evaluate the effectiveness of environmental measures in the food industry, and present examples of circular economy initiatives such as the reuse of coffee grounds.

The monograph also tackles the practical and technological dimensions of modern business. Readers will find analyses of reverse logistics in e-commerce, prospects for intermodal transport development, and insights into the commercialization of artificial intelligence through emerging business models.

Together, these chapters offer a comprehensive reflection on how to navigate the complexity of today's world and how to design strategies that foster resilience, sustainability, and inclusive growth. It is our hope that this monograph will serve as both inspiration and a point of reference for scholars, policymakers, and practitioners seeking to understand and shape the future of the global economy.

Ola Bareja-Wawryszuk, PhD
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CHAPTER I

RE-THINKING THE PHILOSOPHICAL APPROACHES TO DEVELOPMENT: A NORMATIVE STUDY

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Abstract: The research emphasises the conceptual frameworks through which development is understood as a worldview, that is not merely a policy goal or economic process but as a lens through which societies understand progress, human purpose and global order. The purpose of the research is to tackle the various definitions, philosophies and applications of development as a concept in the view to assess its adequacy with post-modern realities, being characterised by shifting social arrangements, climate change, global geopolitical tensions and a predicted civilisational decline. This normative research uses secondary data from the academic literature on development ethics to provide material for comparative analyses, critical comments and conclusions. The paper, as a critical literature review, attempts to examine axiological debates over the notion of development through a range of scientific evidence-based literature to more qualitative critical discourse research. The outcome of this study is to provoke a renewed synthesis of the concept of development as the rudiments for civilisational advancement.
Keywords: development ethics, normative research, critical literature review

Introduction

Since the criticisms evoked in the Meadows Report (1972) towards the growth trends foreshadowing an imminent civilisational collapse, numerous multi-disciplinary criticisms have emerged as a response to the somehow unsustainable conceptualisation and practice of development, which, certainly, are inter-linked by the very fact that the perception one has of development naturally impacts the behaviour adopted towards it. As a matter of fact, the Meadows Report arises in the context of a post-World War II characterised by booming economies and a so-called peace, sometimes referred to as the *pax Americana* in reference the *pax Romana*, an era of the Roman empire from 27 BCE to 180 CE where unprecedented peace and stability within the region lead to significant flourishing of trade, culture and infrastructure. In the same way overconsumption and blatant economic disparities were rife during that period (Thompson, 1982), the same pattern emerged in the western world. In this light, we better understand the core finding of the Meadows Report pointing that if the current growth trends in population, industrialisation, pollution, food production and resource consumption persist, humanity will reach the limits of the Earth's capacity within 100 years. It further states that this will likely result in a sudden and uncontrollable decline in population and industrial capacity. As controversial as it may have been in the epoch the report was

published, where the rapid growth and prosperity seemed to be inexhaustible, it marked a paradigmatic split from the growth-centric doxa by putting forward novel concerns such as ecology, sustainability and human integrity at the epicentre of development ethics debates. Since then, the concept of development has considerably evolved and diverged across school of thoughts, disciplines and geographies.

With the decline of economic growth over the last decades in major economies (Bolt & Zanden, 2020), disenchanted narratives towards growth and development have gained more proportion as societies experience the negative post-growth backlashes of a once idyllic system. Most economies that expanded during the Industrial Revolution are now in a phase of secular stagnation, a phenomenon described by (Summers, 2014; Ford, 2015) as a long-term stagnation in economic growth, due to technological automatism which raises productivity, but harms employment and spend coff declines out of the lowered purchasing power and spending attitudes. This is a clear illustration of the development paradox, where technological advancements mismatch economic dynamics whereas the very purpose of technological development was driven by economic forces, mainly the need for efficiency and productivity.

Whereas the nature of this paper is not to examine purely economic evaluations on development, economic realities cannot be disregarded nevertheless in this normative discussion inasmuch as those realities are created from the very definition we ascribe to development which themselves affect reflexively the evolution of what development means.

The interest in investigating the definitions of development, including development philosophies transformed into practice, is its nature as a primary driving force at all levels of societies, shaping individuals, social groups, religious institutions, political actors and political agendas. Development, in essence, appears to be the inherent and deterministic force guiding humanity which naturally shapes reality. Addressing "development" as a concept, from micro-structural to macro-structural levels, therefore, attempts to radically challenge imposed notions of this terminology in the scope of providing an adequate philosophical foundation to approach development, that would be more coherent with changing social and environmental realities.

Literature review

Philosophy and development

Philosophising about development, at the outset, requires an understanding of what philosophy means or would mean in this specific context and what role it plays in the conception of an idea of development. Whereas in the vulgar, philosophy could take countless forms from proverbs, aphorisms to popular wisdom (Bodunrin, 1991), we ought to adopt the strict sense of philosophy. The contextualised meaning of Oguejiofor (2009) provides that philosophy's role in development, is to contribute to the advancement of the general visible conditions and standards of living, infrastructural improvement and techno-scientific progress. Development, in that lens, would be considerably oriented towards poverty alleviation and material amelioration of tangible factors which affects individuals and communities. Oguejiofor's study exposes a critical questioning in his article, tackling the issue of whether philosophy predates development and what would this imply in the context of African development. This *prima facie* assumption would suggest that there must be a development of philosophy in Africa to lay the epistemological foundations for development to

occur, the rationale being that philosophy would equip the agents of development with virtues that would shape the realisation of development. Hountodji (1983) asserts that African philosophy does not exist, at least in the restrictive approach, and reliance on philosophy would be detrimental for development in Africa. Development should be rather based on science as the standard means of knowledge.

Gasper (2012) suggests that "development", whether understood as economic expansion, industrialisation, urbanisation or as globalisation; as planned intervention; as improvement in general welfare; or as the attainment of valued opportunities, is inherently a "strongly ethically-laden field." Several ethical questions arise when it comes to, for illustration, what kind of intervention should be adopted, who's value would count the most or who benefits and who loses. Ethics, first and foremost, is a subject of philosophy. As put by Goulet (1997), who developed the discipline of development ethics, stipulates that development ethics considers the "ethical and value questions posed by development theory, planning and practice", having as mission the diagnosis of value conflicts. Goulet's founding work in development ethics, *The Cruel Choice,* exposes the paroxysmal goal of development of providing all men with the opportunity to lead full human lives. This notion of 'full human lives' has itself been a widely discussed subject matter in classical philosophy. The most striking reference would be the concept of eudaimonia from Aristotle's Nicomachean Ethics that could be best translated to 'human flourishing' which *per se* has a natural connotation of development.

The meaning of development within international institutions

Development, according to Esteva (2009), has been the subject of what he coins as a 'conceptual inflation' to describe the gradual expansion of the development's semantics. Thompson (1982) explores one of the historically farthest definitions of development, inspired from Strabo's work, showing that in the early Roman empire 'development' arises from the exploitation of natural resources by human industry and ingenuity. Economic strength was estimated by how far the material needs of a population were satisfied. During the nascence of modernity, Esteva (2009) also denotes how development was reduced to economic growth and simplistically associated with 'a growth in the income of a person in economically undeveloped areas' as he puts it. He further states that it was the proposed goal of Arthur Lewis, a prominent figure in development economics, in 1944 and the same could idea was insinuated in the United Nations Charter of 1947. Esteva (2009) found that the interest in social progress, has its origins in the first Report on the World Social Situation of 1952 which was initially dominated by the dogmatic obsession on Gross National Product (GNP) growth characterising the 1950s. The notion of 'social development' arose in subsequent reports but was still vaguely utilised and there was still this duality between economic and social development. In his study, it seems that the first institutional questioning of development was initiated by the Economic and Social Council of the United Nations (ECOSOC) in 1962. This apparently provoked a normative re-assessment of what the topical concept meant as conspicuous in the Proposals for Action of the First UN Development Decade (1960-70), advocating that:

> *The problem of the underdeveloped countries is not just growth, but development... Development is growth plus change. Change, in turn, is social and cultural as well as*

> *economic, and qualitative as well as quantitative... The key concept must be improved quality of people's life.* (United Nations, 1962, p. 2)

However, this initiative did not go unanimous and was even rejected by the World Bank's president, Robert S. McNamara, who argued that the attempts to desacralise GNP as the primary metric of growth did not go very far.

In 1970, the International Development Strategy made a call for a 'global strategy' that would encompass both economic and social life and was followed by a UN resolution to establish a project to develop such an approach to development and planning in the scope of implementing them in policy formulations and programmes. In 1974, the Declaration of Cocoyoc made several remarks on how previous actions to foster development miserably failed and resultingly advocated that the purpose of development should be as follows:

> *Development should not be limited to the satisfaction of basic needs. There are other needs, other goals, and other values. Development includes freedom of expression and impression, the right to give and to receive ideas and stimulus. There is a deep social need to participate in shaping the basis of one's own existence, and to make some contribution to the fashioning of the world's future. Above all, development includes the right to work, by which we mean not simply having a job but finding self-realization in work, the right not to be alienated through production processes that use human beings simply as tools.* (The Cocoyoc Declaration, 1974, p. 4)

In 1975, the concept of an 'another development' emerged, which called urged the redefining of development around a human-centric vision by integrating communities in some aspects of development processes. (Dag Hammarskjöld Foundation, 1975) The same year, an outcry was noted during the Seventh Session of the United Nations General Assembly by demanding to devise a strategy that would be more effective than its predecessors of the International Development Strategy of 1970. (Esteva. 2009) In 1976, the International Labour Organisation (ILO) made a re-emphasis on the basic needs approach by asserting the aim of achieving a certain specific standard of living before the next millennia. (ILO, 1976)

Following the 1980s, which was believed to be a lost decade for development, the 1990s, in contrast, experienced the formation of a new development ethos. In the global North, the need for a 'redevelopment' was at the epicentre of development ideologies with the objective to replace what was maldeveloped or the obsolete. However, the redevelopment concern in the global South was the destruction of adjustment processes built on the span of the last 30 years to remain competitive in the global market by opening their economies as gateways to a form of neo-colonisation of their informal sectors. (Esteva, 2009) Most importantly, in the light the previous dissensus around the semantics of development and the unprecedented international trends, the United Nations Development Programme (UNPD) in 1990 published its first Human Development Report which provided a remodelled definition of development, that is, 'development is the process of enlarging people choices, enhancing human capabilities, and ensuring access to resources, freedoms and opportunities necessary for a long and fulfilling life.' (UNDP, 1990) This definition has stood the test of time as today it is considered as the universally accepted definition of development. However, the

World Bank in its 1991 World Development Report still maintained a differentiation between 'development' and 'development in the broader sense' by describing the former as increaseee in material consumption, education, health and other tangible factors. (World Bank, 1991)

Importantly, in 1987 was published the Brundtland Report which showcased the novel terminology of 'sustainable development' described as a kind of development that would be able to meet immediate needs of the present without compromising the ability of the future generations to meet their own needs similarly. (World Commission on Environment and Development, 1987)

The evolution of the academic literature on development

The notion of development remained for a long time rooted in the classical and neo-classical economics tradition, omitting various aspects of human life that would at a later stage become integral in defining development. McGillivray's (2018) analysis of the meaning of development noted that the earlier academic literature on the topic was characterised by a two-fold paradigmatic division, with the major school of thought understanding development as modernisation or as historical progress. McGillivray elaborates that the former was enlightened by the influential work of Rostow (1960) on the stages of economic growth with would suggest that economies' development follow a universal progress from the traditional, transitional, take-off and high mass-consumption stages. Approaching development, on the other hand, as historical progress originates to earlier doctrines of Karl Marx, who suggested that in his writings thar societies ineluctably undergo through four stages, being the primal state, feudalism, capitalism and culminates with the ideal communist society.

The work of Louis-Joseph Lebret in the 1940s is widely recognised as being the precursor of a new academic field within development economics consecrated to the normative study of ethics in development. (Gasper, 2008) Lebret first acknowledged the multidimensionality of development by postulating that this concept inherently involves economic, social, political, environmental and spirituals facets. (Goulet, 2006) Lebret understood development as a state when every human being in society is entitled to benefit from the 'structural and institutional conditions which foster universal human ascent.' (Goulet, 2006) Marangos, Astroulakis, and Triarchi (2021) also posits that Mahatma Ghandi's practical philosophy contributed to redefining development in his attempts to instigate institutional reforms and applying social planning in India.

However, it was Denis Goulet's work that paved the way for the new sub-discipline of development ethics. He advanced the discipline from the economic humanism of Lebret to a comprehensive ethical framework for social change. He distinguished between descriptive and normative uses of the 'development' terminology and insisted that ethics concerns both its ends and means, embedding moral reflection into political choices, economic strategies and technical methods. Through concepts of existence rationality which referred to the alignment of development with societal values and the concept of vulnerability which he defines as exposure to uncontrollable forces human are subjected, Goulet addressed life-sustenance, self-esteem and freedom as universal goals. (Thirlwall, 2008; Marangos & Astroulakis, 2009; Astroulakis, 2011) Goulet's 'disciplined eclecticism' positioned development ethics as an interdisciplinary field diagnosing value conflicts, evaluating policies and integrating insights from social sciences, humanities, ecology and philosophy. Goulet established development ethics as both a normative and applied discipline, committed to ethnographically informed, ethically oriented and people-centred development. (Gasper, 2008)

Peter L. Berger (1974) brought development ethics into the study of international development in his book 'Pyramid of Sacrifice' by asserting that the world should not be influenced by a particular development pattern, which would be imposed by the developed world, and additionally argued that the study of development economics and social sciences should be value-neutral. Both Berger and Goulet have been remarkable advocates in the application of development ethics in the agenda of development practitioners and policy analyst. Conspicuously, there has been a worldwide appreciation of development ethics by scholars in the late 1970s, and it is believed to have been the revival of a philosophical tradition. Researchers, development practitioners and policy makers in Asia ambitioned the establishment and application of a normative framework of development which encapsulates ethical notions founded based on cultural and societal tradition in India, South Korea, Sri Lanka, the Philippines and Singapore. Such attempts were also noted in Latin America during that same period. One of the most popular scholarly works was from the Argentine Philosopher Mario Bunge who puts forward the term of an 'integral conception of development' in his 1980 book 'Philosophy and Development'. (Crocker, 1991)

The Swedish economist, Gunnar Myrdal, of Keynesian tradition has also significantly contributed to defining development in his article 'What is Development?' describes it as:

> *By development I meant the movement upward of the entire social system... This social system encloses, besides the so-called economic factor, all non-economic factors, including all sorts of consumption by various groups of people; consumption provided collectively; educational and health facilities and levels; the distribution of power to society; and more generally economic social and political stratification; broadly speaking institutions and attributions.* (Myrdal, 1974, p. 189)

In 1980, the work of Amartya Sen redefined development as the expansion of substantive freedom to lead lives they have reason to value, a view grounded in Kant's concept of human capabilities. Drawing from Adam Smith's analysis of necessities, Marx's vision of emancipation and Aristotle's eudaimonia, Sen's capability approach placed human well-being, not as mere economic growth, at the epicentre of progress. In rejection to the value-neutrality of neo-classical economics, he postulated that ethical considerations are integral to understanding poverty, inequality and freedom. For Sen, poverty is capability deprivation and true development lies in empowering individuals to achieve the lives they find meaningful and fulfilling. In fact, the definition of development provided by the UNDP in 1994 was considerably inspired by the work of Amartya Sen. (Gasper & Truong, 2005; McGillivray, 2018) Later on, Anand & Sen (2000) made another significant contribution in the literature by introducing sustainability into a definition of development. Anand & Sen stipulate that sustainability should be seen as a concern of inter-generational equity in relation to the future generations, which is clearly outlined in the Brundtland Report as stated earlier.

Development ethics has gradually evolved over the years into a distinct self-conscious interdisciplinary field within the realm of international development and development studies. (Goulet, 1997; Gasper & St. Clair, 2010; Wilber & Dutt, 2010) Although the field of development ethics has advanced and increaseeingly diversified and specialised in more recent academic works, academicians have maintained the definition of development of their predecessors, mainly from Sen's capability approach with the theoretical foundation of Denis Goulet. (Marangos *et al.,* 2021)

Methodology and research materials

This study employs a normative research design, in line with the development ethics' tradition, in the form of a critical literature, using secondary data from academic sources, policy documents and institutional reports. The aim is to evaluate philosophical approaches to development in the light of contemporary challenges such as climate change, shifting social structures and geo-politics to some extent. The analysis involves:

- Conceptual mapping: identifying major philosophical approaches and institutional definitions of development.
- Historical-comparative review: tracing the evolution of the concept of development across time and contexts.
- Critical discourse analysis: examining ethical and axiological dimensions underpinning development theories.
- Normative evaluation: assessing the relevance of the studied conceptions and their coherence in post-modern realities.

Discussion and critical analysis

Clearly, the objectives of development have fallen short, inasmuch as it can be postulated that the objectives of development ethics have encountered the same failure, to direct humankind to a higher state of existence. The diagnosis of this systemic failure appears to be a rigorous work insofar that empirical evidence demonstrate that societies demonstrate conspicuous signs of atrophy and social recession, but also the ecological integrity of the Earth has been strikingly affected over the last decades from increaseeing exploitation. The academic literature seems to have already settled the definition of development, in the big picture certainly, as most definitions of development englobe more or less the same notions though described differently, it would be of a natural imperative to investigate radically the semantics of development by putting into question the universally conceptions previously articulated. Critics have approached this debate through different perspectives and ideological lenses. The critical discourse in the ethnographic school of development ethics have long criticised the concept of development as an ideologically imposed notion of what would be viewed as 'under-developed' nations through colonial domination. (Esteva, 2009) As Escobar (1995) asserts, the problematisation of poverty by the Western discourse and so-called international organisations has been a critical aspect in constructing the discourse on development and provided a justification for intervention in the economies of the less developed nations. Sachs (1992) articulates that poverty was discovered after World War II, whereas in the past, development was understood as the cultural enlightenment brought by colonial presence in 'uncivilised' lands and not simply poverty alleviation. Development, exclusively founded on Western knowledge system, was brought in the same fashion as Christianity was brought in the Third World that is without cultural consideration and the marginalisation of non-Western knowledge systems. For instance, the Gazmuri & Morandé (1984) observed how the adoption and dominance of North American sociology in the 1940s and 1950s in Latin America set the stage for a purely functional conception of development. The injection of development within lesser developed societies or those untouched by this global hegemonic order has been stated in the discursive literature as neo-colonialist and in other cases as neo-imperialist, with the endeavour to exploit those countries by putting them in a

similar economic structure that would require the intensive exploitation of natural resources, productivity and productive capital, the latter which those countries do not fully possess. In the broader perspective, to be able to exploit and capitalise over factor endowments developing economies must trade with the developed world which possess the necessary technology to transform such materials into valuable goods. By driving smaller economies into the global trade system, they are brutally crushed by the international competitiveness and become dependent on countries buying their resources, that is the First World. This creates a 'development trap' for developing economies where constant export of such primary materials must be constantly exported to sustain a stable balance of trade and revenues for the State, which often attract the greediness of the corrupt mind which would voluntarily thwart national development. Esteva (2009) argued that dependency, corruption, terms of trade, unequal exchange and market imperfections among others are major factors which obstruct development aspirations of the developing world. Therefore, by the creation of a discourse around development and its proliferation within other societies, this creates a reality characterised by the economisation of life and the forceful integration of the vernacular societies into the world economy. (Rahnema, 1991)

There have been cases of closed economies rejecting the influence of the western world and globalisation. The most interesting case study would be Bhutan which has been an isolated economy before the 1960s and now categorised as a semi-closed economy. Since the 1970s, the Fourth Dragon King of Bhutan has implemented a unique metric of well-being of the Gross National Happiness (GNH) which at that time already encompassed tangible and intangible factors required for well-being. This shows how different conceptions and definitions of development emerge when countries are uninfluenced by globalisation. Other alternatives to development also emerged such as the 'Buen Vivir' social movement in Latin America which advocates for development based on indigenous traditions rather than the modern euro-centric tradition. (Gudynas, 2011) The innovation brought by this movement is the inclusion of the notion in the Constitutions of Bolivia and Columbia. Certainly, the Communist regime of the Soviet Union remains one of the most popular alternatives to the capitalist development ideology but collapsed, leaving millions in poverty and famine. Whilst it is a practical limitation in the study of development ethics to test the value of ideas and concepts, the Cold War along with the breakdown of the Soviet bloc somehow evidenced the superiority of the Western economic values over communism at the global level.

Within the global community where various cultures collide, Ivan Illich outlined the cultural homogeneity that was proned by globalisation and raised the issue of cultural erosion. (Sachs, 1992) With due consideration to the postulation of Goulet who claimed that the normative attribute of development ethics makes it universal, it is understood that development in its conception and application should similarly be universal, and the necessary social change should accompany development goals. Therefore, the universal inherence of development jeopardises the historical and cultural inheritance of various developing economies which would simulate western models and behaviour as it is perceived as a model of development. In the recent times, concept such as a global culture has become increaseeingly popular and certain societies have made a radical shift towards the abusive manifestations of globalisation considered as ethnic or identitarian threats.

With particular emphasis on the normative realm of development, as stipulated before the definition has not moved significantly since the first Human Development Report, which dates to three decades ago. The world order has remarkably shifted since then with new threats and

concerns. The pandemic has revealed an enormous part of the systemic vulnerability on which the global economy is built upon. Numerous wars have been declared and the nuclear threat is omnipresent. It seems like the epoch of peace and relative global stability is far gone. We should ask ourselves if core notions such as human security should become central in defining development, which would be quite a reversal of the previous trend in the evolution of the meaning of development, which was approached by the 'basic needs' philosophy and then underscored more qualitative notions like fulfilment that could evidentiate the obsolescence of the previous approach in an era where such basic needs where already acquired by a majority of the known world. Human security is objectively one of the most crucial needs of human existence, and social contract philosophers even theorised that societies and their constituents are constructed for this very purpose. However, the effectiveness of redefining development is highly doubted. The concept of sustainable development, although being as old as the modern definition of development itself, did not result in any significant in the improvement in natural systems. In fact, the Stockholm Resilience Center alerted that six of the nine planetary boundaries have already been transgressed. (Richardson *et al., 2023)* The issue shifts from the normative to the applied, indicating that the failure resides in the into processes of enacting development. The lack of political will has been one major hurdle to sustainable development put under the spotlight. The notable failure of the Kyoto Protocol of 1997 has clearly demonstrated the blatant inobservance of highly polluting economies towards reducing pollution, such the United States of America which never ratified the now defunct Protocol. This can be linked to the intrinsic limitations of development ethics which is unauthoritative by nature, but environmental sciences are indeed epistemologically authoritative, but this does not inevitably alter government policies in the absence of political will. Certainly, if the issue is political, therefore the issue is characterised as a structural one within societies of which those that were at the forefront of the new international liberal order.

In response to the general hopelessness conveyed by the empirical evidence illustrating the health of economies, societies and ecosystems, a rather new movement termed as 'collapsology' coined by Servigne, Stevens and Cochet (2015) has emerged in France and developed by several academics from the country. The main premise of their arguments is largely inspired by the findings of the Meadows Report and recent scientific evidence forecasting an upcoming civilisational collapse. Cochet (2019) asserts that the acceptance of a material decline by reducing complex economic activities and downscaling is necessary to prepare for a post-growth world. This movement rejects the whole concept of development and inversely attempts to advertently de-develop economies to mitigate the effects of an imminent collapse. Despite being labelled as a marginally radical approach, they share the same characteristics as environmentalist movements which is significantly popular among the conscious segment of the population who recognise the overall damage being caused to ecosystems and those who are facing the natural hazards of the Earth more frequently and intensity. The singular difference is that collapsologists do not envision the possibility of development being asynchronous with the ecological realities and thus concepts such as sustainable development are devoid of any pragmatic sense because its embedded notion of intergenerational justice imply that future generations should have their material needs similarly met as the actual generations. Therefore, it does not recognise the gradual decrease in consumption that it necessary for environmental preservation which may consist of abandoning the satisfaction of certain material needs or at least the enhancements on such needs. Choices and opportunities could be limited,

access resources strictly controlled, certain freedoms stripped away, and a fulfilling life would only be metaphysical but such concessions would be necessary for the survival of humanity.

To discuss further on the normative dimension of the concept of development, it can be argued that the notional foundation is based on a short-lived period of prosperity that only lasted for nearly 30 years after the World War II which corresponds to the creation and culmination of the development discourse and peripheral concepts. Grounding the ideals of development on this specific context of development of selected countries, namely the victors, is inevitably unrepresentative of the reality that slow development, dispersed prosperity, instability, geo-political tensions have characterised a larger part of humankind's history since the creation of societies and early forms of economies. Even though these aforementioned characteristics have been omnipresent and rife throughout modern industrial societies, the same historical pattern has been observed by historians, which goes beyond the creation of modern economies. For example, Erdkamp (2019) studied the rise and fall of the Roman Empire and noted that the civilisation experienced a burst of economic prosperity marked by over-consumption patterns and subsequently the Roman civilisation has spectacularly declined. Toynbee (1947) also noted this pattern in this anthropological study of a larger sample of civilisations. Whilst the causes are multifactorial, only the trend is of interest to us, that is the rapid downfall of social organisations after such ostensible economic prosperity which appear to anomalous in nature. Thus, anchoring the concept of development on this economic anomaly irrationally puts this definition as an unachievable vision that makes development and development ethics a field stuck within the normative framework which means that they will remain discussions about how development should occur. This normativity puts development as an endless goal, and not as a state that can be attained that is perhaps the paradox of development. Development ethics should be more informed about the cyclical determinism pending on all civilisation and observe this idea within conceptions of development or articulate definitions of development that would fit each stage of the cycle, for example, for each stage of the Rostow model. The most suitable exemplification would be in reference to Chinese millennial history, which has seen various cycles of rise and fall since its first classical golden age during the Han Dynasty (200 BCE – 220 CE), the Tang Dynasty (618 – 907CE), the Song Dynasty (960 – 1279 CE), the Ming Dynasty's Early Period (1368- c. 1433) and the Qing Dynasty's High Qing Era (c. 1680 – 1790). Now, the People's Republic of China, after being left out from the race of industrialisation, is competing as one of the leading economies in the world.

Conclusion

The philosophical exploration of development reveals that its prevailing definitions and applications are deeply rooted in historically contingent, growth-oriented paradigms that fail to fully address the complex realities of the post-modern era. While the evolution of development thought from early economic determinism to multidimensional human-centred framework has broadened its scope, the core assumptions remain tied to a transient period of prosperity that is neither universally representative nor historically sustainable. The persistence of these normative ideals, despite mounting evidence of ecological degradation, social fragmentation, and systemic vulnerability underscores the limitations of development ethics as a largely prescriptive rather than operational discipline.

Alternative models challenged the universality and desirability of mainstream development, highlighting the need for culturally contextual, ecologically coherent and security-oriented redefinitions. However, the intransigence of entrenched political and economic structures suggests that conceptual innovation alone is insufficient, the practical realisation of any re-envisioned development framework depends on structural transformations and political will. Ultimately, a credible philosophy of development must recognise civilisational cycles, account for the ecological thresholds, align its objectives with both the material and existential dimensions of human well-being whilst accepting that development may not be a linear, universal progression but a dynamic and adaptive process shaped by historical, cultural and environmental constraints.

CHAPTER II

STRATEGY FOR BUILDING RESILIENCE IN THE BANI WORLD

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Abstract: This chapter reviews available definitions of resilience and identifies empirical examples of strategies for building resilience in the BANI world. Using a systematic literature review (SLR) of Scopus, Web of Science, and Google Scholar, the author presents selected types and strategic approaches to building resilience (EU, NRRP, Deloitte, BSI, AG). The chapter also outlines developed model approaches, namely: a comprehensive system for responding to threats as part of a resilience-building strategy, and human-capital resilience. The research demonstrates the relevance of a multidimensional approach to resilience understood at the social, regional, organisational, team, and individual levels.
Keywords: strategy, resilience, BANI, human-capital resilience resilience, organisational resilience

Introduction

The contemporary world of BANI, first defined in 2020 by J. Cascio, describes an uncertain reality, a world of chaos difficult to understand, which requires a new way of thinking and undertaking specific activities and solutions in the management of organisations. The BANI reality is described as: fragile (Brittle), anxious (Anxious), non-linear (Non-linear) and incomprehensible (Incomprehensible) (Roux and Sutton, 2022). Hence, for organisations to dwell in the 'brittle' world, in times of social, economic and environmental challenges, resilience is the element and it is the strategy that allows an incident to survive both short (Martin et al., 2016) and long term (Pendall'a et al., 2010), all thanks to but not limited to actors and leaders, (Bristow and Healy, 2014; Masik, 2018).

Recently, Covid-19 Pandemic and the War in Ukraine have highlighted the need to strengthen human-capital resilience as well as organisations' resilience by means of European initiatives and national solutions for resilience instruments. Part of the Recovery Plan for Europe was the creation (2021) of the European Fund for Reconstruction and Resilience Enhancement. The Polish government, to meet the requirement to boost the domestic economy and the stipulation of the EU Fund, adopted the National Recovery Plan and Resilience (NRRP 2020-2026) all to facilitate withstanding crises. Polish Recovery and Resilience Plan (NRRP) correlates with the EU Council's recommendations for Poland and the National Reform Programme.

The relevance of resilience multidimensionality aspect and the research gap on resilience-building strategies, instigated this literature study. Thus this article aims at review resilience definitions available in the literature and to look for empirical examples of resilience strategy building in BANI world drafting the two - research question: To what extent does the strategy correspond to multidimensional resilience built in BANI world and the research hypothesis: Resilience in the BANI

world involves human and organisational capital for which a comprehensive response system is built. Based on the literature review, selected types of resilience and strategic approaches to building resilience are presented.

Research methods

To this end, in the Scopus, Web of Science/WoS and Google Scholar databases, an SLR (*systematic literature review*) was carried out. The first stage was a selection of articles dealing with the topic of 'resilience' in Scopus and WoS, the second stage was analysis of findings on 'resilience in organisations' and 'strategy' (in Google Scholar), while the third stage was a research in the context of European Union instruments and government documents and secondary empirical research on resilience strategies built in companies worldwide.

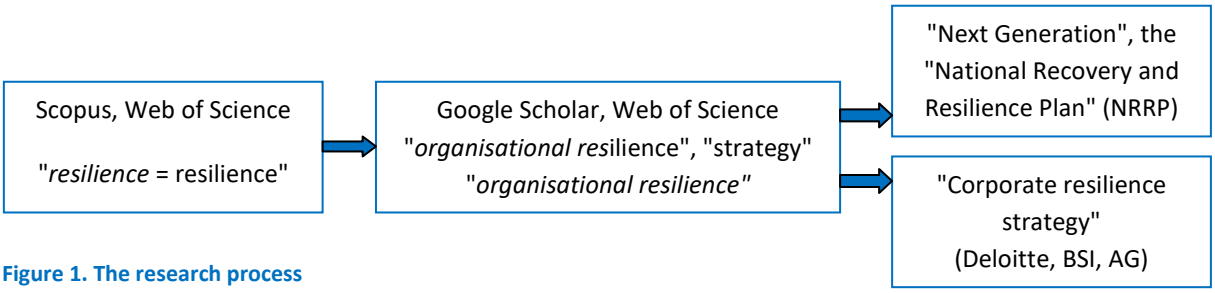

Figure 1. The research process
Source: own study.

Literature review on resilience

Resilience is an ambiguous concept, as exemplified in Synonym.net [translator's note: this is Polish online thesaurus], displaying exactly *111 synonyms*[1] [translator's note: the synonyms are translated into English from a Polish synonyms website] of the word *resilience,* grouped thematically in different contexts:

- resilience – as in durable material;
- resilience - as in resistant to something;
- resilience – as in consistency in pursuit of a goal;
- resilience – as in zealotry;
- resilience – as in human performance;
- resilience – as in not being susceptible to something;
- resilience – as in robustness;
- resilience – as in health resilience;
- resilience – as in capacity of the body.

[1] Resilience is: strength, invulnerability, indissolubility, insensibility, indestructibility, load-bearing, solidity, stability, rigidity, durability, toughness, endurance, not susceptible to something, insensitive to something, resilience, hardened, continuity, bravery, fortitude, consistency, consistency in action, consistent, methodical, firm resolve, steadfastness, tenacity, implacability, steadfastness, willpower, constancy, persistence, stubbornness, perseverance, perseverance in endeavour, determination, exuberance, activity, determination, energetic, fervour, vehemence, passion, uncontrollability, devotion, self-sacrifice, fiery, sharpness, flamboyance, excitement, excitement, dedication, joy, self-denial, strength, soaring, sublimity, commitment, fierceness, fierceness, fervour, fervour, fervour, fervour, resourcefulness, constipation, fierceness, fierceness, fervour, fervour, vivacity, vivacity, form, fitness, fitness, vigour, vigour, vigour, fitness, vigour, insensibility, indifference, resistance, resilience, resistivity, defiance, heroism, fortitude, firmness, fortitude, balance, risk, strength of spirit, calmness, prowess, cold-bloodedness, iron nerves, immunization, horse health, immunization, good condition, energy, hardiness, momentum, energy, capability, potential, power, physical strength, physiological condition, physical vigour, verve and health. https://synonim.net/synonim/odporno%C5%9B%C4%87

The concept of 'resilience' has emerged back the 1970s in the *natural sciences and engineering* and referred to a shocks resistant system and the speed it returns or 'rebounds' to its pre-shock state (Holling, 1973), and in *psychology* as the ability to cope with difficult situations, adaptation and change without losing the possibility of future development (Fonagy et al., 1994). In the PWN dictionary [translator's note: online dictionary by National Publishing House], resilience is defined in the context of *medical science*, firstly as a state of invulnerability to pathogenic microorganisms[2] and secondly as the ability to defend against the entry of pathogens into the body[3]. In *social sciences*, resilience is considered a characteristic of individuals, organisations and communities that allows them to cope with threats (Sienkiewicz-Małyjurek, 2020). Other authors claim that enterprise's resilience is the strong ability to effectively absorb and develop responses to situation-specific events that threaten the enterprise and the enterprise's engagement in transformative activities within these events (Lengnick-Hall et al., 2011). According to the British Standard Institution (2014), the British Standard Institution explains *organisational resilience* as *the sustainability of an organisation*, i.e. the the ability of an organization to anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper. According to some authors, organisational resilience should not only be seen as the ability of an organisation to recover from a disruption (Bhamra, 2015). Organisational resilience is an overarching concept that not only allows companies to continue their business, but also to grow, learn and progress regardless of the environment. Resilience can be a constructive mechanism for building an organisation's competitiveness. The literature also highlights organisational resilience as the strategic ability of a firm to maintain a positive financial balance sheet despite operating in a complex business environment and challenging conditions and uncertain circumstances (Siang Meng et al., 2017).

An analysis of the literature studies (Table 1) based on articles published in Scopus and Web of Science allowed us to discern resilience types.

Table 1. Characteristics of types of resistance based on SLR (Scopus and WoS)

No.	Types of resilience	Characteristics
1.	Individual:	– is based on a competency-based model (Macchi, Silva, V.V., Ribeiro, J.L.D. , 2022), – is an emerging competence, one of the most important competences of a manager (Varajao, J., Silva, H., Pejic-Bach, M., 2022), – Employee resilience is strengthened by key competence areas (flexibility, adaptation, motivation, communication, (2) research, analytical sensitivity, ethics, diversity, (3) epidemiology, (4) readiness and (5) employability) (Czabanowska, K., Kuhlmann, E., 2021), – The resilience of future employees is improved by: (1) general preparedness, (2) individual characteristics and competence, (3) reasonable relationships, (4) creative behaviour and improvisation skills, (5) ability to reflect and learn, (6) emotional effectiveness (Herberg, M., Torgersen G.-E., 2021).
2.	Team:	– Family resilience is supported by warmth, acceptance, trust, open communication and constructive conflict resolution (Skinner, et. all., 2021).

[2] https://encyklopedia.pwn.pl/szukaj/odporno%C5%9B%C4%87.html

[3] https://encyklopedia.pwn.pl/szukaj/odporno%C5%9B%C4%87.html

[translator's note: definitions are from Polish websites and translated into English]

From a medical point of view, there are three lines of defence against pathogens in the human body: line I (skin, mucous membranes, intestinal flora and enzymes), line II defence - phagocytes (macrophages and granulocytes) and line III defence - lymphocytes (T and B cells). Two types of defence mechanisms work together in the human immune system: innate (non-specific) immunity, which is mediated by the I and II lines of defence, and acquired (specific) immunity in the III line of defence. https://zpe.gov.pl/a/jak-dziala-uklad-odpornosciowy/D1HYsEnka.

3.	Organisational:	– analysing external and internal factors to emerge from complex contingencies (Silva, ON., Toro, L.L., Maldonado, F.J., 2022), – dimensions of organisational resilience are dynamic capabilities and social capital (Martinelli, E., Tagliazucchi, G., Marchi, G., 2018), – Resilience leads to higher levels of self-discipline and greater self-efficacy of organisational units (Lee, J. Y., Yahiaoui, D., Lee, K.-P., & Cooke, F. L., 2022).
3.	Organisation:	– The ability to recover from a period of disruption (Burnard and Bhamra, 2011), – a strong ability to effectively absorb and develop responses to situation-specific events that threaten the company and the company's involvement in transformative activities within these events (Lengnick-Hall Beck et al., 2011), – the ability to continue the business by maintaining a stock of resources that allows the organisation to be flexible (Sheffi, 2005), – the company's ability to maintain staffing levels and revenue to adapt and survive in turbulent times (Biggs, 2011), – a company's ability to learn, innovate and reorganise its business model, which includes not only adaptation but also transformation (Dahles and Susilowati, 2015).
4.	Regional:	– includes competence, scientific and technological knowledge financial capital and public and social security (Masik and Rzyski, 2014), – the ability of a region to reconfigure an economy that is adaptive and, through its structure (firms, industries, technologies and institutions), is able to maintain an acceptable growth path in output, employment and wealth over time (Martin, 2012).
5.	Social:	– is the ability of a community to cope with external stresses and disruptions as a result of social, political, and environmental changes (Pallars-Blanch, 2015), – refers to a society characterised by strong social cohesion and a common value system, signalling a return to the status quo (Cabras and Mount, 2016).

Source: own study.

A strategic approach to building resilience

In building resilience, actors and institutions play a special role (Bristow and Healy, 2014; Masik, 2018), the so-called 'key' actors who have long-term visions and the capacity to anticipate social and economic tensions and symptoms of shocks (Davies, 2011). Decision-makers with their actions can: pursue anticipatory policies, or respond to change by taking reactive measures (Bristow and Healy, 2014).

The European Recovery and Resilience Facility (RRF) came into effect in February 2021 to mitigate the social and economic impact of the Covid-19 pandemic[4]. The unprecedented EU recovery instrument is Next Generation EU, to help repair social and economic damage and disburse €723.8 billion in grants and loans to EU Member States[5]. Next Generation makes the EU's vision a reality in five areas, including *building resilience:* human-capital resilience, *organisation* and *regional*[6]:

- driving technology and digitalisation (shaping digital skills);
- building a more resilient Europe (by supporting education in various sectors);
- Europe's health and security (preparing health services for crises);
- strengthening Europe in diversity;
- Green Deal (climate action).

The Polish government, in response to the EU Recovery and Resilience Fund, adopted the National Recovery and Resilience Plan (NRRP), in line with the recommendations of the EU Council for Poland

[4] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html.
[5] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html.
[6] https://next-generation-eu.europa.eu/index_en.

(and *the National Reform Programme*), with 267 billion PLN, 57 investments and 54 reforms in the following areas[7]:

A. Economic resilience and competitiveness;
B. Green energy and reduction of energy intensity;
C. Digital transformation;
D. Efficiency, accessibility and quality of the health care system;
E. Green, smart mobility;
F. Improving the quality of institutions and conditions for the implementation of the NIP;
G. REPower EU.

Poland has negotiated non-refundable investment funds of EUR 23.9 billion and EUR 11.5 billion in concessional loans, which will be invested in a manner strictly defined in the National Recovery and Resilience Plan[8]. *The strategic objective of the NRRP* is to rebuild the development potential of the economy lost as a result of the pandemic and to support the building of sustainable economic competitiveness and an increaseee in the living standards of the population over the long term, which will be done in particular by accelerating the development of a low-carbon, closed-loop economy that makes responsible use of environmental resources, as well as digitally driven development[9]. The NRRP aims to build both *human, organisational and regional capital resilience,* by means of but not limited to[10]:

- matching skills to labour market requirements – adaptability, lifelong learning, soft skills as competences, enable people to stay or adapt to labour market requirements; new skills and qualified staff are sought to respond to trends related to digitalisation, robotisation, automation, including unmanned mobility and artificial intelligence,
- the application of digital competences - the crisis revealed weaknesses related to the lack or insufficient level of digital competences of the society, the failure to use common solutions concerning the application of flexible forms of employment and organisation of working time; the application of digital technologies is a necessity for the preservation of jobs, the maintenance of the operational continuity of enterprises, the competitive advantage of the Polish economy; examples are: remote work, the launch of sales through digital channels, the change of the mode of providing development, educational or advisory services from stationary to remote,
- improving the education system, lifelong learning mechanisms towards a better match with the needs of the modern economy, increaseeing innovation, increaseeing the transfer of new technologies.

From a strategic point of view, preventing unforeseen incidents or mitigating the effects of crises are actions that condition the return to development, thus fostering its resilience (van Bergeijk et al., 2017). In the literature, authors point out that the resilience of an organisation is the result of its development at different levels of management: strategic as well as operational (Ismail, 2011; Duchek, 2019). From a strategic perspective, 'organisational resilience' is a popular term in literature

[7] https://www.gov.pl/web/rolnictwo/krajowy-planu-odbudowy-i-zwiekszania-odpornosci.
https://www.gov.pl/web/obrona-narodowa/krajowy-plan-odbudowy-i-zwiekszenia-odpornosci.
[8] https://www.gov.pl/web/obrona-narodowa/krajowy-plan-odbudowy-i-zwiekszenia-odpornosci.
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[10] https://www.gov.pl/web/planodbudowy/kpo-wyslany-do-komisji-europejskiej.

studies (Annarelli, Nonino, 2016; Bouaziz, Hachicha, 2018; Burnard et al. 2018; Cavaco, 2015; Herbane, 2019; Kantur, Iseri, 2012; Lengnick-Hall et al., 2011; Morais-Storz, 2018).

Deloitte, at the end of 2022, conducted the latest empirical research, in a world referred to as BANI, on *strategies for building resilience in organisations* in companies (N = 20) with operations worldwide; valued at several billion dollars (revenues of at least four billion dollars per year). The entities surveyed offered services to corporate and retail customers in: North America, UK/EU and Asia-Pacific in a variety of industries (consumer goods, telecommunications, technology, automotive, retail, manufacturing, healthcare and life sciences, and financial services) (Deloitte, 2022). Interviews were conducted with executives who held board positions or served as executive vice-presidents to find out what actions they were taking to increaseee resilience. In line with *the research method* set up, the responses obtained were coded to determine (Deloitte, 2022):

A. the scope of *the* resilience-building *strategy*;
B. *the nature of the* activities carried out;
C. *Resilience-building tactics* and *KPIs*;
D. and *obstacles to building resilience*.

ad. A) When thinking about *the scope of building a resilience strategy*, the executives of the companies surveyed perceived it as:

- *a company-wide* strategy, i.e. a coordinated organisational strategy for the company,
- or *operational* strategy that has been used in the chosen area of operation.

ad. B) As in Deloitte's empirics, *the nature of the strategic actions of the* companies studied concerned actions that provide short-term resilience, i.e. *defensive*, as well as long-term *offensive,* more daring.

ad. C) *Resilience-building tactics* and *resilience KPIs* (Deloitte, 2022) were used to respond to crises in companies that addressed:

- financial indicators (profit and loss, cash flow, sales);
- operational indicators (diversification, redundancy of supplier condition);
- employee moods (surveys, feedback, turnover);
- customer feedback, customer sentiment and satisfaction levels;
- accuracy of forecasts, scenario planning, measures of progress i.e. success;
- innovation objectives.

ad. D) The key *obstacles* to building a corporate resilience strategy were (Deloitte, 2022):

- management and a strong culture of resilience;
- lack of human resources interested in building resilience;
- information from employees and efficient communication;
- lack of management interest and short-sightedness;
- difficulty of measurement/lack of relevant KPIs;
- high implementation costs (time, resources and/or finances);
- analyses requiring large amounts of data (e.g. AI);
- Scenario planning, forecasting, war games, threat analysis;
- diversification, embedded redundancies, contract optimisation.

As a result of *mapping the relationship* between *the extent of resilience* and *the nature of activities*, *four approaches to building resilience* (Table 2) were discerned in the strategies (Deloitte, 2022), namely:

1) defensive, operational - meant immediate action in response to a single disruption, with the aim of quickly rectifying the problem and 'avoiding disaster';
2) defensive, company-wide - viewed resilience building as a coordinated strategy aimed at enabling the company to recover quickly from a crisis;
3) offensive, operational - characterised by greater activity, but confined to only part of the organisation, usually the most vulnerable to disruption; companies wanting not just to survive an incident, but to see it as an opportunity to enter new markets, grow their business and improve their performance;
4) offensive, company-wide - resilience was treated as a company-wide strategic objective, with the organisation taking proactive steps to prepare for potential incidents; in the long term, for this type of business, disruptions were sources of new opportunities.

Table 2. Strategic approaches to building resilience in organisations

Offensive	***Nature***	***Offensive, operational*** A proactive approach to the transformation of individual or specific parts of the business.	***Defensive, operational*** A crisis management approach that enables the affected department to recover quickly, usually in isolation from the rest of the business.
Defensive		***Offensive, company-wide*** An interdisciplinary, company-wide approach with the strategic objective of transforming the entire business.	***Defensive, company-wide*** Company-wide, coordinated action to prepare the company for crises and risks.
		Scope	
		Operational	Company-wide

Source: compiled from Deloitte, 2022.

The research found that managers building resilience *into operational-focused strategies* listed fewer risks than when building resilience into multiple aspects of the organisation. In building *a company-wide* strategy, the following were particularly prominent: threats and issues in the supply chain and climate (environmental and 'green deal' issues), as well as digitalisation and/or technology. In contrast, for issues: regulatory, operational infrastructure, financial management, it was the *operational* strategy that highlighted fewer risks. (Deloitte, 2022)

A study of organisational resilience conducted by the *British Standards Institution* group (BSI, 2018) and researchers at Cranfield University on global companies, found *16 elements related to building a resilience strategy* in 4 areas:

- people, including: culture, awareness, fit, community engagement, training and testing;
- leadership, including in this area: financial management, vision and purpose, leadership, resource management and reputational risk;
- product, including: innovation, adaptability and horizon monitoring;
- processes: within the scope of: governance and accountability, supply chains, and knowledge and information, and business continuity.

Resilience as a strategic capability is currently being examined by the *Australian* Government organisation (AG, 2024) through a questionnaire that defines: 13 resilience indicators providing an assessment of the stage of organisational resilience (*developing, establishing, progressive or generative)* according to the Organisational Resilience Maturity Framework. The HealthCheck tool was first developed in 2015. University of Tasmania, with support from REAG, and comprehensively updated in 2023-2024. The aforementioned tool represents the latest contemporary methodology for building organisational resilience based on the following *13 resilience indicators* (which underpin *business-as-usual* performance): leadership, decision-making, situational awareness, creativity and innovation, employee engagement, collaboration, resource management, knowledge management, silo mentality, exercise management, foresight, unity of purpose and proactive attitude.

Research conclusions and perspective

The realisation of the research objective, in the form of *a review of the definitions of resilience in the literature and a search for empirical examples of building resilience strategies in the BANI world*, led to important conclusions.

The definition shows that the concept is multidimensional and refers to resilience: social, regional, organisational/organizational, team and individual. The authors highlight a factor: social, institutional or spatial, and a common feature in the approach to defining resilience is the influence of external factors related to: an incident, shock or crisis, less often internal. For example, the Covid-19 pandemic proved that:

- *human-capital resilience resilience* is the readiness of an individual, team or society to defend itself effectively against threats;
- *organisational resilience* is the readiness to be an entrepreneur not vulnerable to crises; and
- *regional resilience* is the capacity of a society to adept in the face of external disruption.

As a result, a review of examples of resilience strategy building in global companies confirms that 'resilience' can be an evaluation criterion based on different approaches: strategic, operational tactics and metrics that are determined by different factors. The results of the research confirmed the conjecture that resilience *in the BANI world includes human and organisational capital,* for which *a comprehensive response system* is built, and which may include a variety of 'tailor-made' aspects, for example, the elaboration room (Figure 2):

1) strategies to build resilience in dimensions (e.g. human-capital resilience, et al);
2) the approach(s) to building resilience in the adopted strategy;
3) action tactics and resilience indicators (e.g. KPIs);
4) awareness and recognition of the determinants of resilience (alerts on emerging threats and obstacles and unexpected/"fragile" challenges).

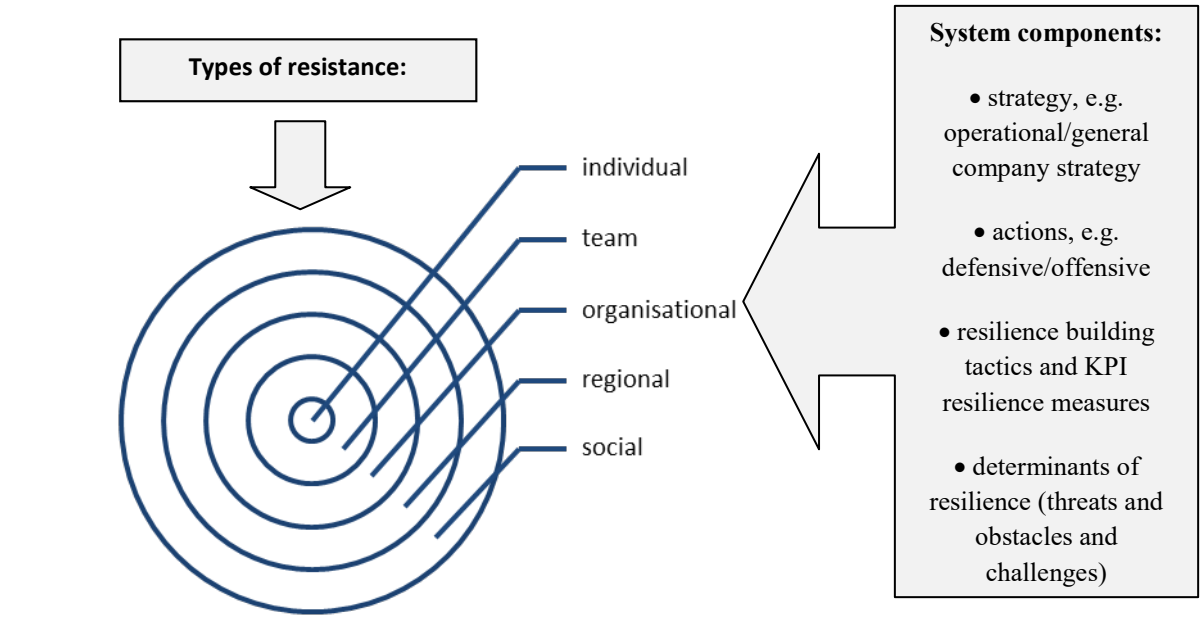

Figure 2. Multidimensional emergency response system
Source: own study.

ad. 1) The research found that *a strategy for building* human-capital resilience *resilience*:

- consists in strengthening individual resilience - i.e. the human being in the organisation (through the acquisition of competences: supervisor, specialist, or employee), which strengthens - the resilience of the team (project team, department, professional group), which allows overcoming a difficult situation and thus contributes to building - the resilience of the organisation (ability to adapt to change and to prosper in new realities);
- the resilience of human and organisational units makes it possible to build resilience strategies in the regions in order to recover from economic shocks and continue the growth underpinning strong social structures (international and/or national);
- the resilience of human-capital resilience to crises is an acquired (specific) resilience at the first level - that of the human individual (also non-specific here), regardless of the type of resilience in question (Figure 3).

Human-capital resilience resilience can only have a positive impact, there are no negative consequences that could possibly occur in the absence of resilience.

Third line of defense - community resilience (local, regional) programs and plans to enhance and rebuild community resilience

2nd line of defense - team resilience (team, family, in-company) crisis-proof strategies, post-crisis team strategies

First line of defense - human resilience (specific, non-specific) and psychological resilience, competences to increase resilience to crises, entrepreneur, employee, leader

Figure 3. Human-capital resilience resilience
Source: own study.

ad. 2) The research carried out shows that in a resilience-building *strategy* it makes sense to take *a variety of approaches and attitudes* to ensure both:

- rapid response in a current crisis;
- as well as taking a broader perspective.

Resilience is changing and the winners see building it as an opportunity to create new opportunities for growth through measures tailored to the circumstances, as one-size-fits-all solutions will not work. The attitude of management in building organisational resilience has applications as short-term (taking corrective action, seeking new, more flexible solutions, etc.), which is extremely important and should be part of what businesses do. However, resilience is also worth considering in the long term (transforming the business model or creating new revenue streams).

ad. 3) Examples of resilience-building have shown that the action tactics and KPI tools used allow for the creation of an effective action plan, in response to single disruptions as well as unanticipated disasters affecting both industries and actors operating across continents. Conscious leaders seek to increaseee the resilience of human, organisational and economic capital to strengthen social structures and regional resilience. International and national actors have the aid instruments and businesses the infrastructure to act quickly, even immediately.

ad. 4) Recognition of resilience determinants, in the form of obstacles and threats in the 'fragile' world of BANI, and awareness of their inclusion in strategy building, needs to be promoted by management. Resilience-building determinants in companies around the world reinforce resilience and encourage actions that help to avoid, withstand or quickly recover from undesirable external impacts.

To conclude the reflections, *a resilience-building strategy* should be *understood as an effort to achieve higher levels of awareness and self-sufficiency in critical sectors and beyond, and to strengthen identities based on shared values*. The planned alternative of a resilient 'B' plan to help cope with a crisis is a 'parachute' for greater security in all dimensions: individual, team, organisation, society, or region (or others).

The carried research demonstrates limitations as resilience changes over time and is multidimensional. According to the BANI concept, the 'fragility' of the modern world requires the adoption of a proactive attitude, the ability to adapt, learn and recover in order to cope with more complex and more difficult incidents in the future. Therefore, in order to obtain a more complete picture, additional research that takes into account the perspective of different assessment sources, by industry, province or capital structure is recommended. This also implies the need for further research on, for example: the resilience of the products offered by organisations, the implemented processes, leadership, or management methods.

CHAPTER III

ASSESSMENT OF THE EFFECTIVENESS OF SELECTED ENVIRONMENTAL MEASURES IN FOOD INDUSTRY COMPANIES IN POLAND

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Abstract: Over the last thirty-five years, the food industry in Poland has undergone profound changes related to operating in a market economy, as well as to implementing the adjustments necessary for conducting business within the enlarged European Union. The aim of the study is to analyse and evaluate the effectiveness of environmental measures undertaken by food-industry enterprises in Poland in the period 2015–2025. The chapter consists of a theoretical and an empirical part. In the theoretical part, methods of descriptive, comparative, deductive, and synthetic analysis were applied. The empirical part provides a synthetic overview of the issue under study using statistical analysis, supported by tables and charts.The results of the study are multifaceted. For national economies, for which sustainable food production has become an indispensable component of building competitive advantage, it is necessary to seek solutions that reduce the negative environmental impact of food production. Food companies consider improving environmental performance, cost rationalisation, and pro-environmental management among their main strategic objectives. The conclusions include the results of the study and recommendations drawn from business practice at home and abroad.
Keywords: effectiveness, environmental activities, innovation, food industry, Poland

Introduction

The system transformation in 1989 contributed to the introduction of market mechanisms for the functioning of the food economy in Poland by freeing prices for products, freedom of trade margins, abolition of universal contracting of agricultural products and subsidies, so in turn, market entities were allowed to make choices in terms of the conditions of commodity and monetary exchange (Zielińska-Chmielewska, 2020a, p. 7; The food industry in Poland has undergone profound transformations over the last 35 years (Kwasek, 2023, p. 8). In particular, the opening of the EU food market has enabled Polish farmers, breeders, processors, owners and managers to develop rapidly under conditions of free exchange of agricultural products, technologies and human resources. The international competitiveness of Polish food producers is high and Polish entrepreneurs are flexible and open to change, which has an impact on the competitiveness of the quality and price of Polish food products in Europe and worldwide.

Since the beginning of the 21st century, the Polish food industry has been facing significant challenges related to the slow and gradual reduction of cost advantages in the prices of raw materials and final products (Dybowski, Pasińska, 2018, p. 28; Zielińska-Chmielewska, 2017). Competitiveness will be determined by improving the efficiency of market actors. A key role in the link of entities operating on the agri-food market is played by processors, on which the efficiency, and thus the competitiveness of the Polish food sector, will depend in the long term. Agri-food enterprises are the glue that binds the whole agribusiness sector together, they shape the technical infrastructure and equipment, influencing the development of the food industry (Urban, Olszańska 2015). In the agribusiness sector, enterprises carry out production, processing, storage, manufacturing and trading of goods (Firlej, 2008, p. 94). Moreover, the functioning of agribusiness enterprises is not possible without active marketing activities (Urban, 2012, p. 28).

Diagnoses and forecasts of the operation of polish food industry indicate an acceleration of its concentration process and a reconstruction of its entity structure (Drożdż and Mroczek, 2017; Mroczek, 2016a; Olszańska and Szymańska, 2014; Stańko, 2013). In the conditions of globalisation, transnational economic and political integration, the development of enterprises will be determined by environmental activities and the reduction of the negative environmental impact of food production (Zielińska-Chmielewska et al., 2021). The continuation of the resilient development of the Polish food industry is inevitably associated with an increaseee in its level of internationalisation, pressure from the state, competitors and growing consumer expectations in terms of environmental protection. It is in the interest of consumers to use the earth's resources as long and as efficiently as possible for present and future generations (Zielińska-Chmielewska, Malinowska, Otto, 2025). Unfortunately, it was only in the second half of the twentieth century that efforts were made to consciously shape the natural environment and protect its components (Meadows, Randers, 1972; Kowal, Kucińska-Landwójtowicz, Misiołek, 2013; Sadowski, Kosierdzka-Federczyk, 2020). Mandatory initiatives imposing the implementation of measures that protect the natural environment have begun to develop (Bielski et al., 2023; Matuszczak, 2020).

In mainstream modern neoclassical economics, the environment was treated as a reservoir of matter and energy in which waste and pollution could be stored indefinitely (Czaja, Becla, 2007, pp. 42-46). Neoclassical models of ecologically sustainable economic growth present issues of intergenerational conditions for maximising social well-being taking into account constraints from emissions and the need to protect the environment. We are witnessing a progressive shift away from attitudes of extreme individualism to collectivist ideas. The paradigm of sustainable development is associated with the efficient exploitation of non-renewable energy sources, maintaining the stability of ecological processes and ecosystems, preserving and improving human health, ensuring the well-being of all citizens, a safe environment while realising the idea of further economic growth (Hadryjańska, 2015, p. 8).

Sustainable development is a challenge in addressing environmental economic and social problems requiring sustained and consistent changes in political, economic and technical orientations. It is a consciously shaped process requiring reorganisation in institutional structures, behavioural patterns of producers, consumers and the behaviour of societies (Zielińska-Chmielewska, 2020b).

Every enterprise can play an important role in maintaining the environmental functions and the constancy of natural capital. On the ground of economic practice, this may consist in the efficient management of raw materials and resources of the enterprise, replacing non-renewable – with

renewable sources of energy, which in the short term - generate operating costs, while in the long term - will bring intangible benefits in social and environmental terms. As a consequence of the 2015 Paris Agreement crowning the 21st UN Climate Change Conference, climate targets and the UN Sustainable Development Goals (SDGs) were formulated, requiring countries to take action to reduce meat production and consumption in industrialised countries (www.consilium.europa.eu/pl/policies/climate-change/paris-agreement; www.un.org.pl).

Primary and secondary research materials were used in the study. Reliable, complete, long time series of analysed categories of cleaned data comming from the survey and secondary data from national and international databases were used in the calculations.

The aim of this chapter is to analyze and evaluate the effectiveness of environmental actvities of food industry companies in Poland in the period 2015-2025. In the theoretical part, methods of descriptive, comparative, deductive and synthetic analysis were applied. In the empirical part, a synthetic overview of the issue under study was made using statistical analysis, supported by charts, tables and summaries. The final conclusion consist of the research results, and recommendation based on the achievements of economic practice from home and abroad. The thesis 1 was formulated and verified: Implementation of environmental measures in food industry companies helps to offset the negative environmental impact of food production.

The paper consists of 5 sections: Introduction, which defines the problem, subject matter and puts forward one research thesis, Methodology, empirical data and analysis subjected to re-testing existing documentation background, Results and discussion and Conclusions supplemented by verification of the thesis, attention to the research limitations, guidelines for future research. In the last section of the chapter References are listed.

Methodology, empirical data and analysis

The foundation of the study is formed by literature studies and the author's cyclical research (every 5 years) on the identification of environmental activities of food industry companies in Poland in 2015, 2020 and 2025. The literature studies are based on domestic and foreign literature, published and unpublished data of the Central Statistical Office, market reports and trade journal *Food Industry*. All data compilations are derived from the longest possible, complete, homogeneous time series. Figure 1 presents a schematic of the preparatory and essential stage surveys, together with their periods of implementation.

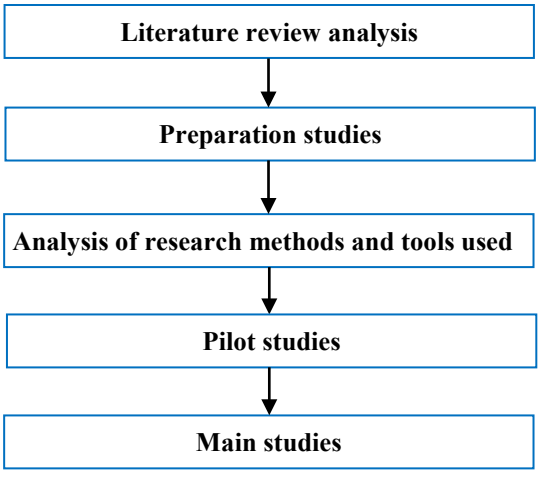

Figure 1. Scheme of the preliminary studies and appropriate lead times

Source: author's own preparation.

In order to determine the actual number of entities contributing to the Polish industry, three reliable lists of actively conducting business companies (which are not in the state of liquidation and/or bankruptcy) from the Central Statistical Office (GUS) branch in Poznań, the Provincial Veterinary Institute in Poznań (WIW) and data from the financial databases EMIS Intelligence and EMIS Profi were used. The occurrence of very large discrepancies in the number of entities actively conducting business has led the author to construct her own database based on the possessed registers of companies conducting business within the PKD 10.1, 10.3, 10.5, 10.7. Ultimately, the research population consisted of 1000 enterprises classified as processing plants, production plants and trade and service enterprises, of which 10% were surveyed. The selection was quota and the survey was representative The author conducted the survey periodically in 2015, 2020 and 2025 (mostly) in the same entities using a survey. In 2025 the study was carried out by the fund of a grant from the "Regional Excellence Initiative" programme for the project "Poznań University of Economics for the Economy 5.0: Regional Initiative - Global Effects (IREG)". The choice of survey, as a research tool, was dictated by substantive and organisational reasons. Firstly, this tool makes it possible to obtain raw data in the form of responses to the questionnaire. Secondly, it is possible to obtain responses immediately, as well as after the respondent has given it some thought. Thirdly, the respondents are territorially dispersed. Fourthly, there is a higher anonymity of responses. Fifth, it is recognised that there are relatively low costs for conducting the survey. Sixth, the survey is conducted by only one person. Disadvantages of the face-to-face interview method include: a) the danger of refusal to participate in the survey and the need to select another research subject and b) the lack of 100 per cent certainty about the veracity of the answers given (Mościchowska, Rogoś-Turek, 2015).

The task of the questionnaire was to identify pro-environmental activities and the factors influencing them. The task of the supplementary part of the survey was to obtain information on the spatial-geographical location of the surveyed units and the number of employees. The survey questionnaire consisted of a questionnaire (part 1-2) and a supplementary part, the so-called ‘metric’ (part 3). The questionnaire was structured with an explicit research objective. The questions were closed questions and were presented to the respondents in exactly the same way as to content and form (Churchill, 2002, p. 423). All respondents answered the same questions and the answers were not predetermined. The interview questionnaire included closed questions, i.e. straightforward questions (answer: yes/no), questions with given answer options (a/b/c/d), questions requiring answers to be prioritised, in-depth closed questions (deliberate repetition of a question in another part of the questionnaire to check the veracity of the respondent's answer) (Sztumski J., 2020), as well as semi-closed questions giving respondents the opportunity to tick and complete the answer ‘other - what?’. These were used when the response options listed in the questionnaire were not, for the respondent, exhaustive (Brzezinski, 2012; Brzezinski 2019; Nowak 2012). An important aspect of the questionnaire was the definition of a rating scale (1-least, 5 most) and the question of tracking changes over time. An ordinal scale was used for its clarity and comprehension and for the sake of mapping the diversity and ordering of the characteristics measured. In several questions, a nominal scale was used to determine the occurrence of a phenomenon (Kaczmarczyk, 2011, pp. 247-250).

Table 1. Presentation of the research characteristics

Subject	Territorial and temporal scope	Measurement methods and tools	Goal
Analysis of pro-environmental measures of food industry enterprises in Poland and EU-28/27	Food industry in Poland in the period 2015-2025	Quantitative methods: - survey questionnaire, - research desk method, - descriptive, comparative, synthesis, analysis methods	Assessment of the implementation of pro-environmental measures on the food market in Poland and EU-28/27

Źródło: author's own preparation.

The criteria for the selection of the sample were: a) obtaining consent to participate in the focus study, b) knowledge of the market as a result of business activity based in the country according to PKD 2007 - classes 10.1, 10.3,10.5, 10.7. It should be noted that the respondents' indications do not add up to unity (100%), due to the fact that the respondents could provide multiple answers.

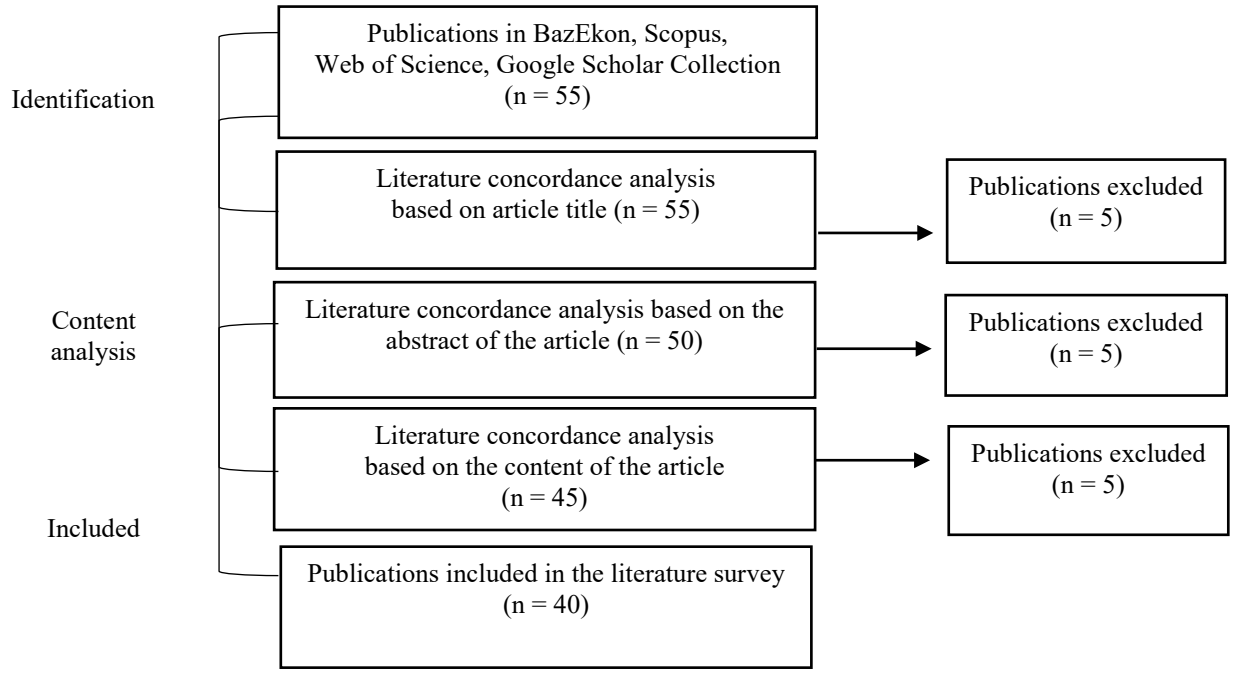

Figure 2. Prezentacja selekcji danych wtórnych według metodologii PRISMA

Source: author's own preparation.

The paper uses primary and secondary research sources. Among national and international databases fifty-five sources were identified and checked, from which 15 were excluded, and 40 publications were used for further analysis. Figure 2 shows the selection of secondary sources according to PRISMA guidelines.

Research results and discussion

Figures 3-5 present the structure of the importance of modified areas of operation as perceived by respondents in the analyzed food industry companies in Poland in the following years 2015, 2020 and 2025. It is very important to mention the results on Figures 3-5 present the overall answers all

together summed up from small, medium and large-sized entities but in the description the results are more detailed presented.

In 2015 and 2020, the most common changes made to the operation of food industry enterprises of all size classes (small, medium and large) were to increaseee the number of improvements and innovations. In 2015, for 72% of small and medium-sized and 66,7% of large food industry enterprises, the key to improving their functioning was to introduce improvements, mainly organisational improvements and innovations in the production process. The second, equally modified area of functioning was to increaseee the use of technologies to improve production processes, indicated by 64-66% of medium and large food industry enterprises and 38% of small companies. In the environmental investment activities of food industry enterprises, a decisive role was played by the implementation of so-called "modern" investment technologies understood as "saturated with knowledge", with the maximum contribution of science to their creation and operation. In modern investment technologies, rationalisation of the consumption of raw materials, materials and energy takes place (Drożdż, Mroczek, 2023, p. 17). Moreover, a national study on innovation of food industry enterprises in Poland in 2019-2021 notes that the share of revenue from sales of new or improved products introduced to the market for all industrial enterprises was 8,9%. In line with the Oslo Manual recommendations, the share of revenue from sales of new or improved products acts as an indicator of the effects of innovation activity of enterprises (Kwasek, 2023, p. 12).

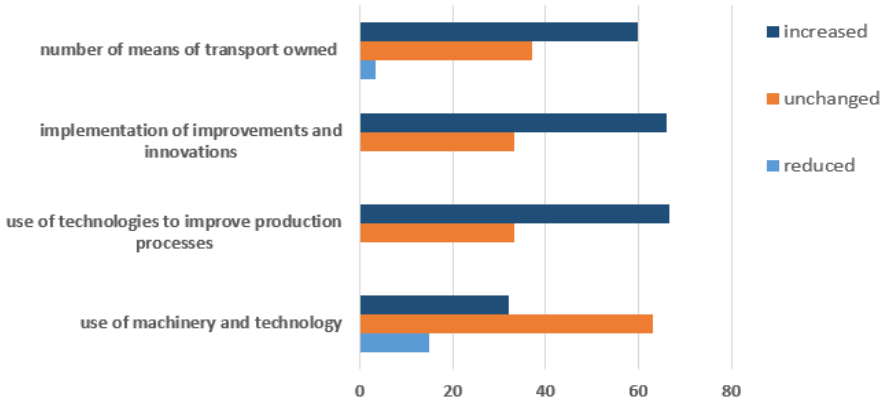

Figure 3. Assessment of the level of implementation of environmental measures in food industry companies in Poland in 2015 [in %]

Source: author's own research.

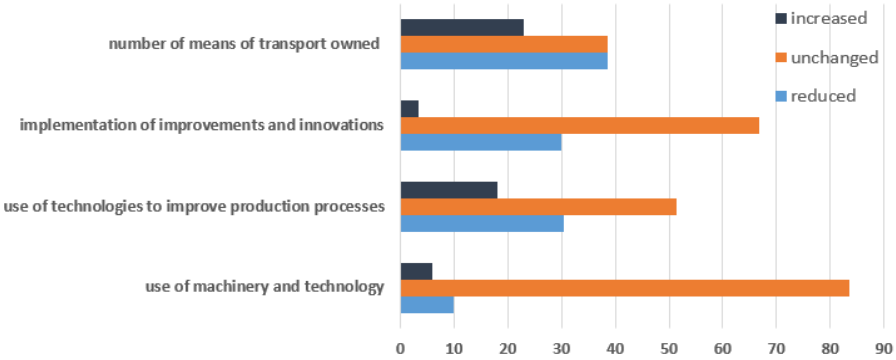

Figure 4. Assessment of the level of implementation of environmental measures in food industry companies in Poland in 2020 [in %]

Source: author's own research.

In 2015, the commonly chosen factor indicated by 60% of large and 60% of medium-sized food industry companies as well as in 2020 by 72% of large and 72% of medium-sized food industry companies, was the increaseeed use of machinery and technology park (Figure 4). This was due to the fact that the primary action to reduce material intensity is to optimise the design of machinery, equipment, products and their manufacturing technology. In 2015 (54%) and in 2020 (83,5%) of small food industry plants did not make any changes in the use of the machinery and technology park. They were the only ones to intensively increaseee the number of means of transport they owned from 7,7% (2015) to 23% (2020), thus expanding their area of territorial influence (Figure 4).

In 2025, for all size classes of enterprises in the food industry in Poland, the most important were the use of technologies to improve production processes (82%) and the implementation of innovation improvements (75%) (Figure 5). The most well-known and widespread classification of innovation includes a new or improved product or business process (or a combination thereof) that differs from previous solutions and that has been made available to potential users (product) or is usable (process) (Szczepaniak, 2023a, p. 10). The author's study is in line with the current trend because in 2019-2022, active innovative food companies, i.e. those that have introduced at least one business process innovation, are 17.8% and at least one product innovation is 15% (GUS, 2020-2022).

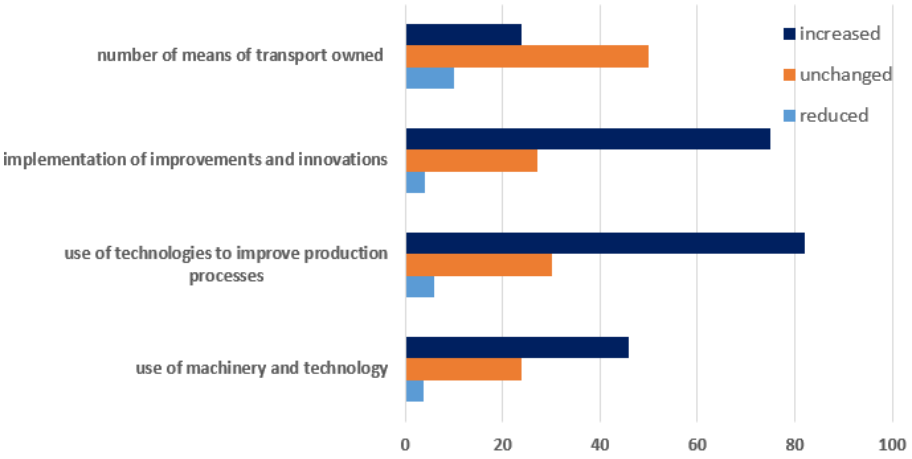

Figure 5. Assessment of the level of implementation of environmental measures in food industry companies in Poland in 2025 [in %]

Source: author's own research.

By comparison, in 2019-2021, across the domestic manufacturing sector as a whole, companies that introduced business process innovation accounted for 18% and product innovation for 13,1% (Szczepaniak, 2023b, p. 10; Zielińska-Chmielewska, Olszańska, Kaźmierczyk, Andrianova, 2021). Although there are players in the food industry sector that can be described as digital leaders, key technologies and the use of digital data were used to a limited extent. A national survey carried out between 2019 and 2021 shows that the sophistication of digitisation processes is at a low level of 16% (Szczepaniak, 2023b, p. 12). The limited use of data analytics is confirmed by statistics, including the low level of cloud computing usage. Between 2019 and 2021, the percentage of companies choosing to purchase cloud services was 16,7%, with 13.2% of food companies choosing to purchase the use of open public data in their operations. As many as 61,1% of food companies (GUS, 2020--2022). In summary, there has been an increaseee in the use of technology by food industry

companies but data collected in-house, as well as external data available on digital media and online platforms, or other digital technologies have been used to a limited extent (GUS, 2020-2022). The research results made it possible to identify innovative, not expensive pro-environmental solutions implemented in the analyzed companies.

Conclusions

The general findings based on the analysis of domestic and foreign literature on the pro-environmental measures in the food industry demonstrate that the concept is current and highly relevant. The difficulties concerning the implementation of pro-environmental activities depend on the specificity and diversity of food market players, both producers and consumers. The research thesis has been positively verified.

After the analysis and assessment of the effectiveness of the environmental measures of food industry companies in Poland in the period 2015-2025, the following general and specific conclusions were formulated.

The specific conclusions:

1. Food industry companies include environmental efficiency growth, cost rationalisation and pro-environmental management among their main strategic objectives. This is important for balancing the activities of actors in the production chain, as well as shortening supply chains.
2. In a broad perspective, globalisation and integration processes are influencing an increaseee in economic interdependence and internationalisation of economic processes, as a result of which environmental protection is becoming a major international issue.
3. The transformation of the economy will involve strengthening the role of local producers and influencing changes in consumer attitudes so that they purchase groceries from local producers and the consumption of plant-based products increasee. It is important to give producers time to implement changes and reforms. Feed crops and livestock production should undergo changes that contribute to reducing greenhouse gas emissions.
4. In order for a production enterprise to realise the paradigm of sustainable development, it must avoid activities that over-exploit environmental components and instead implement activities that make up the greening process. The greening process requires the application of four principles:
    a) minimising the amount of raw materials needed for production, most often through the use of new technologies and recycling,
    b) minimising the amount of pollution and waste generated during production, for example by using closed cycles,
    c) producing products, or parts thereof, with as long a useful life as possible so that the involvement of new raw materials in production is postponed,
    d) designing and organising all stages of the production process with a view to protecting the environment.

The limitation of the study is due to the fact that the survey was conducted on a sample of N=100. This limitation can be reduced by conducting the survey on a larger number of subjects. The high cost of the survey and the labor intensity of data collection are the main reasons for the limitation of the survey population.

Based on the results following proposals for the implementation of pro-environmental activities are:

a) popularization of best pro-environmental practices for the inland food industry enterprises,
b) legal, economic and environmental support for the food industry companies in the establishment of pro-environmental activities,
c) encouragement of potential buyers to purchase environmentally friendly products.

Acknowledgements

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CHAPTER IV

GIVE SPENT COFFEE GROUNDS A SECOND LIFE. EXAMPLES OF SPENT COFFEE GROUNDS IN INDUSTRY AROUND THE WORLD

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Abstract: Coffee is one of the most widely consumed beverages in the world. According to the International Coffee Organization (2023a), global consumption is growing at 2.2% annually and may reach 300 million 60-kg bags by 2050 (Ecofin Agency, 2025). Around 3 billion cups are consumed daily, generating large amounts of coffee waste, especially spent coffee grounds (SCG). Improper management of this waste contributes to greenhouse-gas emissions and environmental degradation. The aim of this article is to assess the potential of innovative re-use of deloitee grounds in six areas: (1) energy and biofuels; (2) biocomposites, bioplastics, and building materials; (3) agriculture and horticulture; (4) the food industry; (5) the cosmetics industry; and (6) the textile industry. The study is based on a literature review (desk research) combined with case-study analysis from various countries. The findings indicate that effective SCG utilisation supports the goals of sustainable development and the circular economy, as promoted by organisations such as the Global Environment Facility (GEF) and the International Coffee Organization (ICO). The article presents conclusions and recommendations relevant to both business practice and environmental policy.
Keywords: spent coffee grounds, coffee waste, sustainable development, circular economy, innovation

Introduction

Spent coffee grounds (SCG), once perceived solely as waste, are increaseeingly recognized as a valuable resource thanks to grooving environmental awareness and advances in processing technologies. Global coffee consumption is growing at an annual rate of 2.2% and is expected to reach a record 169.4 million 60-kg bags in 2025/2026, up from 166.5 million in 2024/2025 (Ecofin agency, 2025). Growing consumption is making a coffee waste an increaseeingly serious problem. Globally, more than 11 million tons of wet coffee grounds are generated annually, most of which end up in landfills, emitting methane during decomposition (ICO, 2023a). This situation calls for a shift in perception, from treating spent coffee grounds as waste to viewing them as a secondary raw material with significant economic and environmental potential. Such a transformation requires cooperation among consumers, businesses and policymakers. Environmentally conscious consumers

can contribute by choosing products made from recycled spent coffee grounds or using them directly, for example in composting. Industry initiatives such as standards and labelling for upcycled products developed by the Upcycled Food Association help build trust and encourage responsible consumption (May & Folkerts, 2021). These trends are reinforced by the growing pro-environmental attitudes of younger generations, which influence market demand for product made from upcycled materials (Szczepanik, 2024; Wojtaszczyk et al., 2024).

This approach aligns with the principles of sustainable development and their circular economy, as outlined in the UN Sustainable Development Goals (SDGs) and reinforced by the Paris Agreement. Recycling spent coffee grounds support climate action, sustainable production and consumption and the development of local communities. Consequently innovative solutions for their large-scale recovery and processing are becoming an essential part of global strategies for reducing the environmental impact of production.

Sustainable development is a challenge in addressing environmental economic and social problems requiring sustained and consistent changes in political, economic and technical orientations (Zielińska-Chmielewska et al., 2022). It is a consciously shaped process requiring reorganization in institutional structures, behavioral patterns of producers, consumers and the behavior of societies (Syed et al., 2024).

The aim of the chapter is to analyze and evaluate the potential of innovative solutions for the large-scale management and processing of spent coffee grounds worldwide, based on a comprehensive literature review and case study analysis. The study focuses on technologies, business models and cross-industry collaborations that enable the integration of spent coffee grounds into sustainable production system, reflecting the principles of the circular economy and supporting the development of scalable, high-value applications across multiple sectors.

Building on this context, the following section explores the theoretical foundations and practical frameworks for spent coffee grounds recovery and reuse, with particular emphasis on sustainable business models, cross-industry cooperation and the role of cities and policy-makers in developing circular value chains.

Theoretical framework of the study on reuse of spent coffee grounds

Companies can develop sustainable business models in which responsible management of coffee waste is an important element. Cafés, restaurants and coffee producers can implement spent coffee grounds collection systems in cooperation with recycling and processing companies. However, the readiness of such entities to participate in fundraising campaigns remains a problem, especially in the case of small organizations that may be afraid of additional work and costs. Investments in innovative spent coffee grounds processing technologies can generate high value-added products. However, it is necessary to conduct research on scaling processes from the laboratory to the industrial level and to promote new business models that take into account the full life cycle of products (Serna-Jimenez et al., 2022).

Effective use of spent coffee grounds requires close cross-industry cooperation. The concept of industrial symbiosis can help in this process. It is an approach to resource management in which companies located in a specific geographical area exchange materials with each other in order to make efficient use of a variety of resources. The main idea is that waste or by-products from one company's production activities become a raw material for another (Neves et al., 2020; Järvenpää et

al., 2021; Oughton et al., 2022). Under this concept, cascading resource utilization is possible, which refers to the sequential use of resources in different production processes, in order to maximize its value before disposal or recycling (Järvenpää et al., 2021). For example, one company recovers e.g. oils or antioxidants from coffee grounds and then transfers the remaining raw material to another company, which uses it to produce biofuels or bioplastics.

Cities generate most of the waste, which is why they play a key role in the circular transition (Zielińska-Chmielewska et al., 2023). An example is urban biorefineries, which convert biowaste, including coffee grounds, into biofuels and other bio-based products. Integrating such solutions into the local circular economy increaseees resource efficiency and reduces environmental impact (Ahmed et al., 2023). Circular Innovation Hubs can be spaces supporting the development of start-ups involved in upcycling spent coffee grounds. Examples include Rotterdam Blue, an abandoned water park that has been transformed into a hub for circular innovation, supporting start-ups using bio-waste, and Barcelon PLA BUITS, which adapts unused urban spaces for social and circular purposes (European Investment Bank, 2024). In Poland, such an example is EcoBean, a technological start-up of the Warsaw University of Technology, which collects spent coffee grounds and processes them into bio-raffinates (coffee oil, lignin, feed additives) or bio-fabricated products (briquettes, biodegradable pots) (https://ecobean.pl/). Construction of the EcoBean Technology Center near Warsaw, the country's first biorefinery processing coffee grounds into new ingredients, is underway (Świsłowski, 2023).

The development of the circular economy can be supported by sectoral partnerships, such as the cooperation of the International Coffee Organization (ICO) with the Sustainable Coffee Challenge (SCC) and the Global Coffee Platform (GCP) to promote circular business models and sustainable development in the coffee sector (ICO, 2018).

In turn, policymakers can stimulate the reuse of spent coffee grounds by introducing regulations that encourage their recycling, as well as a system of incentives and financial support for companies implementing technological innovations. The inclusion of coffee in the GEF-7 (Global Environment Facility) funding program can support the implementation of projects for the reuse of coffee waste on an industrial scale (ICO, 2018). Regulating the recycling and use of spent coffee grounds at an international level will facilitate the development of a global market for spent coffee grounds products, thus promoting sustainability and innovation across industries. On the other hand, state policies or EU regulations related to the introduction of bans on the landfilling of organic waste will force the search for other uses for it. The EU Landfill Directive obliges Member States to limit the landfilling of municipal waste to a maximum of 10% by weight by 2025, which indirectly forces the search for new uses for organic waste (Zrównoważone zarządzanie odpadami: działania UE, n.d.).

Methodology, empirical data and analysis

The study was conducted using qualitative research methods, combining a comprehensive literature review (desk research) with the case study approach. The choice of these methods was dictated by the research objective which was to identify and evaluate the potential application of spent coffee grounds within a circular economy framework, drawing on both theoretical foundations and practical implementations. Desk research enabled the collection and synthesis of data from scientific publications, industry reports, statistical databases and documents from relevant organizations, allowing for a broad, cross-sectoral perspective and the integration of national and international

resources (Bednarowska-Michaiel, 2015). The analysis applied descriptive, comparative, deductive and synthetic methods to evaluate the potential for spent coffee grounds management and processing on an industrial scale (Table 1).

Table 1. Presentation of the research characteristics

Subject	Territorial and temporal scope	Measurement methods and tools	Goal
Analysis of the potential reuse of spent coffee grounds in energy and biofuel industry, biocomposites, bioplastics and building materials, agriculture and horticulture, food, cosmetics and textile industries	Six chosen industries in 2025 globally	Quantitative methods: - research desk method, - descriptive, comparative, synthesis, analysis methods, - case-studies	Assessment of the potential reuse of spent coffee grounds in six analyzed industries

Source: authors' own preparation.

The case studies were selected purposefully to illustrate innovative and scalable applications of spent coffee grounds across diverse sectors, including energy and biofuels, biocomposities and building materials, agriculture and horticulture, the food industry, cosmetics industry and textile industry. Selection criteria included documented implementation, evidence of environmental and/or economic impact, scope of innovation and potential for replication in other industry branches in different countries. The examples reflect current market practices and embodied the principles outlined in the theoretical framework, such as sustainable business models, industrial symbiosis, cascading resources use. The results of the case study analysis are presented in the form of six tables (figures 2-7) describing real-life applications supported by literature and market data. Each table is followed by a summary highlighting the key findings and potential of spent coffee grounds.

The methodological approach enabled the identification of best practices, innovative technologies and business models that can support the integration of spent coffee grounds into sustainable production system worldwide. The combination of literature review and case study analysis provided a comprehensive understanding of both the conceptual underpinnings and practical dimension of spent coffee grounds valorization, forming a solid basis for the conclusions presented below.

Results and discussion

Figures 2-7 present the descriptions and chosen examples of market implementations in six analyzed production sectors, such as: 1) energy and biofuels industry, 2) biocomposites, bioplastics and building materials industry, 3) agriculture and horticulture industry, 4) food industry, 5) cosmetics industry and 6) textile industry. The following examples of companies show that the potential of spent coffee grounds is significant and that an innovative approach can revolutionize various industrial sectors. Reusing spent coffee grounds reduces waste, greenhouse gas emissions and the consumption of primary raw materials, supports the circular economy and creates new economic opportunities, such as: producing bio-based plastic and biodegradable packaging, developing natural cosmetics using spent coffee grounds as active ingredients or manufacturing eco-friendly building materials.

Figure 2. Assessment of the use of spent coffee grounds in energy and biofuels industry, which can be implemented worldwide

Description	The carbon content of spent coffee grounds ranges from 51,4% to 71,6%, making them a valuable raw material for the production of biofuels such as biogas, biodiesel and biochar (Waloszyńska & Mościcki, 2020). The residues from biodiesel extraction can be further used as solid biofuel or biochar, increaseeing the energy efficiency of the biofuel production process (Ahmed et al., 2024; Sidło & Latosińska, 2025). Biofuels obtained from spent coffee grounds have lower CO2 emissions compared to fossil fuels, contributing to a reduction in the carbon footprint and dependence on conventional energy sources (ICO, 2023b; ICO et al., 2024; ICO, 2023a; Lee et al., 2023). Alternatively, spent coffee grounds can be used directly in the form of briquettes and pellets, which are available on the European and American markets (Johnson et al., 2022).
Chosen examples of market implementations	**EcoBean** is a Polish start-up that, in cooperation with the Warsaw University of Technology, processes spent coffee grounds. Previously, it produced briquettes from coffee waste as a carbon-neutral biofuel. Currently, the company offers a solution based on the collection of spent coffee grounds, which are then processed into raw materials and products: biorefinery products (coffee oil, lignin, polylactide, feed additives) or biofabricates (briquettes, biodegradable pots) (https://ecobean.pl/).
	Jacobs Douve Egberts from the Netherlands, **in cooperation with Veolia**, has implemented a project to use spent coffee grounds as fuel in a heating plant. Wet grounds at a temperature of 90°C are processed into biomass, which is then burned in a 12 MW boiler. The steam produced in this way powers the technological processes in the factory, creating a closed energy cycle (Piszczatowska, 2017).

Source: authors' own research.

Due to their high carbon content, spent coffee grounds are a promising raw material for the production of biofuels. Studies indicate that biofuels from coffee grounds have lowered CO2 emissions compared to fossil fuels. Practical implementations such as the activities of the Polish start-up EcoBean or the Jacobs Douve Egberts project from Veolia in the Netherlands confirm not only the commercial potential of this technology, but also its scalability – from local solutions to industrial installations with high efficiency.

Figure 3. Assessment of the use of spent coffee grounds in biocomposites, bioplastics and building materials which can be implemented worldwide

Description	The high lignin and cellulose content makes spent coffee grounds suitable as a filler in biocomposites, i.e. materials in which at least one component comes from natural sources (Johnson et al., 2022;ICO, 2023a). Biocomposites with added spent coffee grounds are used in 3D printing and the production of biodegradable food packaging (Lee et al., 2023, Dordevic et al., 2024). They can also be used as a raw material for the production of bioplastics and lightweight building materials (ICO, 2023b), which supports the circular economy and reduces the demand for primary raw materials (ICO et al., 2024).
Chosen examples of market implementations	**Kaffeeform** is a Berlin-based start-up that produces eco-friendly cups and mugs made from a combination of spent coffee grounds and biopolymers. The resulting products are durable, lightweight and biodegradable, providing a sustainable alternative to traditional disposable tableware (www.kaffeeform.com).
	Bioffee is a Polish organization whose main goal is to recycle spent coffee grounds and process them into eco-friendly, durable and original products. Its offer includes cups and mugs made from coffee grounds (https://bioffee.pl/).
	Aimplast is a plastics technology center in Spain, has produced plastic film from used spent coffee grounds as part of the 'WaysTUP!' project and intends to use it to manufacture flexible packaging, achieving the goal of processing urban bio-waste on a mass scale. (AIMPLAS to produce packaging from coffee grounds..., 2023).

Source: authors' own research.

The lignin and cellulose content of spent coffee grounds make them a suitable additive for biocomposites, bioplastics and lightweight building materials. Such applications are in line with the assumptions of the circular economy, reducing the demand for primary raw materials. Market examples such as the Kaffeeform start-up, the Polish brand Bioffee or the Spanish WaysTUP project confirm the possibility of commercial implementation of this technology in various industries and its adaptability to diverse business models.

Figure 4. Assessment of the use of spent coffee grounds in agriculture and horticulture, which can be implemented worldwide

Description	Spent coffee grounds, when used in appropriate doses, enrich the soil with magnesium, calcium, potassium and iron, while improving the functional properties of plants by increaseeing the content of antioxidants and phenolic compounds (Jeon et al., 2024). Thanks to their high content of nitrogen, potassium and phosphorus, which are essential for proper plant growth, they are a valuable raw material for the production of organic fertilizers and growth biostimulants (ICO, 2023b; ICO, 2023a, Ahmed et al., 2024). Their use supports sustainable agriculture by reducing the need for artificial fertilizers and lowering agricultural production costs (ICO et al., 2024). Studies have shown that adding spent coffee grounds to compost increaseees the nitrogen and organic carbon content, improving soil quality and stimulating plant growth, but optimal doses need to be determined to avoid potential negative effects (Jeon et al., 2024; Dimitrijevic et al., 2024). Spent coffee grounds have also been used as a substrate for mushroom cultivation, which is in line with the idea of a circular economy and the maximum use of organic raw materials (These companies give coffee grounds..., 2022).
Chosen examples of market implementations	**Finlays** is an American brand that uses spent coffee grounds as an ingredient in a mixture that, after three years of composting, becomes a fertilizer used in corn cultivation (https://www.finlays.net/).
	Neutorg is an Australian company that produces a fertilizer called Human Beans. It is an organic fertilizer made from processed spent coffee grounds, composted chicken manure and covered with over 242 beneficial live microorganisms, used as a universal fertilizer, particularly suitable for growing vegetables, fruits and flowers (https://neutrog.com.au/).

Source: authors' own research.

Due to high content of macro and microelements, spent coffee grounds are a valuable raw material for the production of organic fertilizers and plant growth biostimulators. They can improve soil fertility, reduce the use of artificial fertilizers and support sustainable agriculture (Jeon et al., 2024). Studies confirm their positive effect on the composting process and their use as a substrate in mushroom cultivation. The presented market examples can illustrate sustainable business models and industrial symbiosis, in which coffee grounds become raw materials for agriculture and horticulture within local circular economy ecosystems (Fig. 5).

Spent coffee grounds, rich in antioxidants, fiber and phenolic compounds, are widely used in the food industry, where they can enrich products with polyphenols, replace saturated fats with coffee oil and support the intestinal microflora (Cavanagh et al., 2023). They are used in the production of functional foods, healthy snacks, dietary supplements and alcoholic beverages, which allows to combine health-promoting aspects with activities that fit into the principles of the circular economy. The Japanese brand SOI and the Scottish William Grant & Sons demonstrate the technology potential in various segments of this market and its ability to create innovative solutions, responding to the growing consumer demand for upcycled products (Fig. 6).

Figure 5. Assessment of the use of spent coffee grounds in food industry, which can be implemented worldwide

Description	As a source of antioxidants, fiber and bioactive phenolic compounds, improving the shelf life and nutritional value of products, spent coffee grounds are widely used in the food industry (Franca & Oliveira, 2022; Andrade et al., 2022; Bevilacqua et al., 2023). When added to baked goods, they increaseee the polyphenol content, and spent coffee grounds oil can replace butter, enriching products with healthy fatty acids (Batista et al., 2023). Thanks to their prebiotic properties, they support the intestinal microflora and can lead to a feeling of satiety and a reduction in calorie intake (Bevilacqua et al., 2023). The high fiber and natural antioxidant content makes spent coffee grounds a potential raw material for the production of functional foods (Bevilacqua et al., 2023). SCG are also used in the production of alcoholic beverages, such as liqueurs and fermented drinks, and even as an alternative to peat in the drying of malt for whisky, which reduces the environmental impact (Franca & Oliveira, 2022; Krakowiak et al., 2024). Their antibacterial and anti-inflammatory properties, as well as their increaseeed fiber, protein and bioactive compound content, make them suitable for use in the production of healthy snacks and low-calorie baked goods, especially for people on special diets (Bevilacqua et al., 2023, Ahanchi et al., 2024). Their potential for use in various sectors indicates their potential as a valuable raw material in sustainable food production.
Chosen examples of market implementations	**SOI** is a Japanese company that uses spent coffee grounds to produce chocolate, functional foods and dietary supplements (Langenbahn, 2024).
	William Grant&Sons is a Scottish company that uses spent coffee grounds as a substitute for peat in the malt drying process for the production of Scotch whisky (Krakowiak et al., 2024).

Source: author's own research.

Figure 6. Assessment of the use of spent coffee grounds in cosmetics industry, which can be implemented worldwide

Description	Spent coffee grounds, rich in antioxidants and oils, are widely used in the production of natural cosmetics (ICO, 2023b). Thanks to their antioxidant and anti-cellulite properties, they are used in the formulas of skin care cosmetics, such as body scrubs, soaps and face masks (Johnson et al., 2022; ICO, 2023a). In addition, oils extracted from SCG have moisturising, anti-ageing and UVB protective properties (Kotianova et al., 2023), increaseeing the sun protection factor (SPF) by 20%, which allows for a reduction in the amount of synthetic chemical filters (Santos et al., 2021). Spent coffee grounds can also be used as natural fragrances, enriching cosmetics and perfumes with a delicate coffee aroma (Andrade et al., 2022).
Chosen examples of market implementations	**Kaffee Bueno** is a Danish company that uses advanced biotechnological processes to transform coffee by-products (including spent coffee grounds) into active and functional ingredients for cosmetics, nutraceuticals and functional foods (https://www.kaffebueno.com).
	UpCircle Beauty is a British brand that creates cosmetics and body care products using recycled spent coffee grounds (https://upcirclebeauty.com/).

Source: authors' own research.

In the cosmetics industry, spent coffee grounds, rich in antioxidants and oils, are used in the production of natural scrubs, soaps, masks and preparations with anti-cellulite and anti-aging properties. Oils extracted from coffee grounds have moisturizing, UVB protection and SPF-boosting properties, which reduces the use of synthetic chemical filters. Market examples such as the Danish brand Kaffee Bueno or the British UpCircle Beauty show that the processing of coffee grounds in the cosmetics industry can combine biotechnological innovation with the idea of a circular economy, while offering products that respond to growing consumer expectations (Fig. 7).

Spent coffee grounds have potential in the textile industry, where they can be used as an additive to fabrics with antibacterial, odour-neutralizing properties and accelerating drying, making them particularly attractive for the production of sportswear. In addition, the spent coffee grounds extract can act as a natural dye for wool fabrics, and the presence of tannins improves light and wash resistance, providing an ecological alternative to synthetic dyes. Market examples such as Singtex

with innovative yarn or Finnish start-up Rens Original show that coffee waste can become the basis for advanced material technologies, the development and scaling of which can be supported by start-ups and circular innovation hubs.

Figure 7. Assessment of the use of spent coffee grounds in textil industry, which can be implemented worldwide

Description	The literature indicates the potential of spent coffee grounds as an additive to antibacterial and odour-neutralising fabrics, which is used in the production of sportswear (Barros & Gupta, 2024). The possibility of using spent coffee grounds extract as a natural dye for wool fabrics has also been described. Studies have shown that SCG contain sufficient pigments to give fabrics a lasting brown colour, and the presence of tannins increaseees light and wash resistance, offering an eco-friendly alternative to synthetic chemical dyes (Hong, 2018).
Chosen examples of market implementations	**Singtex** is a Taiwanese organisation that invented the eco-friendly coffee yarn S.Café®. Spent coffee grounds are mixed with polyester derived from recycled PET bottles. This yarn is used to produce fabric with antibacterial, odour-neutralising and quick-drying properties. It is used in the production of sportswear. S.Café® is currently used by over 110 brands (www.singtex.com).
	o **Rens Original** is a Finnish start-up that has launched the world's first sneakers made from yarn derived from spent coffee grounds and recycled plastic, with antibacterial and odour-neutralising properties (RENS Original Finland, n.d.).

Source: authors' own research.

The presented areas of use of spent coffee grounds indicate their universal potential in the circular economy. Such solutions can be implemented through cross-industry collaboration, involving cities, businesses and start-ups, as well as with the support of public policies and regulations that reduce the landfilling of organic waste. Incorporating spent coffee grounds into closed production cycles not only minimizes the environmental impact, but also reduces the consumption of primary raw materials, also opens up new prospects for the development of innovative business models, both locally and globally and creates new economic opportunities

Conclusions

The dynamic growth in global coffee consumption means that the amount of waste generated in the form of spent coffee grounds is constantly increaseeing, becoming a significant environmental, economic and organizational challenge. Currently, the dominant practice is to landfill or dispose of this raw material, even though its physical and chemical properties allow it to be reused in the spirit of a circular economy. In view of growing environmental pressure, the need to reduce greenhouse gas emissions into the atmosphere and achieve sustainable development goals, the implementation of innovative solutions for the use of spent coffee grounds is becoming an important task. The research thesis has been positively verified.

The general conclusions

The literature analysis and presented case studies confirms that spent coffee grounds can be successfully used in the production of high value-added products in various sectors of the economy. For example: 1) in agriculture and horticulture are used as a raw material for the production of fertilizers and biostimulants, 2) in energy and biofuels, for the production of low-CO_2 fuels; 3) in the materials industry, for the production of biocomposites, bioplastics and lightweight building materials, 4) in the food industry, as ingredient to produce functional foods and health-promoting snacks, 5) in the cosmetics industry, as a bioactive ingredient in the production of skin care, protective and antioxidant cosmetics, 6) in the textile industry, as a base in the production of functional clothing.

To sum up, in each of these examples spent coffee grounds offer opportunities to replace primary raw materials, reduce greenhouse gas emissions and design value-added products, thereby supporting the goals of the circular economy and sustainable development.

The detailed conclusions

The development of sustainable business models based on responsible coffee waste management requires the preparation of effective collection systems, especially among small market players, who often fear additional costs and burdens.

1. Industrial symbiosis can provide support in this area by enabling the exchange of raw materials between companies and their cascading use, ranging from the recovery of oils or antioxidants from spent coffee grounds to the conversion of residues into biofuels or bioplastics. It is worth supporting the creation of partnerships within cross-sector cooperation to develop local and regional spent coffee grounds recovery networks linking collection points with processing plants.
2. Cities that generate the majority of waste and should implement solutions such as urban biorefineries or circular innovation centers. EcoBean in Poland, Rotterdam Blue City and Barcelona PLA BUITS show that it is possible to effectively combine technological innovations with business models covering the entire product life cycle. Moreover, sectoral partnerships, such as the cooperation between International Coffee Organisation, Sustainable Coffee Challenge and Global Coffee Platform, can contribute to the dissemination of circular business models in the coffee sector.
3. Policy makers are fundamental because they can stimulate actions for the reuse of spent coffee grounds by introducing recycling-friendly regulations, incentive and financial support schemes, as well as legislation restricting the landfilling of biowaste. Such measures foster the creation of a global market for products made from spent coffee grounds, while promoting innovation and sustainable development in many industries.

Nevertheless, the study revealed few barriers to scaling up the analyzed solutions, including the dispersion of raw material sources, logistics costs and processing technology. The selection of examples does not cover the full range of possible applications for spent coffee grounds. In addition, some of the initiatives presented are still at an early implementation stage, which makes it difficult to assess their long-term effectiveness. The lack of quantitative methods means that the conclusions are descriptive in nature and further verification through empirical research is necessary.

The limitation of the study can be reduced by: a) tighter cooperation at multiple levels, b) regulatory support, c) investment in research to scale up processes from the laboratory to industrial level.

Based on the study results, following proposals for giving spent coffee grounds a second life include: a) the establishment of public-private partnerships, b) the creation of effective spent coffee grounds collection systems, c) the development of processing technologies enabling cost-effective industrial-scale production, d) the use of financial incentives and regulatory measures.

Concluding, the use of spent coffee grounds can combine business potential in the form of product innovation with environmental, economic and social benefits, providing a good example of how the economy can benefit from waste by treating it as a valuable resource for reuse. In the long term, fully exploiting the potential of spent coffee grounds can stimulate the development of circular economy, green innovation and reduce the negative impact on the environment.

CHAPTER V

LOGISTICS OF RETURNS IN POLISH E-COMMERCE

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Abstract: Poles are increaseeingly choosing to shop online, returning goods more often and expecting returns to be handled in a responsible and transparent manner. A hassle-free return can encourage customers to make repeat and more frequent online purchases. From a logistical point of view, the return process can be quite challenging for an online shop. The interest in professional returns handling as part of logistics outsourcing on the part of e-commerce entities in Poland reflects, among other things, growing expectations of buyers for easy, fast, and secure returns, efforts to minimize the risk of customer loss, and optimization of logistics costs. The aim of this study is to show the specific nature of e-commerce return logistics and to indicate the role of logistics operators in logistical handling of e-commerce returns in Poland. The study was based on an analysis of source literature and online materials from operators on the Polish TFL market.
Keywords: e-commerce, e-commerce returns, return logistics for e-commerce, logistics operator

Introduction

E-commerce has quickly become a rapidly growing sales channel and a significant segment of the retail market in Poland (Table1). According to the National Chamber of Commerce, total e-commerce turnover in the twelve months (October 2023 – September 2024) accounted for 8.9% of total retail trade turnover in the enterprise sector and was 5.2% higher than in the previous year (E-commerce in September 2024). According to the study by the Central Statistical Office (GUS) entitled "The information society in Poland in 2024", in 2024, 67.4% of people aged 16-74 made purchases online in Poland (in 2023, the percentage was 64.3%). (Information society in Poland in 2024, p. 124). The number of companies using the Internet as a sales channel is growing, both in the consumer market and in B2B. According to data from the Central Statistical Office (GUS), 18.1% of companies in Poland conducted electronic sales; 12.0% of companies sold via their own website or app; 10.3% via online trading platforms, and 3.5% via EDI (Electronic Data Interchange) messages (Monthly review of e-commerce results, January 2025, p. 3).

The growth of the e-commerce market in Poland accelerated during the Covid-19 pandemic, with consumers increaseeingly shifting to online channels. The number of online retailers has been steadily increaseeing. According to the report "E-commerce in Poland 2024", the percentage of Internet users in Poland who shopped online was 78%. 75% of Polish internet users shopped in Polish online shops, while 36% shopped in foreign online shops, and 19% of internet users shopped on and through social media (E-commerce in Poland 2024, p. 23).

Table 1. Value of e-commerce market in Poland and courier shipment volume

Year	Value of e-commerce market in billion zloty (PLN)	Volume of courier shipments in millions of items
2014	28	194
2015	33	216
2016	36	264
2017	40	308
2018	45	369
2019	55	441
2020	80	636
2021	100	776
2022	109	901
2023	124	1052
2024*	139	1200
2025*	155	1340
2026*	170	1500
2027*	187	1650

**forecast*

Source: Report on the state of the postal market in 2021, Office of Electronic Communications (UKE), p. 24, https://bip.uke.gov.pl/download/gfx/bip/pl/defaultaktualnosci/23/63/3/raport_o_stanie_rynku_pocztowego_w_2021_roku_online.pdf; Report on the state of the postal market in 2023, Office of Electronic Communications (UKE), p. 8, https://www.uke.gov.pl/download/gfx/uke/pl/defaultaktualnosci/36/541/6/raportpocztowy_2023_net.pdf

There are intense changes taking place in the purchasing behavior of e-consumers. Consumers in Poland have grown fond of online shopping, but they have also grown fond of returns, and a significant portion of shipments in e-commerce are returned to the seller. According to the report "E-commerce in Poland 2019", 31% of online shoppers who were aware of the possibility of returning goods did not use this option (E-commerce in Poland 2019, p. 103). The report "E-commerce in Poland 2021" stated that 26% of online shoppers have never returned a product (E-commerce in Poland 2021, p. 114). The report "E-commerce in Poland 2022" stated that 20% had never returned goods (E-commerce in Poland 2022, p. 108). The report "E-commerce in Poland 2024" stated that 17% of people who shop online and are aware of the possibility of returning goods have never returned anything, and only 2% of people who shop online are unaware of the possibility of returning goods purchased online (E-commerce in Poland 2024, p. 137). As highlighted in the report "The decade of polish e-commerce", the top changes of the decade included the widespread adoption of free returns and, as a result, a significant increaseee in the scale of returns in e-commerce, especially in the fashion category (The decade of polish e-commerce, p. 61).

Literature review

The literature on the subject examines the issue of returns in e-commerce from the perspective of both the customer and the online shop. Return management by an online shop is a key factor influencing the consumer experience. Customers expect clear, understandable information about returns and should know exactly how the returns process works, what options are available, and whether and what shipping costs they will incur for returns. Online shoppers expect fast and efficient processing of returns. The minimum time that a customer has to return goods under the Consumer Rights Act of May 30, 2014, is 14 days. Returns are not possible in all situations, as regulated by law

(Consumer Rights Act of 30 May 2014, Dz. U. [Journal of Laws] of 2020, item 287). There are often situations where customers order many items and then, after further consideration, return the unnecessary goods. As stated by D. Derouene, GEODIS, Global Director, Reverse Logistics, Supply Chain Optimization: "The exponential growth of eCommerce has led to the development of new consumer habits. For one, online customers tend to order several sizes and/or colors of an item to try at home. This implies a high volume of returns. How your retail business handles these returns will determine your customer's shopping experience. And that is important because 95% of satisfied customers come back to shop for more; while 90% will not if they're dissatisfied" (Returns logistics, Geodis). DHL also emphasizes that there are consumers who purchase different variants of a given product with the clear intention of returning it (41%), wanting to try out different options or post a photo on social media (E-commerce returns: three ways to tackle this growing challenge, DHL).

In its report entitled "Decade of Polish e-commerce", e-Izba emphasizes that customer trust in e-retailers and familiarity with well-known and proven brands are becoming increaseeingly important (Decade of Polish e-commerce, p. 29). As T. Osman emphasizes in the aforementioned report, from a purchasing perspective in e-commerce, usability, security, and flexibility are key for customers. Therefore, when operating in e-commerce, particular attention should be paid to the transparency of the offer and the convenience of the purchasing process, fast and secure payment methods, flexible and fast delivery of shipments, and free product returns (Decade of Polish e-commerce, p. 59).

The development of e-commerce is not possible without efficient logistics as an important pillar of the business. The logistics of an online shop can be considered in the following basic areas (Demianiuk, 2024, p. 74–75):

- goods management (delivery forecasting, contact with suppliers, information flow, etc.);
- storage/receipt and completion of orders;
- delivery/distribution of shipments (shipping of ordered goods);
- accepting and handling returns/complaints.

Returns involve the reverse flow of products in the supply chain from the customer to previous links (Jeszka, 2013, p. 12). From the perspective of return processes at an online retailer, each return triggers a similar algorithm of processes as in the reverse order of goods sales (Walczyński, Kanciak, 2023, p. 153). A. Pluta-Zaremba and M. Cichosz propose a definition of e-commerce reverse logistics, emphasizing the type and purpose of returns: "E-commerce reverse logistics involves managing the flow of products returned for various reasons from the point of consumption to the retailer, distributor or manufacturer, and the accompanying information, in order to recover the value of the goods through repair and resale, or their proper disposal or recycling" (Pluta-Zaremba, Cichosz, 2016, p. 10). For more information on the origins of reverse logistics, see the publication by K. Lysenko-Ryba and A. Bąk (Lysenko-Ryba, Bąk, 2017, p. 25–29). The authors of the publication "A circular reverse logistics framework for handling e-commerce returns" developed a three-stage, strategic decision-making model to tackle the returns of an e-commerce firm under Circular Economy (CE) (Nanayakkara, Jayalath, Thibbotuwawa, Perera, 2022).

Logistics customer service consists of closely related logistics activities that determine customer satisfaction when purchasing a product (Wójcik, 2022, p. 105). Logistics customer service includes returns handling. More information on returns as part of customer service logistics can be found in the publication "Pro-consumer return policy" (Lysenko-Ryba, 2020, p. 117-132). The

approach to e-commerce returns logistics is based on three main levels: pre-transaction, transaction, and post-transaction (Huk, Goń, Pękalska, 2019, p. 38–40).

Consumer returns can be a significant challenge for logistics of e-commerce entities for some reasons: volume, cost, complexity, reverse logistics, quality control, environmental impact (Wanganoo, Tripathi, 2023). Effective returns logistics from the perspective of an online retailer should ensure the right balance between customer satisfaction and reduced e-commerce operating costs. Online shops are looking for solutions that will provide the hassle-free returns service that customers expect in a cost-effective manner. As retailers and manufacturers strive to increaseee profitability in the digital marketplace, logistics related to returns, local delivery, and inventory adjustments are becoming critical. Their margins depend on logistics service providers who can help streamline complex logistics processes (Logistics vision 2030: pivoting to a client-centric future, p. 3).

From the perspective of an online retailer, an inappropriate e-commerce return policy generates additional logistics and operating costs and has negative consequences for the environment. According to Geodis, returns logistics is a critical business process, considering that the return rate for online sales is 30% (Returns logistics, Geodis). DHL's e-commerce study found that 53% of companies consider returns to be one of their main supply chain challenges, and reducing return rates has a huge impact on their bottom line (E-commerce returns: three ways to tackle this growing challenge, DHL). As highlighted in the study "Returns in e-commerce", the environmental costs of returns are important and significant (Oksanowicz, 2023). According to the report "Responsible e-commerce", 67% of online shoppers believe that returning goods purchased online has a negative impact on the environment (Responsible e-commerce, 2021, p. 31). In the article "Customer-to-customer returns logistics: Can it mitigate the negative impact of online returns?" the authors emphasize that customer returns are a serious problem for online retailers due to their economic and environmental impact, and explore a new concept for handling online returns: customer-to-customer (C2C) return logistics, which involves delivering returned products directly to the next customer, bypassing the retailer's warehouse (Eruguz, Karabağ, Tetteroo, van Heijst, van den Heuvel, Dekker, 2024).

Materials and methods

In view of the dynamic development of e-commerce in Poland and the frequent phenomenon of returning goods in the online channel, there is a clear need to consider an e-commerce logistics model based on outsourcing logistics services and establishing cooperation with a logistics service provider offering professional returns handling as part of comprehensive logistics services. The aim of this chapter is to present, alongside the specific nature of e-commerce returns logistics, the role of logistics operators in handling e-commerce returns in Poland. E-shops are looking for ways to streamline and optimize this sensitive, complex, and time-consuming area of their business. The study uses methods of analysis and synthesis. The basis for the research was a review of domestic and foreign source literature and online resources, with particular emphasis on online materials from Polish TFL (transport-forwarding-logistics) operators handling returns in e-commerce.

The role of logistics operators in logistical handling of e-commerce returns in Poland

Processing returned products in e-commerce is a complex and costly process. According to analysts, the average cost of handling returned goods is approximately 20% of the value of the purchased

goods, which in turn reduces the margin (Oflakowski, 2023). An e-commerce entity should take care of, among other things, the collection and classification of returned products, entering them into inventory, inventory management, and coordinating activities within the framework of customer logistics services.

In the current turbulent socio-economic conditions and economic slowdown, online shop owners are looking for ways to improve profitability, reduce logistics costs, and streamline returns. Returns are becoming a major challenge for online retailers, which is why e-commerce businesses are looking for ways to streamline the returns process and allow online retailers to focus on their core business and grow their business. An online shop does not have to organize all logistics on its own, but can take advantage of the wide range of logistics solutions offered by operators on the Polish TFL sector (Table 2).

Table 2. Ranking of companies according to revenues from TFL activities 2024 in Poland

Place in the 2024 ranking	TFL company	Origin of foreign capital	Revenues from TFL in PLN in 2023	Revenues from TFL in PLN in 2024	Main source of revenue / main type of activity	E-commerce services
1.	Grupa Raben	Netherlands	4 222 695 641	4 576 412 703	logistic services	B2B
2.	GK DPD Polska Sp. z o.o.	France	3 952 252 138	4 419 102 244	courier services	B2C, B2B
3.	DSV	Denmark	2 420 700 937	2 516 869 423	logistic services	B2C, B2B
4.	ROHLIG SUUS Logistics S.A.	-	1 707 203 006	2 177 882 508	forwarding	B2C, B2B
5.	LPP Logistics Sp. z o.o.	-	1 574 763 193	2 080 989 158	logistic services	B2C
6.	ID Logistics Polska S.A.	France	1 664 590 305	2 074 951 721	logistic services	B2C, B2B
7.	Grupa Rhenus	Germany	1 801 034 783	1 804 612 256	logistic services	B2C, B2B
8.	Kuehne + Nagel Sp. z o.o.	Germany	1 359 878 562	1 598 950 035	logistic services	B2B
9.	Optima Logistics Group S.A.	-	1 556 465 000	1 583 776 000	forwarding	-
10.	FM Logistic (FM Polska Sp. z o.o.)	France	1 437 818 724	1 556 109 541	logistic services	B2C, B2B

Source: compiled on the basis of: Ranking of companies according to revenues from TFL activities in 2024, The 30. edition of TFL operators, Dziennik Gazeta Prawna, 26 June 2025, No. 122 (6539), https://edgp.gazetaprawna.pl/wydanie/59981,26-czerwca-2025/79519,30.-Ranking-firm-TSL/1.

Most of the companies in the top ten of the TFL ranking by Dziennik Gazeta Prawna (DGP) listed logistics services as their main source of revenue. Nine out of ten companies offer e-commerce services. For years, as shown by previous DGP rankings, the Raben Group, which provides comprehensive logistics services, has been the leader in the TFL industry in Poland. The Raben Group is a highly competitive player on the Polish TFL market and has extensive experience in providing services to online retailers, including both large e-shops and smaller e-sellers. E-commerce operations focus on three main areas: product storage, order preparation and shipping, handling returns and product exchanges, including comprehensive returns logistics, recording reasons for returns, entering returned products into inventory, and an individual process agreed with the online shop for handling returned and damaged products/shipments (E-commerce logistics services, Raben).

An example of a logistics service provider (LSP) that manages returns logistics in the e-commerce sales channel is Rhenus Logistics. "(…) At Rhenus Poland, we recognize the importance of returns management and the competitive advantage that can be gained from a robust and consistent process. We provide global support in the form of effective returns management tailored to customer needs. In addition to accepting returns, our experts are happy to arrange collection of goods and return them to the central warehouse or return point. Products are assessed for damage and the possibility of repair. Undamaged, unused devices can be repackaged, relabeled, and quickly returned to stock, while damaged goods can be recycled or disposed of" (Returns management, Rhenus).

International logistics operator Kuehne+Nagel also handles returns as part of its e-commerce services. E-commerce experts create customized B2C and B2B solutions that match your growing e-commerce business. E-retailers can simplify returns with Kuehne+Nagel's quality-focused system: check-in; sorting, grading and special services; inventory and resale. Kuehne+Nagel enables fast reintroduction of fully intact goods back into the warehouse so that they are ready for repurchase. The operator's reverse logistics solutions reduce waste by refurbishing and repackaging products. Thanks to secondary markets, products are recycled or reused to manufacture new products (E-commerce returns that drive an unrivalled customer experience, Kuehne+Nagel).

Logistics operators occupy a special place in the e-commerce supply chain. They integrate and coordinate logistics processes between e-retailers, buyers, and delivery providers. They often tailor the customer service process to individual e-commerce preferences, ensuring scalable solutions. They are able to effectively manage the returns process from the moment a return is reported, through to the receipt of the returned goods, verification of the return against the documents, assessment of the returned goods to determine whether they are in full value and in terms of damage/repair possibilities. sort and classify returns, refurbish and manage repairs; provide value-added services for returned products, e.g. authorized product disposal if necessary; accept returns to the target warehouse; put goods back on sale; ensure real-time visibility; confirm completion of the process and provide reports on returns, enabling e-shops to identify problems in the area of returns and improve customer service. The Omnipack operator emphasizes that: "It is worth creating a separate position in the warehouse and assigning a person to it who is constantly dealing with returns and understands their specifics. This allows her to expand her knowledge and work more effectively. Ideally, this position should be protected from frequent staff turnover" (Returns handling – how to manage the process to gain customer trust, Omnipack).

Observing the dynamic growth of e-commerce in Poland, logistics operators have become increaseeingly active in providing services for the online channel. Currently, the leaders of the TFL sector in the country offer comprehensive logistics services for online shops, including returns handling – the fulfillment model. For example operator FM Logistic offer comprehensive online order processing, will handle the fulfillment of the order from the moment the customer purchases products on the website, through picking and packing the products, to shipping and managing returns (Logistics for e-commerce, FM Logistic). Cooperation with a logistics operator enables cost optimization within logistics outsourcing, provides assistance in developing an effective returns system, and enables access to sustainable logistics. Operators have warehouse space that is often equipped with state-of-the-art technology, designed for maximum efficiency and product safety. They provide a range of innovative solutions tailored to the needs of e-retailers (e.g., AutoStore at

DSV, Locus Robotics robots at FM Logistic's warehouse, which will help reduce IKEA's online order fulfillment times). Currently, online trade support and logistics services for e-commerce represent significant potential for companies in the TFL sector in Poland. E-commerce returns handling for logistics operators is an important value-added service.

Poles choose attractive and flexible online shopping conditions, including returns. Customers want an easy and transparent product return process and convenient return options. As part of efforts to make the returns process easier for e-consumers, a ready-made return form or return label is often included in the package. The return label can be sent to an email address in PDF format or generated using an online form, to which the customer receives a link. They use shipping packaging with a double adhesive strip, which allows the packaging to be reused for returns. However, an important aspect for the customer is the possibility of sending a return package without having to print a label**.** Scientists from three institutes of the Łukasiewicz Research Network have developed a prototype of smart packaging for e-commerce (e-Pack), which is reusable and allows customers to access detailed data about their shipment (e.g., shock and drop levels). E-Pack has an electronic label, which should facilitate the return of goods in the same packaging (e-Pack – Smart return packaging for the e-commerce industry).

At this point, it is worth taking a look at popular forms of e-commerce returns in Poland. In the case of returns, customers have the option of using a courier service to send the return shipment; returning the goods using items outside the addressee's place of residence, known as OOH, including PUDO (Pick-Up Drop-Off, parcel drop-off and collection points) and using APM (Automated Parcel Machine), e.g. InPost parcel lockers, Allegro One Box, ORLEN Paczka, DHL POP BOX, DPD Pickup Station, Swipbox Poczta Polska), as well as return to a brick-and-mortar shop. According to the report "E-commerce in Poland 2023", the most popular forms of returns were: delivery to a parcel machine – 34% (89% chose InPost parcel lockers); free return by courier – 12%, free return to a brick-and-mortar shop – 12% (E-commerce in Poland 2023, p. 93). According to the report "E-commerce in Poland 2024", the most popular form of returns in 2024 were the option of free return of a product via parcel machines – 36% (95% chose InPost parcel lockers to return goods purchased online); free return of the product by courier – 12%, and free return to a brick-and-mortar shop – 12%. Less frequently, customers chose to return items purchased online by post – 7%. The possibility of returning the product free of charge at a PUDO point was declared by 7% of respondents (E-commerce in Poland 2024, p. 141, p. 144). As of the end of 2024, there were 51714 customer service machines operating in Poland, which is a 35.1% increaseee compared to 2023. In 2020, the number of devices was 10700 (Report on the state of the postal market in 2024, p. 52).

For an e-commerce entity, it is important to cooperate with courier companies and have access to a network of OOH points, especially if it wants to offer free returns. Optimal transport organization and customer access to a convenient and fast return network will have a positive impact on the image of online shops. For example, GLS offers flexible return options and has a network of 24000 GLS collection points, including 6000 Orlen 24/7 parcel machines (For online shops, GLS). It operates throughout Europe, enabling quick returns to online shops operating outside the country. As part of cooperation with GLS, customers can choose from services such as: ShopReturnService – a service for returning goods to a selected GLS Quick Parcel point; ExchangeService – allows you to deliver a parcel and collect goods for return at the same time – ideal for companies that service equipment; Pick&ReturnService – allows you to collect parcels from a specified address and forward

them to the sender; Pick&ShipService – this service allows you to collect a parcel from any address and forward it to another (e.g., delivery from a supplier to an end customer) (Returning goods purchased online – everything you need to know, GLS).

Table 3 below presents a list of selected TFL entities providing returns logistics for e-commerce in the country.

Table 3. Selected TFL sector entities in Poland providing returns logistics solutions for e-commerce

TFL entities	Link to the website
Grupa Raben	https://polska.raben-group.com/uslugi-logistyczne/logistyka-kontraktowa/e-commerce
DPD	https://www.dpd.com/pl/pl/oferta-dla-firm/dpd-fulfillment/ https://www.dpd.com/pl/pl/oferta-dla-firm/zwroty-z-dpd-polska/
Fedex	https://www.fedex.com/pl-pl/shipping/global-returns.html
Fiege	https://www.fiege.com/pl/logistyka/ecommerce-fulfillment
DHL	https://dhl24.com.pl/zwroty/
UPS	https://www.ups.com/pl/pl/smallbusiness/content/parcel-delivery/returns.page
GLS	https://gls-group.com/PL/pl/blog/zwroty-produktow/; https://gls-group.com/PL/pl/wysylanie-paczek/kurier-dla-firm/#gls_group_module_41_headline_4
Grupa DSV	https://www.dsv.com/pl-pl/nasze-rozwiazania/rozwiazania-logistyczne/logistyka-kontraktowa/rozwiazania-e-commerce
Rhenus Logistics	https://www.rhenus.group/pl/pl/warehousing/products-services/uslugi-wartosci-dodanej/#acc26264
ROHLIG SUUS Logistics	https://www.suus.com/logistyka-dla-ecommerce
InPost	https://inpost.pl/szybkie-zwroty
No Limit	https://nolimit.pl/informacje/obsluga-zwrotow
ID Logistics	https://www.id-logistics.com/pl/rozwiazania/logistyka-kontraktowa/
GEODIS	https://geodis.com/pl-pl/magazynowanie-i-logistyka-o-wartosci-dodanej/fulfillment-i-logistyka-wielokanalowa https://geodis.com/pl-pl/magazynowanie-i-logistyka-o-wartosci-dodanej/logistyka-zwrotow
Kuehne + Nagel	https://pl.kuehne-nagel.com/pl/-/services/e-commerce-logistics/returns
FM Logistic	https://www.fmlogistic.pl/rozwiazania/omnichannel/
Omnipack	https://omnipack.com/pl/fulfillment

Source: own study.

A logistics operator for an e-commerce entity often becomes a strategic partner supporting foreign expansion and sustainable development. According to the report "Logistics vision 2030: pivoting to a client-centric future" 88% of e-commerce leaders say having an international presence will be essential for their company's success in the next five years (Logistics vision 2030: pivoting to a client-centric future). Cross-border e-commerce (CBEC) is growing, and more and more Polish e-shops see the need to expand their business beyond the country's borders. For cross-border returns in e-commerce, it is also important to provide the customer with a clear and transparent procedure, with the option of easily downloading a return label and sending the parcel locally. As highlighted in a report prepared by the Łukasiewicz Research Network – Institute of Logistics and Warehousing on behalf of GS1, despite the relatively low popularity of cross-border trade in Poland,

there is a wide choice of logistics operators, which favors the expansion of companies into the global market (Cross-border e-commerce. GS1 standards in cross-border logistics, p. 12).

Conclusions

Returns are an integral part of online commerce. The approach to returns affects the positioning of an online shop – from informing customers about the return policy to putting the goods back on sale. Returns require logistical effort and should be managed in a consistent and seamless manner. Return logistics is a challenge for the e-commerce sector in Poland. The answer to improving this area is outsourcing logistics services and taking advantage of the experience and professionalism of TSL operators serving e-commerce.

Logistics operators are an important link in the supply chain in e-commerce. They play an important role in handling returns in Polish e-commerce and recognize the importance of competent logistics services in building a positive image for online shops. By ensuring fast and efficient returns logistics, operators contribute to optimizing storage and transport costs, thereby improving the profitability of e-commerce businesses. Automation and improvement of logistics processes in the area of returns contribute to increaseeed operational efficiency in e-commerce. Long-term cooperation between an e-commerce entity and a socially responsible logistics operator supports the sustainable development of an online shop. It is important to establish guidelines for efficient and sustainable customer service in the area of returns as part of supply chain cooperation. Customer experiences in the area of sustainable returns should serve as a reference point for further efforts to improve e-commerce logistics.

Online shops in Poland need logistics service providers who implement efficient return processes, are focused on continuous development, prioritize innovation in logistics services, are proactive, and stay ahead of today's logistics challenges in serving the e-commerce sector.

CHAPTER VI

INTERMODAL TRANSPORT IN POLAND – CURRENT STATUS AND DEVELOPMENT PROSPECTS

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Abstract: Intermodal transport in Poland plays an increaseeingly significant role in the country's logistics system, representing a response to the need for enhanced efficiency, reduced emissions, and adaptation to sustainable development trends. Poland, owing to its strategic location at the intersection of major European transport corridors, possesses considerable potential for the development of this transport mode. The analyses conducted by the authors indicate that further development of intermodal transport in Poland requires integrated actions in the areas of infrastructure, financing, and management. The objective of this study is to assess the current state of intermodal transport in Poland, identify factors that facilitate and constrain its development, indicate directions for actions required to improve its role in the national transport system, and analyse the impact of modern technologies and European Union policy on intermodal transport development. The study employs the analysis of literary sources and strategic documents – Transport Development Strategies, reports from the Central Statistics Office (GUS) and the Office of Rail Transport (UTK), statistical data analysis, case studies – the analysis of selected transport corridors and operators, as well as deductive reasoning – utilized to assess barriers, opportunities, and development directions for intermodal transport.
Keywords: intermodal transport, logistics, sustainable transport, transport corridors, multimodal freight transport

Introduction

At present, transport plays a vital role in the economic development of every country. Transportation needs arise primarily from increaseeed opportunities for population mobility and freight movement. This is caused by the development of global processes, as well as market development, world economy, and above all, society. Technical and technological progress along with innovation in the field of transport have resulted in needs related to goods movement requiring the use of more than one transport mode, and appropriate infrastructure for transshipment purposes. The response to this type of demand is intermodal transport, which integrates transport processes, combines the possibility of cargo transport from the most distant corners of the globe. This approach supports the development of international trade and affects customer satisfaction with goods delivery.

The objective of this study is to assess the current state of intermodal transport in Poland, identify factors that facilitate and constrain its development, indicate directions for actions necessary to enhance its role in the national transport system, and analyse the impact of modern technologies

and European Union policy on intermodal transport development. The topic of intermodal transport development in Poland is important for several key reasons – from both national and international perspectives. Poland is located at the intersection of major European transport corridors, constituting an important transit hub between East and West and between North and South Europe. For this reason, it has the potential to become a key link in global supply chains, particularly in transport between Europe and China. Intermodal transport, in which rail plays a significant role, is much more environmentally friendly than road transport. Promoting intermodal transport aligns with European Union policy aimed at reducing CO_2 emissions, alleviating traffic congestion, and reducing the number of road accidents. The growth of trade exchange, development of e-commerce and industry require efficient, predictable, and flexible logistics solutions. Intermodal transport can relieve road infrastructure and shorten transport time, especially over long distances.

The essence of intermodal transport

The foundation of intermodal transport functioning is social demand for using this type of transport and its profitability. Chief criteria for transport mode selection include reliability, punctuality, speed, flexibility, as well as cargo security and lowest transport costs. Considering these attributes, the service provider can make a decision about choosing a specific mode or combination of different transport modes that will be able to ensure the most optimal and desired results (Mindur, 2014, p. 336). Often the best solution for cargo transport is intermodal transport, which involves the transport of goods carried out using one, unchanged loading unit or the same road vehicle, during which different transport means belonging to at least two transport modes are used consecutively, without the need to reload the cargo itself when changing the transport means. Goods transport is carried out based on unified conditions resulting from an intermodal transport contract concluded between the client and the intermodal transport operator (Neider, 2019, pp. 119-121). Intermodal transport is a process in which goods movement is realized by transport means of different transport modes, e.g., using maritime, rail, and road transport means (Kacperczyk, 2012, p. 85). Intermodal transport consists of transporting loads in the same transport unit or vehicle, using at least two different types of transport applied consecutively, without the need to reload goods during transport mode changes. Contemporary changes in the transport industry focus mainly on redirecting part of transport from road transport to more ecological transport forms and technologies. Intermodal transport occurs when transport carried out by rail or waterway replaces road transport over longer distances. An example of such a solution is using trucks only for local and regional distribution transport, i.e., on the route between the sender or recipient and intermodal terminals (Wronka, 2008, pp. 17-18). This signifies that if cargo is placed in a container at the beginning of the journey, it must remain in one until the end. Key features of intermodal transport are: use of minimum two different transport modes, conclusion of one transport contract, participation of one performer responsible for delivery, and the necessity of cargo unitization (Leksykon transportowy, 2025). Table 1 depicts the advantages and disadvantages of intermodal transport.

Table 1. Advantages and disadvantages of intermodal transport

Intermodal transport	
Advantages	**Disadvantages/limitations**
• Through the integration of different transport modes, it is possible to reduce goods transport costs. • The application of alternative transport means (e.g., rail, inland navigation) allows reducing road traffic intensity. • In the case of using ecological transport means, intermodal transport becomes more environmentally friendly. • Technical modernization of transport offer – intermodal transport development favours investments in modern infrastructure, rolling stock, and logistics technologies, which improves the quality and efficiency of transport services. • Possibility of utilizing advantages of individual transport modes – intermodality allows combining advantages of different transport means, e.g., large capacity and low costs of rail with road transport flexibility. • Reduction of labour input in loading and unloading – through the use of unitized loads (e.g., containers), the number of transshipment operations decreases compared to traditional transport carried out using different transport means without containerization, which translates into time and labour cost savings.	• The intermodal transport service process involves more complex transport documentation. • There are limitations regarding the transport of certain types of cargo, e.g., livestock or goods requiring special conditions, such as isothermal transport. • The necessity of using specialized transshipment equipment – transport of unitized, often multi-ton loads requires the use of technologically advanced machines, such as cranes, hoists, or self-propelled vehicles, which enable their efficient movement beyond the reach of standard stationary equipment. • Requirement for appropriate equipment of rail terminals – to ensure an efficient transshipment process between different transport modes, terminals must be technically and logistically adapted, which involves high investment and operational costs.

Source: Own elaboration based on: Kacperczyk, R. (2012). Transport i spedycja p.1., Warszawa: Difin, Stolarski, J., Ślizewska, J., Ślizewski, P., Zielińska, A. (2020). Organizacja transportu p. 1. Warszawa: WSIP.

The main objective of using intermodal transport for transport service implementation is minimizing transport costs and time, as well as improving goods transport from producer to consumer (Stolarski, Ślizewska, 2017, p. 51). Intermodal transport in Europe is mainly based on the combination of rail and road transport. The essential part of the route is covered by rail, where loads are transported in unitized units such as containers or swap bodies. Road transport performs a supplementary function – it serves only for delivery of loads to rail terminals and their collection from the destination station and delivery to the final destination (Kacperczyk, 2012, p. 86).

Intermodal transport has contributed to significant convergence of different transport modes, which was possible thanks to the unification of loading units and the necessity to ensure their efficient and safe use. As a result, transport conditions and methods between individual transport means became similar, and favourable conditions for deep internal integration of transport processes were created. This process encompassed several key areas (Neider, 2019, p. 121):

- technical-technological - introduction of new types of transport means and modern transshipment and handling equipment;
- organizational - emergence of intermodal transport operators who coordinate the entire transport process;

- documentation - implementation of new or modified transport documents adapted to intermodality specifics;
- pricing - simplification of transport and transshipment tariff systems;
- legal - modification of liability rules and regulations concerning rights and obligations of participants in the process of moving loading and transport units.

The intermodal transport subsystem derives from traditional transport systems and represents the result of striving to optimize logistics processes through integration of transport carried out using at least two different transport modes. It encompasses real, functional connections between individual infrastructure elements and participants involved in the transport chain, which enables efficient and coordinated cargo movement (Wronka, 2008, p. 46).

Given that intermodal transport is based on building integrated transport chains in which individual stages are carried out by different transport modes, their mutual adaptation is of key importance. The previously mentioned integration areas – technical, organizational, documentation, pricing, and legal – emphasize how important compatibility between diverse transport systems is for smooth cargo flow. Developing common, coherent solutions in these areas constitutes a necessary condition for increaseeing competitiveness and attractiveness of intermodal transport. The efficiency and speed of cargo movement directly affects the quality and profitability of services provided within the so-called "intermodal", and thus, its market position (Krekora, 2019, p. 334).

Intermodal transport in Poland

Intermodal transport enables the creation of modern, integrated transport chains in which at least two different transport means cooperate within one coherent system. A key role in this system is played by transport nodes – terminals, which constitute contact points of different transport modes and enable cargo movement without the necessity of unloading from the loading unit, e.g., container. The more such terminals (both land and land-maritime), the greater the accessibility and flexibility of the transport network. An intermodal terminal is a place enabling fast, safe, and efficient transshipment of loading units between transport means belonging to different modes, e.g., from rail to road or from road to ship. The efficiency of the entire transport process depends on its infrastructure, equipment, and work organization. In 2023, a total of 39 active intermodal terminals operated in Poland. Of this number (GUS, 2024, p. 1):

- 4 terminals are maritime terminals, handling shipments in sea-rail and sea-road relations;
- 35 terminals are land terminals, designed to handle shipments in rail-road relations.

This structure shows the dominance of land terminals in the national intermodal infrastructure and the importance of seaports as key points in the international supply chain. Figure 1 presents the distribution of intermodal terminals in Poland in 2023.

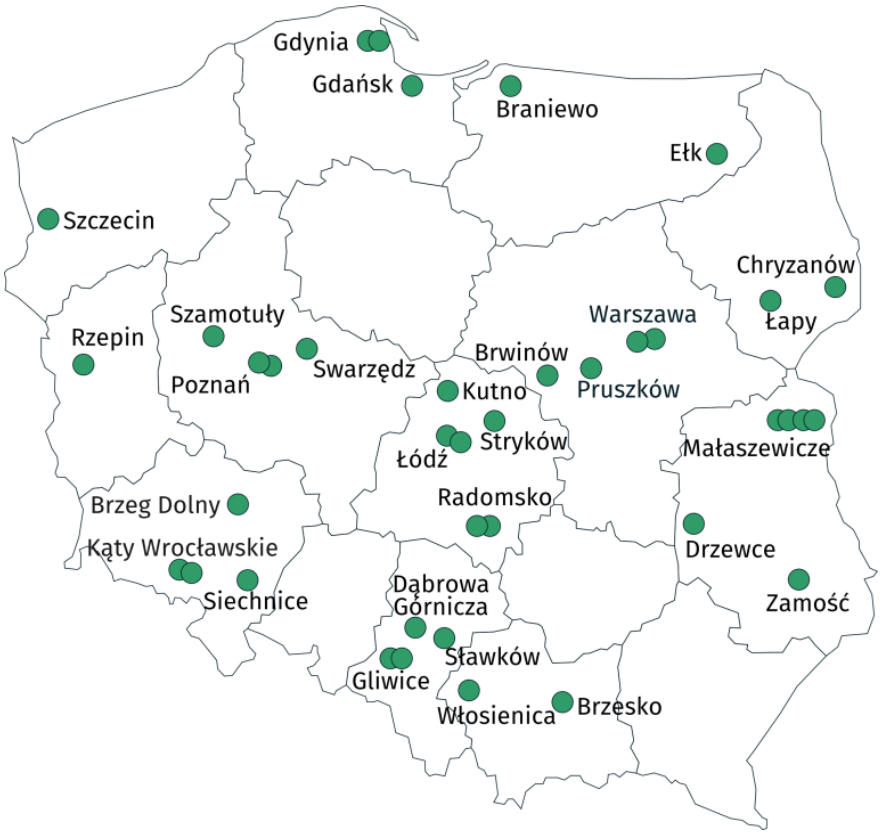

Figure 1. Distribution of intermodal terminals in Poland in 2023

Source: GUS (2024). Intermodal transport in 2023, https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5511/14/8/1/ transport_intermodalny_w_polsce_w_2023_r.pdf

The equipment of intermodal terminals and the scope of tasks performed by them are diversified and depend on their role in the supply network. These terminals differ significantly in terms of available infrastructure and technology, which directly affects their operational capabilities. A key indicator used for evaluating and comparing container terminals is annual transshipment capacity, expressed in TEU (Twenty-foot Equivalent Unit). Terminal transshipment capacity is primarily influenced by the number and type of transshipment equipment used and their operational efficiency, as well as storage area, which determines the possibilities for storage and rotation of loading units. Differences in terminal equipment and work organization determine their efficiency and the role they play in the national and international intermodal transport system. In 2023, maritime terminals in Poland had extensive transshipment and storage infrastructure, enabling efficient handling of intermodal units. Their key parameters were as follows (GUS, 2024, p. 2):

- Total length of transshipment quays was 5.8 km, of which 73.3% were quays designated for handling units in the lo-lo system (lift-on/lift-off).
- Parking and manoeuvring area occupied 6.1 ha, while the total storage area of terminals was 169.8 ha, of which as much as 95.4% was designated for containerized units.
- Storage capacity of maritime terminal yards reached 115.2 thousand TEU, reflecting their storage capabilities.
- Terminals possessed a total of 17.0 km of standard gauge railway tracks, of which 70.7% were used directly for loading and unloading operations of intermodal units.

- Average length of railway consist that could be simultaneously handled in a maritime terminal was 71 wagons.

These data indicate high specialization and potential of Polish maritime terminals in handling intermodal freight traffic. In 2023, land terminals in Poland were characterized by developed infrastructure adapted to intermodal transport service, particularly in rail-road relations. Their most important parameters were as follows (GUS, 2024, p. 2):

- Parking and manoeuvring area totalled 25.0 ha.
- Total storage area of land terminals was 99.3 ha, of which 79.6% was designated for containerized units.
- Storage capacity reached 128.8 thousand TEU, representing significant storage potential.
- Land terminals possessed a total of 102.2 km of standard gauge tracks, of which 39.9% served directly for loading and unloading intermodal units.
- Average length of handled railway consist was 29 wagons.

Compared to maritime terminals, land terminals have greater total track length and higher storage capacity, but a smaller share of tracks used directly for transshipment and shorter consists handled simultaneously. These data reflect the specificity and function of land terminals in the national intermodal transport system – as intermediate links between rail transport and the final recipient. Table 2 presents the share of intermodal transport in total transport in Poland in 2018-2023.

Table 2. Share of intermodal transport in total transport in Poland in 2018-2023

Year	Intermodal transport (TEU)	Total transport (TEU)	Intermodal share (%)
2018	1 200 000	15 000 000	8%
2019	1 250 000	15 500 000	8.1%
2020	1 300 000	16 000 000	8.1%
2021	1 350 000	16 500 000	8.2%
2022	1 400 000	17 000 000	8.2%
2023	1 450 000	17 500 000	8.3%

Source: GUS (2025). https://new.stat.gov.pl/

Intermodal transport in Poland shows stable growth both in absolute numbers and in percentage share relative to total transport. Intermodal transport constitutes a significant part of freight transport in the country, which may indicate the growing importance of efficient and ecological transport methods. Table 3 shows transport performance for intermodal transport in Poland in 2020-2024.

Table 3. Transport performance for intermodal transport in Poland in 2020-2024

Year	Intermodal transport – transport performance (billion tkm)
2020	7.8
2021	8.2
2022	8.4
2023	8.5
2024	9.4

Source: GUS (2025). https://new.stat.gov.pl/

In 2023, total transport performance of freight transport amounted to 494.563 billion tkm, of which rail (including intermodal) performed approximately 61.085 billion tkm, giving a 12.3% share (Office of Rail Transport (UTK), 2025). A significant increaseee of 10.7% in intermodal transport performance occurred in 2024, from 8.5 to 9.4 billion tkm.

The importance of intermodal transport for Poland

Poland, as a country located at the intersection of two key European transport routes – north-south and east-west – plays an important role in international trade exchange. Regardless of transport mode, enormous quantities of export cargo are transported through our country. In recent years, intermodal logistics has gained importance in the Polish market, resulting from, among other factors, the growth in transport volume, including on the Europe-China route. The use of rail transport on this route allows reducing delivery time by half compared to maritime transport and lowering costs by as much as 70% compared to air transport. In the era of rapid technological changes, modern solutions that are worth implementing and developing are of key importance. Investments adapted to the needs of the contemporary market, especially in the railway sector, can significantly improve transport processes, shorten delivery time, and ensure greater predictability and price stability (Centralny Port Komunikacyjny i rosnące możliwości dla transportu intermodalnego w Polsce, 2025).

Intermodal transport in Poland shows great development potential, resulting from, among other factors, the country's strategic location in the centre of Europe and access to the Baltic Sea. However, this development is constrained by certain obstacles, such as the poor condition of railway infrastructure and insufficient number of intermodal terminals, particularly in northeastern and eastern Poland (Transport intermodalny – co to jest i jakie ma znaczenie w logistyce, 2023).

It should be emphasized that Poland should fully utilize its strategic location at the crossroads of major European railway corridors. Of particular importance are corridors connecting the Baltic Sea with the Adriatic Sea and the North Sea with the Baltic Sea. Increaseeingly intensive traffic is observed on the east-west axis, where transport between China and Europe dominates, and Poland plays a key role as a transit country. To increaseee the importance of other transport directions, it is necessary to intensify activities within the corridor connecting Polish seaports with southern neighbours, and the transport corridor running from southeastern Poland through Slovakia, Hungary, and Slovenia to the border with Belarus in Małaszewicze. Development of these routes requires not only expansion of intermodal infrastructure and optimization of transport organization, but also adjustment of customs and tax regulations, which will improve cargo handling and increaseee Poland's competitiveness as a key link in the European logistics chain (Teraz środowisko, 2025).

The dynamic development of intermodal transport is a response to the changing needs of the logistics industry and growing demand for transport solutions that are both efficient and environmentally friendly. The largest intermodal operators continue to play a key role in the Polish market. PCC Intermodal and PKP Cargo together account for nearly 40% of transport – both in terms of mass and transport performance. Other experienced carriers, such as DB Cargo Polska, LTE Polska, and Metrans Rail, are also of great importance. At the same time, increaseeed activity of smaller companies is noticeable, including Alza Cargo, LTG Cargo Polska, and Laude Smart Intermodal. Their growing market share indicates increaseeing sector competitiveness and greater flexibility in adapting services to customer needs. Current market stabilization combined with the growing importance of smaller players confirms the maturity of the intermodal sector. In the face of growing

requirements for sustainable development, automation, and logistics digitization, intermodal transport remains one of the key areas for further railway development in Poland (KoleoNews, 2025).

Development perspectives of intermodal transport in Poland

Among the key factors favouring the development of intermodal transport in Poland, the following can be mentioned (Szepietowska, Baran, 2012, p. 610):

- European Union transport policy, which promotes pro-ecological transport modes, aims to reduce pollution emissions and improve safety (in accordance with the assumptions of the "White Paper" from 2011);
- Poland's favourable geographical location, situated at the crossroads of major trans-European transport corridors;
- Growth in international trade exchange, which translates into growing demand for efficient and reliable freight transport;
- Increaseeed demand for transport of highly processed goods, which require a fast and integrated logistics system, favouring the use of combined transport technology;
- Availability of spare transport capacity in the railway sector, creating a real opportunity to take over part of cargo currently transported by road;
- Entry of new intermodal operators into the market, possessing their own rolling stock and developing terminal networks, which contributes to increaseeed competitiveness and improvement in the quality of transport services provided.

These factors together create solid foundations for further development of intermodal transport as a modern, sustainable, and increaseeingly important segment of the transport market in Poland.

Intermodal transport in Poland possesses significant development potential. This largely results from the relatively well-developed railway network and systematic appearance of new operators in the market. An important factor supporting the development of this segment is also the dynamic development of Polish seaports, such as Gdańsk, Gdynia, and Świnoujście, which drive the growth of intermodal transport. Despite the mentioned advantages, the share of intermodal transport in the total transport market in Poland still remains small. Challenges include difficulties in precisely estimating costs and prices in various areas—such as infrastructure management, terminal handling, and other logistics processes. Operational complexity makes intermodal transport logistically more demanding than traditional rail transport (Barcik, Bylinko, 2018, p. 17).

The transport development strategy in Poland until 2020 assumed achieving a 10-15% share of intermodal transport in the market; this goal remains within reach, especially given the current pace of international trade growth and further development of port infrastructure (Strategia rozwoju transportu, 2013).

However, the key problem remains insufficient financial support from the state. Intermodal transport generates additional costs related to transshipment operations, and high infrastructure access rates and lack of reliefs do not favour its competitiveness. Without systemic supporting measures, development of this segment may be hampered despite its great potential (Barcik, Bylinko, 2018, p. 17).

The development of intermodal transport involves the necessity of significant financial outlays, both for infrastructure expansion and purchase of modern rolling stock, as well as for implementing innovative solutions in transport organization. Although the freight transport sector generally does not belong to the most innovative, in the first two decades of the 21st century, a number of technological improvements were implemented. Progress concerned, among others (Ministry of Infrastructure, 2022):

- Modern constructions of loading units (ITU);
- Wagon modernization;
- Development of modular transport systems (including wagon, ITU, and transshipment technologies);
- Advanced loading and unloading equipment;
- Terminal management systems;
- Digital information platforms;
- Automatic container and wagon identification systems;
- Modern transport and logistics service concepts.

These solutions translate into better operational parameters – e.g., increaseeed loading capacity, more efficient rolling stock turnover, and shortened service time. A key condition for their effective application is optimal utilization of available resources, including proper selection of wagons for the type and structure of cargo and maximum utilization of consist length.

Modern systems are distinguished by modularity and the possibility of adaptation to specific needs of various industries and individual customer requirements. An example is the Innofreight system, which includes specialized platform wagons (InnoWagon), containers adapted for transporting various materials (e.g., biomass, ore, coal), and dedicated transshipment equipment. Other examples include the ACTS system and technologies for transporting road trailers, such as CargoBeamer, Megaswing, and Modalohr (Lohr Railway System). In the case of intermodal terminals, increaseeing importance is attached to (Ministry of Infrastructure, 2022):

- Noise reduction (e.g., through systems that brake grippers before containers);
- Automation of transshipment operations;
- Improvement of staff working conditions;
- Increaseeed safety (including anti-terrorist security);
- Maintaining high hygiene standards (e.g., rapid washing and disinfection systems for cargo spaces and material resistance to contamination and odours).

All these measures aim to increaseee the efficiency, safety, and flexibility of the intermodal transport system in Poland, making it more competitive and adapted to contemporary logistics challenges.

Conclusions

Poland possesses significant opportunities for intermodal transport development, primarily due to its favourable geographical location, dynamically developing seaports, and increaseeing volume of international exchange, especially on the Europe-Asia axis. The share of intermodal transport in railway transport performance has reached a record level, indicating its growing role in national logistics. Smaller operators are also gaining increaseeing importance, which affects increaseeed

competitiveness and service flexibility. The development of container terminal networks – especially in underserved regions – and railway infrastructure modernization are key conditions for further sector growth. Modern transshipment systems, digital platforms, automatic cargo identification, and modular rolling stock solutions significantly increaseee operational efficiency and open new possibilities for serving various industries.

The lack of systemic financial support and tax reliefs for intermodal transport slows its development. Greater state involvement and better adaptation of customs and tax regulations are required. European Union policy promoting low-emission transport forms (e.g., rail) and growing pressure for sustainable development create strong justification for investment in intermodal transport. Intermodal transport still involves higher operational costs and greater logistics complexity than traditional road transport. Better system integration and process optimization are necessary.

CHAPTER VII

COMMERCIALIZING AI THROUGH WRAPPER TECHNOLOGIES: BUSINESS MODELS, ADOPTION CHALLENGES, AND MANAGEMENT IMPLICATIONS

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Abstract: This study examines AI wrappers as strategic management instruments for organizational implementation of generative artificial intelligence capabilities. Through a structured narrative review of 23 sources (2020-2025), author analyze how management teams can leverage AI wrappers to accelerate organizational transformation while managing implementation risks. The research addresses critical management challenges including resource allocation, change management, and strategic positioning in competitive markets. Findings reveal that 95% of organizations fail to achieve ROI from AI initiatives due to poor management alignment and inadequate organizational learning mechanisms. Author propose a five-dimensional management framework encompassing strategic monetization, operational architecture, governance systems, competitive defensibility, and market positioning. The study contributes practical management guidelines for executive decision-making, including staged implementation approaches, cost-benefit analysis frameworks, and organizational capability development strategies. Key managerial insights include the necessity of contextual learning systems, cross-functional integration, and adaptive governance structures for sustainable AI adoption in complex organizational environments.
Keywords: strategic management, organizational transformation, AI implementation, managerial decision-making, technology adoption, competitive advantage

Introduction

The generative artificial intelligence (GenAI) market has experienced precipitous acceleration, accompanied by substantial capital availability for "model-native" solutions. This paper advances the thesis that AI wrappers—defined as an intermediary layer that encapsulates existing models and facilitates their practical deployment—offer enterprises and start-ups a privileged pathway to reducing time-to-value. However, this potential is realised only under conditions of intensive competition and considerable operational challenges. On one hand, market demand remains enormous: according to Gartner's projections, global expenditure on generative AI is expected to rise to $644 billion in 2025, representing a 76.4% increaseee compared to 2024 (CDO Magazine Bureau, 2025). On the other hand, funding has reached record levels: global venture capital investment in generative artificial intelligence surged to $49.2 billion in the first half of 2025 (EY Ireland, 2025), with the close of 2024 marked by fourth-quarter transaction values reaching $31.1 billion—an 84% increaseee compared to the third quarter (Austin, 2025). Simultaneously, the current market is characterised by oversaturation with elementary solutions.

Today's landscape is replete with AI tools, the majority of which are simple wrappers executing API calls without robust competitive advantage. In such an environment, the implementation layer serves as a catalyst for the transition from prototype to outcome, provided it delivers genuine added value. An AI wrapper is defined as software that invokes AI systems, such as ChatGPT, to perform specified tasks, often serving as an intermediary that facilitates user interaction with complex AI systems (Dhaliwal, 2025). This intermediary role extends beyond basic invocation, enabling enhanced functionality through workflow orchestration, data integration, and quality assurance mechanisms. Market practices in the GenAI application layer have accelerated considerably more rapidly than academic reflection on the mechanisms of value creation and preservation. Industry sources catalogue proven monetisation archetypes, including:

1) the freemium model, which offers a basic product version gratis with charges for premium features;
2) usage-based billing, which aligns revenue with customer value; and
3) hybrid models that combine subscription predictability with usage elasticity.

These archetypes have demonstrated efficacy in fostering adoption, yet their implementation in wrappers must contend with emerging challenges, such as the need for contextual learning to bridge adoption divides (Challapally et al., 2025). For instance, research highlights a "GenAI divide," where 95% of organisations achieve zero return on investment despite high pilot volumes, primarily due to limitations in learning-capable systems and misalignment with operational processes (Challapally et al., 2025). However, the literature also indicates significant challenges: AI wrapper start-ups encounter market saturation that hampers differentiation, low barriers to entry that lead to intense competition, and long-term viability risks associated with dependence on third-party AI models (Dhaliwal, 2025). Additional risks include biases embedded in underlying models, contextual misunderstandings, and sensitivity to prompts, which can undermine reliability in business applications (Cheung, 2024). In sectors like finance, GenAI wrappers promise improvements in language modelling and data handling but face issues such as data scarcity, inference latency, and inherent biases (Desai et al., 2025). Sociotechnical implications further complicate deployment, with potential disruptions to information ecosystems, including content pollution and inequities in access that exacerbate digital divides (Mitra et al., 2024). Open-source wrappers offer opportunities for innovation and cross-pollination but introduce dual-use risks and regulatory concerns (Eiras et al., 2024). Governance frameworks are essential to address these, as GenAI's autonomy and opacity—manifest in phenomena like hallucinations—necessitate risk-based approaches to mitigate harms such as erroneous outputs or intellectual property infringements (Schneider et al., 2025). To comprehend these dynamics, mature theoretical frameworks are incorporated. Organisational absorptive capacity explains how the wrapper layer can reduce cognitive costs and accelerate the internalisation of new technology (Cohen & Levinthal, 1990), whilst dynamic capabilities theory underscores the significance of integrating, building, and reconfiguring competencies in response to changing environments (Teece et al., 1997). The technology acceptance perspective, in turn, elucidates why perceived usefulness and low barriers to entry are empirically critical (Davis, 1989). These frameworks collectively suggest that wrappers can convert "raw" model capabilities into sustained adoption, but only with proper design and execution. Recent studies on adoption processes reveal additional divides: a learning divide, where individuals vary in updating perceived utility, and a utility divide, influenced by demographics such as education and background (Ma et al., 2024). Wrappers can mitigate these through user-centric strategies, such as prompt engineering and

assessment frameworks (Sun et al., 2024), yet must incorporate openness principles for reproducibility and transparency (White et al., 2024). On this foundation, a balanced research thesis is formulated: AI wrappers can democratise access to GenAI capabilities and accelerate monetisation, yet success is not guaranteed owing to intensive competition, low barriers to entry, significant operational costs, and evolving risks such as those in transitioning to agentic AI systems (Schneider, 2025). A wrapper becomes a genuine product when value is generated through facilitating individual tasks or assisting enterprises in earning revenue (Dhaliwal, 2025).

The objectives of this article encompass: (1) a critical analysis of wrapper adoption models, considering both successes and failures; (2) the proposal of a business model taxonomy with risk assessment; (3) the identification of regulatory implications; and (4) the formulation of managerial recommendations based on cost-benefit analysis.

Methodology

The author conducted a structured narrative scoping review, informed by PRISMA-ScR where applicable, to synthesise evidence on implementation wrappers in the context of generative systems. The review focused on definitional boundaries of the wrapper layer, business models and adoption, architectural and integration issues together with governance, and regulatory and social implications. Findings are integrated into a five-dimension framework that covers monetisation, architecture and integrations, governance, defensibility, and go-to-market and adoption. The protocol was not prospectively registered given the exploratory scope, and ethics approval was not required because only published sources were analysed.

The review addressed three research questions: first, the key characteristics and business models of wrappers; second, the principal barriers and risks that accompany implementation and adoption; third, the extent to which established organisational theories such as absorptive capacity, dynamic capabilities, and the technology acceptance model can guide value creation and risk mitigation.

The time window covered 2020 to 2025 in order to reflect rapid field evolution. Searches and screening were conducted in English and Polish. Sources comprised Scopus, Web of Science Core Collection, ACM Digital Library, IEEE Xplore, and arXiv, complemented by institutional repositories and reports relevant to governance, adoption and return on investment, openness and reproducibility, and the transition toward agentic tooling. Inclusion required at least one of the following: a clear definition or scope of wrappers, a monetisation or adoption model, a technical or governance challenge, empirical implementation or ROI evidence, an organisational or adoption theory contribution, or sociotechnical risks and implications for agentic functionality. Exclusion covered non-substantive commentaries, duplicates, and items without verifiable bases.

The search strategy combined implementation-layer terms with business, technical, and governance facets. Representative strings, adapted to each index syntax, included the following: "AI wrapper" or "LLM wrapper" or "application layer" combined with monetization or pricing or "business model*" or adoption; "generative AI" or LLM* combined with implementation or integration or latency or reliability or governance or "EU AI Act"; open source combined with GenAI or LLM* combined with risk* or dual use or openness or taxonomy; "agentic AI" or "AI agent*" or orchestration combined with governance or evaluation or oversight. The initial search was completed on 6 August 2025 and an update was performed on 20 August 2025. Institutional sources

were queried by title and author for items such as State of AI in Business 2025, Governance of Generative AI for Companies, and Generative to Agentic AI, and by thematic strings such as Model Openness Framework and Risks and Opportunities of Open-Source GenAI.

Backward and forward citation chasing complemented database retrieval. Screening and selection proceeded in two stages carried out by one reviewer with calibration by a second reviewer. Titles and abstracts were screened first, followed by full texts for records that appeared eligible. Duplicates were removed before full-text assessment. To reduce optimism and publication bias, the corpus intentionally included critical and null-result perspectives, for example on pilot stall and zero ROI, sociotechnical risks, and evaluation challenges in agentic settings. As this was an exploratory narrative scoping review and early-stage counts were not recorded in a form suitable for reliable quantitative reporting, those counts are not presented to avoid misrepresentation. In total, 23 sources met the inclusion criteria and were synthesised. Data were extracted with a structured sheet aligned to the article architecture. The extraction captured definition and scope of the wrapper layer including orchestration, quality assurance, and integrations; architecture and integrations including multi-model use, API management, latency and reliability, and scaling costs; monetisation and ROI including freemium, usage-based and hybrid models together with value metrics; governance and risk including monitoring, regression testing, legal compliance, hallucinations, bias, and intellectual property; defensibility including domain moats, switching costs, and openness and intellectual property; go-to-market and adoption including CAC and LTV logic, pilot-to-scale-to-adopt pathways, and segmentation; and risks and failure patterns including market saturation, pilot stall, dual use, and divides in learning and utility.

Appraisal of source quality was matched to the scoping aim. Peer-reviewed studies were assessed for relevance to the research questions and for methodological transparency including data scope, metrics, and limitations. Grey literature was appraised using the AACODS framework that considers authority, accuracy, coverage, objectivity, date, and significance, with particular attention to disclosure of methods and limitations in institutional reports and industry analyses. Synthesis followed a concept-centric thematic approach that mapped evidence onto the five-dimension framework. Governance findings were connected to risks of hallucination and bias and to applicable policy regimes such as the EU regulatory framework discussed in the literature. Architectural findings were connected to latency, reliability, and total cost of ownership for scaled operation. Defensibility findings were connected to questions of openness, platform replication risk, and switching costs. Adoption and market findings reflected heterogeneous user groups and documented learning and utility divides. Monetisation findings were anchored in realised value and the dynamics of pilot stall. The interpretive layer drew on absorptive capacity understood as the ability to acquire, assimilate, transform, and exploit external knowledge in orchestration standards, on dynamic capabilities understood as the capacity to reconfigure resources under shifting models and regulation, and on the technology acceptance model understood as perceived usefulness and ease of use as adoption drivers. These lenses were used to relate implementation choices in the wrapper layer to sustained value under uncertainty. Bias management recognised three main risks, namely rapid evolution of the field, the proportion of grey literature, and under-reporting of failures. Mitigations included prioritising peer-reviewed strands for governance, openness, and sociotechnical topics, systematic AACODS appraisal for reports, deliberate inclusion of critical or null findings, and transparent reporting of search dates together with a qualitative flow description. No new data were generated.

Literature review and conceptual framework

The quality and functionality of AI wrappers vary widely. At one end of the spectrum sit minimal implementations, often described as thin user interfaces that forward application programming interface (API) calls without adding material value. This segment is crowded and offers limited competitive advantage (Dhaliwal, 2025). Such tools tend to present cosmetic layers over existing model capabilities and contribute to a proliferation of undifferentiated solutions noted by industry analysts. At the other end are wrappers that extend underlying models in practical ways. These implementations mediate user interaction, standardise data handling, and add control over inputs and outputs. They combine workflow automation, error handling, and product-level quality assurance that go well beyond interface provision (Rapacke, 2025). In finance, for example, wrappers can apply generative artificial intelligence (GenAI) to anomaly detection or predictive analysis by leveraging large language models (LLMs) for context handling and structured output, while also addressing biases and inference latency that affect operational reliability (Desai et al., 2025). Between these endpoints lies a set of hybrid approaches. Some are narrowly focused and embed domain knowledge; others orchestrate multiple models to support end-to-end processes. The key analytical distinction is whether a wrapper delivers value that cannot be replicated easily by direct access to a foundation model.

Open-source tooling adds both opportunity and risk. The Model Openness Framework (MOF) classifies models by the release of code, data, and documentation under permissive licences, improving reproducibility and transparency (White et al., 2024). Openness, however, introduces dual-use concerns and requires safeguards against bias and harmful content generation (Eiras et al., 2024). Within this article, wrappers are treated as an implementation–product layer above GenAI models. The layer includes user interface, API management, workflow orchestration, integration with data and tools, and quality mechanisms. Technical barriers to basic functionality are relatively low, yet defensible and scalable products require domain expertise, careful engineering, and sound positioning. Sociotechnical aspects also matter. Risks such as content pollution or manipulation of information access underline the need for mitigation strategies that protect equity and trust (Mitra et al., 2024). Commercial models for wrappers tend to follow software as a service (SaaS) conventions. Three patterns recur in the literature: freemium funnels that convert to paid tiers (Dhaliwal, 2025), usage-based pricing that links spend to realised value (Dhaliwal, 2025), and hybrids that mix predictability with elasticity (Dhaliwal, 2025). Adoption is not automatic. Many wrappers face intensive competition and are easy to copy unless they add substantial value beyond what general-purpose models provide (Dhaliwal, 2025). Evidence of a GenAI divide is strong: exploration rates remain high, yet a reported 95% of organisations record no return on investment, often due to brittle workflows and limited contextual learning (Challapally et al., 2025). Durable advantage rarely comes from the interface itself. Vertical integration and domain-specific capability create moats that are harder to displace (Vargas, 2024). The trade-off is cost. Initial configuration and ongoing maintenance can be expensive due to computation, data pipelines, and monitoring requirements (Sai et al., 2025). In applied settings, LLMs show promise for analysis and decision support, but bias, prompt sensitivity, and context limits require careful evaluation before core operations are affected (Cheung, 2024). Open-source models can lower barriers and foster experimentation, while raising long-term concerns about runaway progress and the need for robust risk management practices (Eiras et al., 2024). Business models are also moving towards more adaptive systems. Wrappers

increaseeingly incorporate agentic features, including planning and interaction across components, with potential for multi-agent orchestration and richer monetisation options (Schneider, 2025). These gains arrive with externalities, such as energy use from large-scale deployments, and create a design problem: innovation must be balanced with sustainability and governance (Mitra et al., 2024). Adoption dynamics can be read through established organisational theories. Absorptive capacity explains how wrappers reduce cognitive costs by standardising interactions and packaging capabilities, which supports internalisation of new technology (Cohen & Levinthal, 1990). There are limits. Lower cognitive load can coincide with higher operational overhead, including compute budgets, API management, and maintenance (Sai et al., 2025). Recent work also documents learning divides and utility divides across user groups. Without targeted intervention, these dynamics can produce belief traps and underuse (Ma et al., 2024). Dynamic capabilities focus attention on integration and reconfiguration of competencies as conditions change (Teece et al., 1997). In wrapper contexts, this includes adapting to evolving model offerings, shifting regulation, and active competition. Model adaptation may require costly retraining or pipeline changes, which affect feasibility and timing (Sai et al., 2025). In user-centred scenarios, prompt engineering and assessment methods, such as Learning–Using–Assessing, can support adoption, but they must also accommodate co-creation and constraints from usability and compliance (Sun et al., 2024). The technology acceptance perspective links adoption to perceived usefulness and ease of use (Davis, 1989). Wrappers that simplify interfaces and deliver reliable gains are more likely to scale. Realising these gains typically involves integration work, training, and change management. Governance is central. Autonomy and opacity in GenAI require frameworks to manage hallucinations, bias, and intellectual-property exposure, and to align systems with organisational controls (Schneider et al., 2025). Taken together, these theories suggest that wrappers can translate model capability into persistent use and economic outcomes. The translation is not cost-free. It entails operational expense and competitive risk, which call for explicit return-on-investment analysis. Openness principles, as captured by MOF, can strengthen reproducibility and auditability, yet they must be balanced against risks in open-source ecosystems (White et al., 2024). Implementation brings technical and regulatory demands. Integration across multiple APIs requires robust error handling, clear documentation, and thorough testing (Dhaliwal, 2025). Scalability concerns include elasticity under load and control of latency at scale (Dhaliwal, 2025). Security covers data protection, access control, and secure API practices (Dhaliwal, 2025). Reliability of outputs remains a primary issue. Inaccurate results and weak explainability undermine trust (Dhaliwal, 2025). Reported figures include a 30% failure rate on mathematical and statistical prompts and hallucination rates of 25% in private chat agents in settings with poor implementation practices (AI4SP, 2024). In finance, challenges extend to data scarcity, pre-training issues, and bias. Parameter-efficient fine-tuning and prompt methods are used to mitigate these constraints (Desai et al., 2025). Sociotechnical risks, including content pollution and unequal access, complicate reliability and require structured evaluation to reduce harm (Mitra et al., 2024). Regulatory baselines in the European Union follow a risk-based approach under the European Union Artificial Intelligence Act (EU AI Act), which assigns obligations by application class (European Parliament, 2025). Licensing and privacy law add further requirements. Organisations must manage the terms of model and dataset licences, and comply with the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) where applicable (Dhaliwal, 2025). Mature governance therefore includes regression testing, continuous quality monitoring, incident response, and access

control, with realistic accounting for cost. High-risk systems must also address autonomy and opacity, with extended adaptation periods provided in the EU AI Act for compliance (Schneider et al., 2025). Open-source wrappers intensify both benefits and risks by enabling cross-pollination of practice while raising dual-use concerns (Eiras et al., 2024). Transitions to agentic systems add complexity and call for controls around reasoning, memory, and interaction to handle evolving risks (Schneider, 2025).

This section proposes a five-dimensional taxonomy for the design and evaluation of AI wrappers. The taxonomy is grounded in the structured narrative review and reflects realistic limitations and costs. The five dimensions are: monetisation, architecture and integration, governance, defensibility, and go-to-market (GTM) and adoption. Each dimension specifies indicators, principal risks, and mitigation options that together provide a practical framework for assessing viability in competitive generative artificial intelligence (GenAI) markets.

Table 1. Five-dimensional taxonomy for AI wrapper evaluation

Dimension	Key indicators	Primary risks	Mitigation considerations
Monetisation	Presence of freemium tiers, usage-based pricing, hybrid subscription–usage models, competitive landscape analysis	Price wars in saturated segments, dependency on external vendors, churn under competitive displacement, investment bias toward visible functions over high-return back-office operations (Challapally et al., 2025)	Align price with realised value through hybrid approaches, incorporate contextual learning to raise perceived utility and reduce churn, prioritise use cases with measurable outcomes (Challapally et al., 2025)
Architecture and integration	Number and type of integrated application programming interfaces (APIs), multi-model orchestration, latency and scaling bottlenecks	High operating costs at scale, external API dependency and latency, infrastructure lock-in, data scarcity in domain settings (Desai et al., 2025)	Use open-source components for flexibility with robust error handling, apply fine-tuning and prompt methods to strengthen multi-model capability, add agentic elements such as reasoning and memory where they improve adaptability (Desai et al., 2025; Schneider, 2025)
Governance	Automated monitoring, integration testing, audit trails, alignment with the European Union Artificial Intelligence Act (EU AI Act) and the General Data Protection Regulation (GDPR)	Regulatory non-compliance, false positives or negatives in validation, escalating compliance cost, autonomy and opacity producing hallucinations or bias (Schneider et al., 2025)	Adopt risk-based governance, implement the Model Openness Framework (MOF) for reproducibility of code, data, and documentation, use human-in-the-loop controls in high-stakes contexts (White et al., 2024)
Defensibility	Depth of vertical integrations, distinct value proposition, switching costs and embedded workflows	Replication by large platforms, ease of replacement via direct model access, dual-use concerns in open source (Eiras et al., 2024)	Build moats through domain-specific customisation and proprietary interfaces, selective openness with safeguards, intellectual property strategies where applicable (Eiras et al., 2024)
GTM and adoption	Pilot–scale–adopt pathways, customer acquisition cost (CAC) and lifetime value (LTV), engagement and retention metrics	High CAC in crowded markets, usability barriers and resistance to change, learning and utility divides that create belief traps (Ma et al., 2024)	Apply user-centred methods including prompt design and Learning–Using–Assessing (LUA) frameworks, segment by user heterogeneity, combine training with change management to support scale-up (Sun et al., 2024)

Source: own study.

Monetisation patterns largely follow software as a service (SaaS) conventions. Indicators include the presence of freemium offers that create trial funnels, usage-based pricing that links spend to outcomes, and hybrids that retain predictability while scaling with use (Dhaliwal, 2025). Key risks stem from saturation and price competition, vendor dependency on third-party models, and churn when rivals substitute similar functionality (Challapally et al., 2025). Wider market dynamics amplify these risks. Investment often favours visible functions such as sales tooling rather than high-return back-office use cases, which contributes to pilot activity without profit and loss (P&L) impact (Challapally et al., 2025). Sector analyses, including finance, highlight the effect of API pricing and compute cost on margins even where tasks such as anomaly detection appear promising (Desai et al., 2025). Mitigation involves hybrid price designs aligned with realised value and the use of contextual learning to improve utility perceptions, lower churn, and stabilise revenue (Challapally et al., 2025). This dimension addresses the coupling to infrastructure and the breadth of model support. Indicators are the number and type of APIs, mechanisms for multi-model orchestration, and identification of bottlenecks such as latency under load. Primary risks include high operating costs during scale-up, external API delays, and infrastructure lock-in that restricts flexibility (Sai et al., 2025). Practical deployments also face prompt sensitivity and context limits in large language models (LLMs), which can degrade performance in real time (Cheung, 2024). Open-source wrappers can widen adoption and reduce cost but raise dual-use concerns and require careful security posture (Eiras et al., 2024). In information access, weak integration can trigger sociotechnical side effects, including content pollution or search manipulation (Mitra et al., 2024). Effective mitigation combines fine-tuning and prompt engineering to stabilise behaviour and, where beneficial, agentic features that add local planning, memory, and interaction for adaptive workflows (Schneider, 2025). Governance comprises quality assurance, compliance, and monitoring. Indicators include automated tests, regression suites, data lineage, access control, and alignment with the EU AI Act and GDPR (European Parliament, 2025; Dhaliwal, 2025). Risks relate to regulatory exposure, validation errors, and rising compliance cost. Inherent GenAI issues such as hallucinations and bias can escalate legal and reputational harm in high-stakes uses (Schneider et al., 2025). A risk-based approach is recommended. The EU AI Act differentiates obligations by application class and provides adaptation periods for high-risk systems (Schneider et al., 2025). Sociotechnical concerns, including inequities and health-related harms from degraded information quality, argue for transparency and independent review (Mitra et al., 2024). Mitigation options include adopting MOF for reproducibility, documenting model and data provenance, and applying human oversight when stakes are high (White et al., 2024; Schneider et al., 2025). In open-source contexts, governance should also manage dual-use risk while enabling cross-pollination of practices (Eiras et al., 2024). Defensibility depends on depth of domain integration, switching costs, and the uniqueness of the value proposition. Indicators include embedded workflows, specialised connectors, and performance gains that are not easily replicated by direct access to a foundation model (Vargas, 2024; Dhaliwal, 2025). Risks arise from replication by large platforms and rapid commoditisation in thin-wrapper segments (Dhaliwal, 2025). Open-source approaches can strengthen community momentum and reduce adoption friction, yet they increaseee exposure to dual-use scenarios and require careful licensing and risk controls (Eiras et al., 2024). Transitions toward agentic systems intensify the challenge. As orchestration and autonomy improve, firms must continue to differentiate through domain-specific reasoning and assurance layers (Schneider, 2025). Mitigation includes targeted intellectual property strategies, proprietary interfaces

for critical integrations, and specialised fine-tuning to reduce bias and latency in sectors such as finance (Desai et al., 2025). The overall objective is to produce value that cannot be displaced by a generic model invocation while addressing global equity concerns noted in sociotechnical analyses (Mitra et al., 2024). GTM strategy focuses on moving from pilots to production with clear economics. Indicators include a defined pilot–scale–adopt path, measurement of CAC and LTV, and engagement metrics that track retention and depth of use (StateScoop, 2024; Dhaliwal, 2025). Risks involve high acquisition cost in high crowded categories, high perceived complexity that slows uptake, and documented learning and utility divides that suppress realised value (Ma et al., 2024). In practice, GTM must blend usability work with compliance readiness. User-centred methods such as prompt design patterns and LUA frameworks have been shown to assist adoption, although they require training and change management (Sun et al., 2024). The GenAI divide compounds these issues. Many enterprises lead in pilots but underperform at scale due to operational misalignment (Challapally et al., 2025). Mitigation combines targeted enablement for distinct user segments, staged rollout with measurable objectives, and partnerships or open-source collaboration where this accelerates adoption without compromising equity (Eiras et al., 2024). Implementation framework with return on investment (ROI) assessment. Effective adoption of AI wrappers requires a staged approach built around the pilot-scale-adopt path (StateScoop, 2024) and a systematic return on investment (ROI) review at each stage. The intention is to treat implementation not as a one-off deployment but as an organisational change that develops capability over time. This framing is relevant for the GenAI divide, where high pilot volumes frequently translate into limited profit and loss (P&L) impact (Challapally et al., 2025). The pilot should focus on low-risk use cases with clear success criteria. Baselines for latency, accuracy, cost per transaction and user effort need to be measured before any change. Success metrics should cover technical performance and business outcomes. Practical checks include integration complexity, adoption barriers and initial operating overhead. Evidence from deployments shows that contextual learning is decisive at this stage. Wrappers that adapt to existing processes, for example through prompt design and workflow constraints, are better placed to reduce learning divides and utility divides across user groups (Ma et al., 2024). In finance, pilots should test the ability to handle large data volumes and evaluate parameter-efficient fine-tuning for tasks such as anomaly detection, while accounting for data scarcity and bias (Desai et al., 2025). Scaling calls for infrastructure and governance preparations that extend beyond per-call pricing. Monitoring, quality assurance, security controls and compliance must be budgeted as first-class workstreams. Hidden costs typically emerge in system integration, user enablement, change management and ongoing support. Sociotechnical risks, including content pollution and unequal access, should be mitigated to avoid reinforcing digital divides (Mitra et al., 2024). Open-source wrappers may lower cost through reuse and collaboration, yet they introduce dual-use concerns that require explicit risk management across near-, mid- and long-term horizons (Eiras et al., 2024). Full adoption embeds wrapper capability in core processes with continuous optimisation. Organisations should compare wrapper ROI against alternatives such as direct model access, in-house builds or competing products. Transitions toward agentic AI – systems with planning, memory and interaction – can enable broader coverage of tasks, but they also raise issues around autonomy, oversight and evaluation (Schneider, 2025). The financial literature underscores the ongoing nature of upkeep: modern models resemble complex devices that require continuous updates by experts, and expert time has a measurable cost (Sai et al., 2025). A realistic view of total cost of ownership should therefore include maintenance,

updates, scaling infrastructure, compliance management and competitive response. This perspective helps avoid belief traps in which value is underestimated and adoption stalls (Ma et al., 2024). The wrapper layer benefits from its own governance stack comprising documentation, testing and monitoring. At minimum, this includes comprehensive application programming interface (API) documentation, integration tests, automated regression checks, production monitoring and defined incident response procedures (Dhaliwal, 2025). The stack must address technical reliability and regulatory compliance, while remaining cost-aware. Complexity rises when multiple models are integrated, each with distinct behaviours and obligations. Reported issues such as hallucinations – in some evaluations as high as 25% under poor implementation practices – and bias can erode trust in business settings (Cheung, 2024). Regulatory obligations vary by risk class. The European Union Artificial Intelligence Act (EU AI Act) applies a risk-based scheme with differentiated requirements (European Parliament, 2025). High-risk systems receive an adaptation period – reported as 36 months after the regulation enters into force – but ultimately must satisfy documentation, testing, human oversight and performance monitoring (European Parliament, 2025). Compliance can act as both a barrier to entry and a recurring cost. Governance should also consider sociotechnical harms, including effects on information quality, democracy and health, which call for mitigation strategies such as diverse-source evaluation and transparency about provenance (Mitra et al., 2024).A workable governance framework spans four layers:

1. Technical quality assurance – automated testing, performance monitoring, error detection, data lineage and rollback paths.
2. Regulatory compliance – documentation, audit trails, reporting mechanisms and mapping to the EU AI Act and the General Data Protection Regulation (GDPR), and when relevant to the California Consumer Privacy Act (CCPA).
3. Security – access control, encryption in transit and at rest, key management and threat modelling.
4. Operations – incident response, change management, post-incident review and continuous improvement cycles.

In open-source contexts, governance should adopt Model Openness Framework (MOF) principles to improve reproducibility of code, data and documentation, while managing dual-use risks and bias (White et al., 2024). Quality and compliance are not mere overheads. Treating them as core product work is often a condition for enterprise adoption, regulatory approval and sustainable competition. Organisations that embed governance early gain advantages in reliability, readiness and customer confidence. User-centred strategies, including Learning-Using-Assessing (LUA) frameworks, can further strengthen governance by addressing usability and enabling co-creation with domain experts (Sun et al., 2024). In high-risk sectors such as finance, governance should include fine-tuning methods that mitigate latency and bias and remain aligned with evolving rules (Desai et al., 2025). For agentic evolutions, safeguards for autonomous behaviour are required to balance innovation with ethical oversight (Schneider, 2025).

Results and discussion

The evidence indicates that AI wrappers can accelerate value creation in generative artificial intelligence (GenAI). Success is not automatic. Competitive pressure is high, barriers to entry are low, and operating costs are material. A wrapper becomes a product when it delivers demonstrable value

(Dhaliwal, 2025). Realising this value requires overcoming structural issues in markets and technology. The GenAI divide is central here. Widespread piloting has not consistently produced profit and loss (P&L) impact, which points to the need for contextual learning and tighter alignment with day-to-day operations to avoid zero return on investment (ROI) outcomes (Challapally et al., 2025). A realistic view of total cost of ownership (TCO) is critical. Cost does not end at development. Infrastructure, maintenance, compliance and displacement risk all matter. Organisations that build deep domain integrations while controlling costs are better positioned to sustain advantage. Practical hurdles remain. Bias, prompt sensitivity and context limits in large language models can undermine reliability and slow adoption (Cheung, 2024). Sector work in finance shows the same pattern. Gains in data handling and anomaly detection are possible, yet data scarcity, inference latency and bias must be managed to reach viable TCO (Desai et al., 2025). Sociotechnical risks add complexity. Disruptions to information quality, including content pollution and unequal access, can widen divides and call for careful deployment strategies (Mitra et al., 2024). Open-source wrappers expand the space for innovation and reuse. They also introduce dual-use risks and longer-run concerns about unchecked progress, which require explicit risk management across development stages (Eiras et al., 2024). Governance is therefore an enabler rather than a constraint. Risk-based approaches help address autonomy and opacity in GenAI and reduce harms such as hallucinations and intellectual property exposure (Schneider et al., 2025). The move towards agentic AI – systems that coordinate reasoning, memory and interaction – is an important evolution. It raises challenges in evaluation, oversight and reproducibility that must be addressed before scale-up (Schneider, 2025). Openness principles, including release of code, data and documentation, can support transparency and auditability. These benefits need to be balanced against possible bias and harm (White et al., 2024). In sum, wrappers can broaden access to GenAI, yet their effectiveness depends on connecting theory – for example absorptive capacity and dynamic capabilities – with practical mitigation of divides and risks to produce equitable and sustainable outcomes. Short term recommendations - Apply a pilot–scale–adopt framework with explicit ROI checks at each stage. Establish baselines and learning mechanisms to address adoption divides (StateScoop, 2024; Challapally et al., 2025). Build quality mechanisms from the outset and cost them realistically. Automated monitoring should target hallucinations and bias, with clear thresholds for intervention (Dhaliwal, 2025; Cheung, 2024).

Conduct competitive analysis that includes the risk of displacement by large platforms. Consider open-source options for cost control while managing dual-use exposure (Eiras et al., 2024).Include full infrastructure and maintenance in the business model. Treat model upkeep as ongoing expert work with measurable cost, not a one-time expense (Sai et al., 2025).

Medium term recommendations - Develop hybrid architectures that pair lightweight wrapper layers with domain data and tools. Align compliance with the risk classification of the European Union Artificial Intelligence Act (EU AI Act) from the start (European Parliament, 2025). Use fine-tuning and prompt methods to improve task performance in sectors such as finance. Address latency and data scarcity explicitly in design and budgeting (Desai et al., 2025). Introduce user-centred strategies, including Learning–Using–Assessing (LUA) frameworks, to reduce learning and utility divides and to avoid belief traps (Sun et al., 2024; Ma et al., 2024).

Embed openness for reproducibility. Maintain audit trails and human oversight to meet regulatory expectations, including those set by the EU AI Act (Schneider et al., 2025; White et al., 2024). Long term recommendations - Prepare for the shift from single tools to orchestration of

specialist agents embedded in vertical workflows. Build capability for planning, memory and interaction with safeguards for autonomy and evaluation (Schneider, 2025).

Invest in sociotechnical protections that limit ecosystem harms and inequities. Use open-source ecosystems where they accelerate innovation, while maintaining ethical risk controls (Mitra et al., 2024; Eiras et al., 2024). Treat regulatory evolution and technical uncertainty as constants. Adaptive capacity in governance and engineering will be necessary to convert GenAI enthusiasm into sustained impact.

Conclusions

This study has several constraints. The evidence base contains a high share of promotional industry sources, which can bias results toward optimistic narratives. Failure case data are scarce, which limits insight into unsuccessful implementations. The market changes quickly, both technologically and in regulation, and this reduces the strength of generalisation across time. The method used is a structured narrative review. It is transparent, but it is not exhaustive, so emerging grey literature or niche use cases may be missed. The time window of 2020 to 2025 may not capture long-run effects, including those tied to transitions into agentic systems in which wrappers gain autonomous planning, memory and interaction. These shifts introduce new evaluation problems (Schneider, 2025). Sociotechnical biases are present in the reviewed corpus. Global inequities and potential health-related harms from generative artificial intelligence (GenAI) deployments can be underrepresented and, as a result, the analysis may be constrained (Mitra et al., 2024). Future work should address the following areas. Failure cases and the GenAI divide. There is a need for systematic analysis of failure cases, especially where pilot activity is high yet return on investment (ROI) is reported as zero. Many of these cases relate to brittle workflows and weak contextual learning (Challapally et al., 2025). Clear taxonomies of failure modes and recovery patterns would help organisations avoid repeated errors. Long-term productivity and cost. Studies should measure long-run productivity with full total cost of ownership (TCO), including maintenance, compliance and environmental impact for large-scale models and data pipelines (Sai et al., 2025). Methodologies that combine operational metrics with financial measures would improve comparability across settings.

Platform effects and defensibility. Research is needed on the impact of large platforms on the wrapper ecosystem. Replication by major players affects defensibility and may accelerate commoditisation. Empirical work on displacement, timing and the role of proprietary integrations would be valuable (Vargas, 2024). Digital divides and belief traps. Adoption studies should examine learning and utility heterogeneity across user groups and test interventions designed to reduce belief traps. Designs that segment users and measure learning dynamics over time are likely to yield actionable guidance (Ma et al., 2024). Open source, dual-use and openness frameworks. Work on open-source wrappers should evaluate dual-use risks and bias while using openness frameworks to improve reproducibility and cross-domain innovation. Comparative studies of licence regimes and governance models would inform practice (Eiras et al., 2024; White et al., 2024). Agentic systems and governance. As wrappers move toward agentic behaviour, research should focus on governance for autonomous reasoning, memory integration and interaction within multi-agent systems. Evaluation methods and oversight mechanisms require refinement for these contexts (Schneider, 2025). The evidence to date suggests that AI wrappers are a promising pathway to the democratisation of GenAI. Success depends on a clear understanding of market dynamics, rigorous attention to

implementation costs and positioning that goes beyond technical capability to verified value in specific domains. Organisations that combine technical sophistication with operational discipline and credible cost control are better placed to succeed. In finance, for example, wrappers must balance the benefits of improved data handling and fine-tuning with latency and bias risks in order to reach equitable outcomes (Desai et al., 2025). Sociotechnical considerations remain important. Potential disruptions to information ecosystems and harms to democracy or wellbeing reinforce the need for inclusive strategies that address global inequities (Mitra et al., 2024). Regulation is moving rapidly. The European Union Artificial Intelligence Act (EU AI Act) is likely to shape global standards. Strategies for wrappers should therefore build adaptive capacity so that compliance is not only reactive but anticipatory. This calls for technical competence and organisational learning that can respond to complexity and change. User-centred methods, such as Learning–Using–Assessing (LUA) frameworks for iterative assessment, can support co-creation while navigating usability and compliance constraints (Sun et al., 2024). Overall, the democratisation of AI through wrapper technologies offers opportunity and risk. Sustainable advantage will rest not on the wrapper alone but on the unique value that emerges where AI capability meets domain expertise and organisational competence. Bridging adoption divides and mitigating sociotechnical risks will be central to the realisation of GenAI's potential across sectors (Dhaliwal, 2025).

CHAPTER VIII

EMPLOYEES OF THE FUTURE – DEVELOPMENT OF COMPETENCES REQUIRED ON THE LABOUR MARKET

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Abstract: The contemporary labour market is undergoing transformation, driven by the interplay of technological, demographic, and economic factors. This chapter explores the skills that will determine worker success in the coming decades. It goes beyond traditional skills to examine the dynamic interplay between cognitive, social, and emotional intelligence. The future of work is not just about adapting to new technologies but also about cultivating a people-centered approach to skills development that emphasizes adaptability, resilience, and creativity. The aim of this chapter is to present the concept of competencies that future workers should possess to find their place in the labour market. Furthermore, various perspectives on these competencies will be presented, based on research conducted by research companies and our own studies. The chapter presents conclusions and recommendations for practice.
Keywords: mega-trends, employees of the future, labour market, required competences

Introduction

Behind the constant technological changes and advancing digitalization processes, and consequently the necessity and inevitability of change, lies so-called Industry 4.0, the fourth generation of industrial transformation. It is worth briefly tracing the history and chronology of the great changes that marked specific eras and became forever remembered as revolutionary.

The first industrial revolution dates back to the late 18th century. This period in human history marked the beginning of mechanization. It was the time of the first steam engines, which gradually began to relieve human labour. The beginning of the 20th century ushered in the second industrial revolution, which is remembered as a time of optimization of production processes. This was the time when electric drives were developed, and assembly lines enabled mass production. The 1960s saw the dawn of the third generation of revolutions, as developing IT technologies ushered in industrial automation. Today, we are experiencing the fourth industrial generation. Today, the world is experiencing the fourth industrial generation. This is evidenced by phenomena such as the increaseeing digitization that has taken over both the world of machines and the world of people (interpersonal communication channels have changed, as have the ways of storing and using data thanks to so-called cloud solutions, and more and more matters of everyday life and work are being handled remotely). Paradoxically, the pandemic has had a very positive impact on these phenomena, forcing the accelerated digitization of societies.

The main goal of this chapter is to present diverse perspectives on the competencies of future workers, which are undergoing changes in response to global economic, technological, and social developments. Furthermore, emerging mega- and macro-trends indicate evolving behaviors and the need to develop various soft and hard skills in the labour market. Employee competencies are a key resource for organizations in times of technological transformation, globalization and market uncertainty.

Macro- and megatrends on the labour markets

The literature generally agrees that future labour markets will require workers to possess entirely new skills. These changes are driven by macro- and global mega-trend as: the digital revolution, automation, demographic shifts, and the need for sustainable development. These trends are changing employee expectations. Organizations must also adapt to diverse age groups and societal demands. Future skills will require a combination of technological knowledge, flexibility, and social sensitivity. One of the most visible megatrends today is the growing automation and development of artificial intelligence (AI). A study by McKinsey Global Institute found that as much as 30% of the workforce could be automated by 2030 (McKinsey, 2021). This process is not limited to manual professions but also applies to intellectual workers in areas such as accounting, data analysis, customer service, and management. Furthermore, the growing importance of machine learning-based algorithms, recommendations, and business process automation (RPA) is redefining what is necessary for success. Employees must demonstrate not only technological skills, but also emotional intelligence, creativity, the ability to collaborate with technology, and mental resilience (World Economic Forum, 2023).

Another visible megatrend is the globalization of labour sources and the explosion of remote and hybrid work, forced by the COVID-19 pandemic. Research conducted by Gartner showed that as many as 48% of knowledge workers expect to work remotely for at least part of the week (Gartner, 2022). This phenomenon leads to the decentralization of organizational structures and intensified competition in the global talent development market. Remote work requires employees to develop new competencies, such as self-discipline, time management, asynchronous communication, and the use of collaboration in a digital environment, as well as the rapid development of digital skills (OECD, 2021).

As technological trends evolve, an aging population can be observed in developed countries. According to the United Nations (2023), by 2050, people over 60 will constitute over 20% of the global population. This could lead to a multigenerational workforce, where up to four generations may coexist within a single organization. Furthermore, managing age-diverse teams requires developing strategies for inclusive leadership, cultural empathy, and individualized career paths (CIPD, 2022). Organizations must also manage diverse expectations regarding work styles, communication, and professional development, which can be a source of conflict and tension.

Despite technological progress, the labour market continues to grapple with deepening digital inequalities. This phenomenon affects not only access to technology but also the digital skills necessary to use it effectively. People from rural areas, older generations, and employees with lower levels of education are particularly vulnerable to digital exclusion (UNESCO, 2022).

Another important megatrend is climate and environmental issues, which are becoming a central element of economic strategies. A green transformation is taking place worldwide, forcing changes in business models in production, services, and consumption. New industries and concepts

are emerging, such as the circular economy, renewable energy, and zero-emission technologies, which generate demand for green skills, including digital ones (European Commission, 2022).

It is important to emphasize that technological changes and innovations such as digitization, artificial intelligence (AI), and automation will be used to create key forces shaping the future world of work. Digitalization is a transformation of business organization, organization, and education into a fully digitalized version, eliminating the need for manual, paper-based work. For employees, this means learning new systems, platforms, and technologies that support processes, as well as collaboration, communication, and more detailed management (Brynjolfsson, McAfee, 2014). Digitizing various methods of resource management enables responding to alternative needs. Examples of such digitization include the implementation of ERP systems, the use of cloud-based communication applications such as Slack or Microsoft Teams, and longitudinal analysis that supports strategic decisions (Schwab, 2017).

Technological change, geoeconomic fragmentation, economic uncertainty, demographic shifts, and the green transition - individually and in combination - are key drivers shaping and transforming the global labour market by 2030. The Future of Jobs Report (2025) brings together the perspectives of over 1,000 leading global employers, representing over 14 million workers across 22 industry clusters and 55 economies worldwide, to examine how these macro trends are impacting jobs and skills, and the workforce transformation strategies that employers intend to pursue between 2025 and 2030. Expanding digital access is expected to be the most transformative trend—both in the technology sector and generally. Sixty percent of employers expect this trend to transform their businesses by 2030. Technological advances, particularly in artificial intelligence and information processing (86%), robotics and automation (58%), and energy production, storage, and distribution (41%), are also expected to be transformative. These trends are expected to have a mixed impact on employment, boosting both the fastest-growing and fastest-shrinking occupations. They will also drive demand for technology-related skills, including artificial intelligence and big data, networking and cybersecurity, and technological literacy—the three skills projected to be the fastest-growing. Overall, rising costs of living are the second most important trend and the most significant trend related to economic conditions. Despite a projected decline in global inflation, half of employers still expect this trend to transform their businesses by 2030. An overall economic slowdown remains a priority, but to a lesser extent, expected to transform 42% of businesses. Inflation is projected to create a mixed outlook for net job creation by 2030, while slower economic growth is expected to result in the loss of 1.6 million jobs globally. These two impacts on job creation are expected to increaseee the demand for creative thinking, as well as resilience, flexibility, and agility. Climate action is the third most important trend overall and the most important trend related to the green transition, while climate adaptation ranks sixth. Forty-seven percent and 41% of employers, respectively, expect these trends to transform their businesses over the next five years. This is driving demand for occupations such as renewable energy engineers, environmental engineers, and electric and autonomous vehicle specialists—all of which are among the 15 fastest-growing occupations. Climate trends are also expected to lead to a greater focus on environmental protection, which has been included in the Future of Jobs Report's list of the top ten fastest-growing skills for the first time. Two demographic shifts are increaseeingly impacting the global economy and labour market: an aging and shrinking workforce, particularly in high-income economies, and a growing workforce, particularly in low-income economies. These trends are driving growing demand

for skills such as talent management, teaching and coaching, and motivation and self-awareness. Aging populations are driving growth in healthcare-related occupations, such as nursing, while a growing workforce is driving growth in education-related occupations, such as higher education teaching. Geoeconomic fragmentation and geopolitical tensions are expected to cause one-third (34%) of surveyed companies to transform their business models over the next five years. Over one-fifth (23%) of global employers cite increaseeed trade and investment restrictions and an increaseee in subsidies and industrial policies (21%) as factors impacting their operations. Almost all of the economies where respondents expect these trends to have the greatest transformational impact have significant trade ties with the United States and/or China. Employers anticipating geoeconomic trends to transform their businesses are increaseeingly outsourcing, and even more frequently. These trends are driving demand for security-related positions and network and cybersecurity skills. They are also increaseeingly demanding other people-centric skills, such as adaptability, flexibility and agility, as well as leadership and social influence – Figure 1.

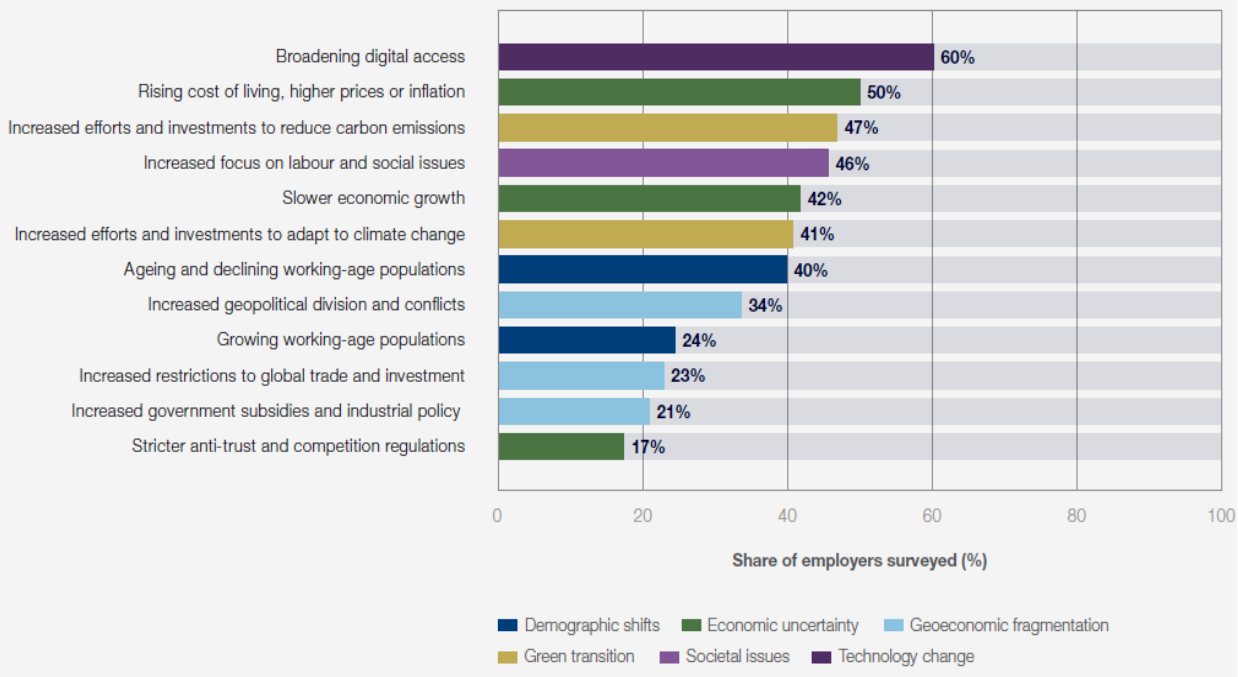

Figure 1. Macrotrends driving business transformation (share of employers surveyed that identify the stated trend as likely to drive business transformation)
Source: WEF, 2024.

In the "Future of Jobs" survey, employers were asked how advances in nine key technologies will transform their businesses. Three of these technologies are expected to have the greatest impact. Robotics and automated systems are expected to transform the businesses of 58% of employers, while energy generation and storage technologies will transform businesses for 41%. However, artificial intelligence (AI) and information processing technologies are expected to have the greatest impact – 86% of respondents expect these technologies to transform their businesses by 2030 (Figure 2).

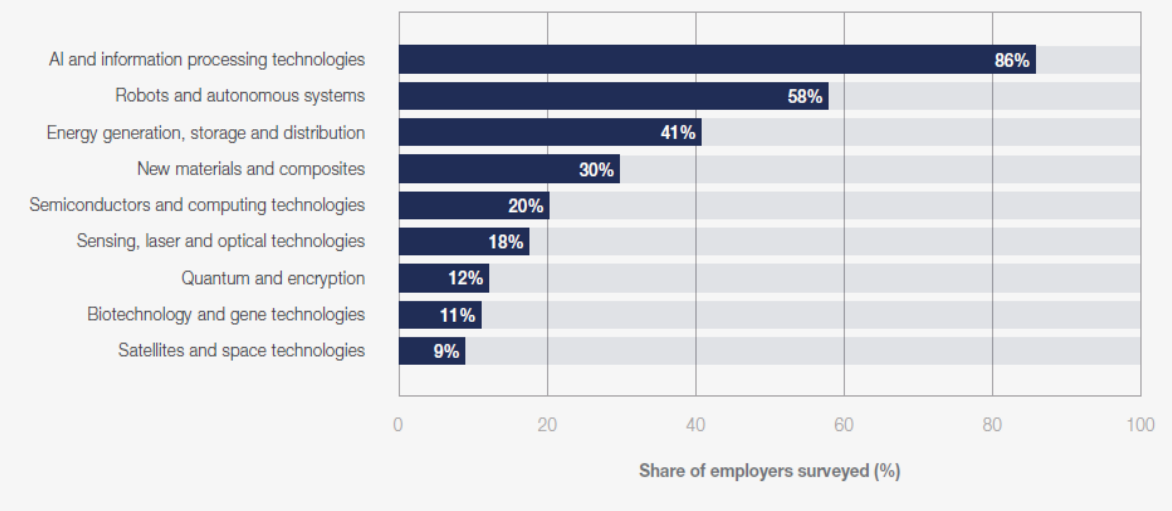

Figure 2. Technology trends driving business transformation, 2025-2030 (share of employers surveyed that identify the stated technology trend as likely to drive business transformation)
Source: WEF, 2024.

The tenth edition of the Ipsos Global Trends report, published in 2024, presents a new model of nine global trends based on over 50,000 interviews conducted in 50 markets representing three-quarters of the world's population and 90% of global GDP (Ipsos, 2024). These megatrends are illustrated in Figure 3. The first trend, "Cracks in Globalization," shows that perceptions of globalization have improved in many markets over the past decade. While the world remains deeply interconnected, the geopolitical environment has become more tense, with political leaders increaseeingly emphasizing the primacy of their own countries and allies. Despite increaseeingly positive views on the impact of globalization, geopolitical headwinds are driving a focus on domestic issues.

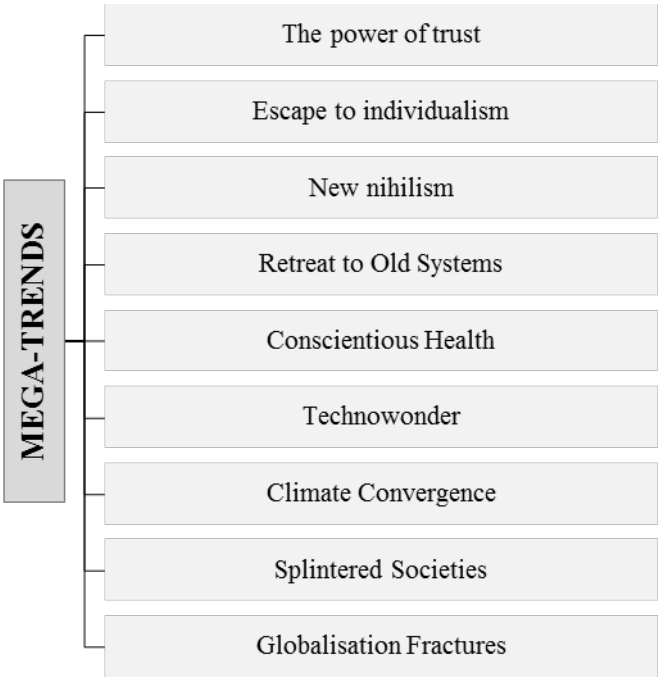

Figure 3. Key megatrends according to IPSOS research firm in 2024 (based on 50,000 interviews conducted in 50 markets representing three-quarters of the world's population and 90% of global GDP)
Source: own research.

Another significant trend is a "splintered" society. Widespread disparities in income and wealth are widely considered detrimental to society, but in many countries they have deepened over the past decade. This growth is leading to growing social tensions, the breakdown of traditional structures, and the emergence of new ideologies and political alliances. As societies around the world age and populations decline, immigration will become a significant dividing line. Globally, about half of respondents believe immigration has a positive impact on their society. However, a larger number believe that immigration levels are excessive.

Another trend is climate convergence. With continued global investment in renewable energy and the growing impact of global warming, the macroclimate environment is changing rapidly. The data reflects that global views on the importance of climate action have been converging and strengthening over the past decade. There are real differences between the core group (those most concerned about climate issues) and the more inward-looking, broader group.

The report notes that another phenomenon is the wonders of technology. While 71% of respondents believe the world needs modern technology to solve future problems, 57% believe technological advances are destroying our lives - a view that has significantly intensified over the past decade. Scientists have legitimate concerns about mental health and career progression, while the benefits of technology and tech companies are not widely recognized. The allure and convenience of technology often clash with its potential risks and human vulnerability.

One of the most important trends is health awareness, which is becoming increaseeingly prevalent as most people around the world recognize they need to make more of an effort to take care of their physical and mental health. Despite this, a healthy lifestyle remains a challenge for many, and most feel the need to lose weight. People are also exploring the connections between health and other systems, such as nutrition and technology. This has led to a focus not only on longevity but also on how to age well. The tension between physical and mental health is decreasing, but the question of who has access to it remains relevant, especially with the emergence of new "miracle" drugs. Technology has made health monitoring and management easier, but it is also partly to blame for the mental health crisis.

For many respondents, the trend of "returning to the old system" was significant. Escape into nostalgia appeals to many people around the world; at least half of 40 markets want their countries to return to the past. Even if the past is perceived as "sanitized," this can lead to resistance to trends perceived as challenging the existing system. This can mean calls for a "return" to historical power structures, religious practices, employment patterns, gender roles, and more. While some see this as progress, others see it as a departure from tradition, cherished values, or a threat to self-discovery.

In recent years, a new kind of nihilism has become a distinct trend. Generational differences are becoming increaseeingly evident around important life milestones like buying a home, getting married, or starting a family. Economic realities prevent many from realizing these dreams. This, in turn, has fueled a widespread belief that living in the present is better -either because the future is uncertain or because people feel powerless over their own fate. In many countries, traditional life goals remain a priority, even though more and more people believe they are beyond their reach. This nihilistic tendency encourages people to live in the moment and can lead to hasty decisions, such as the growing popularity of "buy now, pay later" and debt products.

The power of trust is a key trend in societal development. In a world flooded with information, and disinformation people crave authentic information from trusted sources. In this context,

companies are becoming increaseeingly important as extensions of worldviews and values. However, greater uncertainty now stems from changes in how and why society trusts some organizations more than others. As trust volatility increaseees, its importance grows.

The latest trend in the report is the "escape" from individualism. Faced with a seemingly threatening and stressful world, people are focusing on the only thing they can control: themselves. While individualism has been strong over the past decade, since 2024, personal autonomy has become the most powerful value. However, this is, by definition, a multifaceted trend. People see simplicity, social status, and the pursuit of new experiences as paths to self-development. For some, self-development means slowing down and avoiding rushing, while for others it means achieving success and building social status. The proportions of goal-oriented individuals versus content individuals vary across and within countries. Focusing people on the things they can control in their lives, helping them express and strengthen their self-esteem and strengthen their values, will create many opportunities for companies and policymakers.

Theoretical aspects of key future competences

The concept of competencies in management and quality sciences, as well as labour economics, has evolved from an emphasis on formal qualifications and specialized knowledge (hard competencies) to an increaseeing consideration of social, cognitive, and emotional skills (soft competencies). Technological changes such as automation and artificial intelligence are reinterpreting the division of labour and rewarding tasks requiring coordination, communication, creativity, and adaptability (Autor et al. 2003; Deming, 2017). At the same time, organizations report difficulties in recruiting employees who meet both technical thresholds and behavioral expectations (Succi, Canovi, 2020; WEF, 2023). In the literature, the terms "competencies" and "skills" are sometimes used interchangeably, although competencies are more often understood more broadly as an integrated configuration of knowledge, skills, attitudes, and motives manifested in effective behaviors that address role requirements (Boyatzis, 1982; Spencer, Spencer, 1993). In management and labour economics, a more operational distinction is often made between hard skills (measurable, task-specific) and soft skills (interpersonal and intrapersonal) (Robles, 2012).

What is more, hard competencies are measurable skills needed to perform specific tasks: knowledge of technology, analytical methods, programming languages, standards and procedures, machine operation, and industry certifications. Their acquisition is typically associated with formal education and technical training, and their verification with exams and practical tests (Laker, Powell, 2011). Soft skills include communication, collaboration, leadership, negotiation, emotional intelligence, self-organization, resilience, creativity, and problem-solving (Robles, 2012; OECD, 2021). It is important to emphasize that these competencies are more difficult to measure, more context-dependent, and often revealed through behavior in complex and socially interactive tasks (Deming, 2017).

Furthermore, alternative approaches divide competencies into cognitive (e.g., reasoning, problem-solving) and non-cognitive (e.g., personality traits, perseverance) competencies (Heckman, Kautz, 2012), as well as generic skills (Becker, 1993).

Early research on the future of work, particularly in the early 2000s, focused on the growing importance of digital skills. However, over time, with advances in artificial intelligence and automation, the focus has shifted to skills that are more difficult to automate.

For example, the World Economic Forum (WEF) reports on the "Future of Work" series (WEF, 2018, 2020) are considered important sources in this area. The 2020 edition explicitly highlights the growing importance of social and emotional skills. The top ten future skills include active learning and learning strategies, analytical thinking and innovation, as well as resilience, stress tolerance, and flexibility. The WEF emphasizes that these skills are crucial because they enable employees to adapt to changing environments and collaborate effectively in hybrid work models. What is more, McKinsey Global Institute research, "The Future of Work After COVID-19" (Manyika et al., 2021), confirms these trends. McKinsey analysts found that demand for higher-order cognitive skills (such as critical thinking and complex problem-solving) and social and emotional skills (such as leadership and collaboration) is growing. It is worth mentioning that the report points out that due to the impact of the epidemic, remote work and digital collaboration capabilities have become a basic skill rather than just an additional benefit. Cognitive skills go beyond traditional knowledge and encompass the ability to quickly absorb, analyze, and apply new information. The PwC's report (2018) introduced the concept of "cognitive agility," which refers to the ability to adapt to new situations, learn quickly, and solve problems in a dynamic environment. The report states that in a world where knowledge rapidly becomes obsolete, the ability to "learn to learn" is the most valuable skill. Deloitte's "Global Human-capital resilience Trends" (2021) analysis emphasizes that a key characteristic of future organizations is "organizational resilience," which is based on employee resilience. This requires employees to not only be resilient to stress but also proactively seek new solutions and adapt to unpredictable situations.

The concept of digital literacy has evolved from basic knowledge of office software to a deep understanding of how technology is transforming workflows, communication methods, and business. Gartner analysts (2022) indicate that "digital literacy" encompasses more than just technical skills; it also includes an understanding of how artificial intelligence, data analytics, and automation can streamline work, as well as awareness of cybersecurity risks. Digital literacy enables employees to not only use tools but also integrate and leverage them to create value. The IBM Institute for Business Value report, "The Enterprising Advantage: Building the Workforce of the Future" (IBM, 2021), shows that while technical skills remain important, the largest skills gap lies in analytical and data-related skills. These skills are in such high demand that experts have dubbed them "the most in-demand skills of the 21st century."

Existing literature on this topic proposes various classifications of competencies, with authors categorizing them based on their characteristics and functions (Oleksyn, 2006; Moczydłowska, 2008; Rostkowski, 2002). Competencies are generally divided into four main categories: technical competencies (primarily job-related knowledge and skills), methodological competencies (problem-solving and decision-making skills), social competencies (collaboration and communication skills), and personal competencies (social values, motivations, and attitudes). Lamri (2019) proposes a slightly different classification: technical competencies, behavioral and motivational competencies, cognitive competencies, and civic competencies, the latter related to the world and personal status.

Another classification scheme distinguishes between key competencies and specific competencies. According to Oleksyn (2006), key competencies are related to the organization, the position, and the individual employee. From an organizational perspective, they represent the company's strengths and are essential for fulfilling the tasks and responsibilities within the position. An employee's key competencies relate to the individual and encompass their unique traits. Specific competencies, on the other hand, are traits that are necessary and unique to a particular position.

Empirical data and analysis of the research companies

Reports from leading analyst companies such as Gartner, McKinsey, PwC, and the World Economic Forum provide data and forecasts regarding this potential occurrence. For example, the McKinsey Global Institute report "The Future of Work After COVID-19" (2021) notes:

- increaseeed demand for social and critical tasks: Studies predict that demand for social and critical tasks will decline by 10–15% in the US and Europe by 2030;
- decreased demand for routine tasks: Demand for routine, repetitive manual and cognitive tasks that can be automated will decline by 18–20%;
- increaseeed demand for technical tasks: Demand for advanced technical tasks (e.g., programming, data analysis) will increaseee by over 50% by 2030.

Meanwhile, the World Economic Forum's "Future of Work" report (2020) indicated that the most important skills of the future (by 2025) would be:

1. Analytical thinking and innovation.
2. Active learning and learning strategies.
3. Complex problem-solving skills.
4. Critical thinking and analytical skills.
5. Creativity, originality, and initiative.
6. Leadership and social influence.
7. Technology utilization, monitoring, and control.
8. Technology design and programming.
9. Resilience, stress tolerance, and flexibility.

Gartner's "Future of Work" report (2022) states:

- adaptability to change: 67% of employees say that changes in the labour market are difficult to manage, and 80% of companies believe their employees lack the necessary skills to meet future challenges;
- critical skills gaps: Gartner identifies three key gaps: digital skills, social-emotional skills, and adaptability;
- key company investments: The report recommends that organizations invest in reskilling and upskilling programs and tools to support self-assessment and continuous learning. PwC's "Future of Workforce: Shaping Competitive Strength in 2030" report (2018) states:
- future scenarios: PwC identifies four possible future work scenarios based on current trends. However, automation-resistant skills such as creativity, leadership, and collaboration are crucial in all scenarios.
- the growing importance of leadership: the report indicates that, regardless of the pace of automation, the role of leaders will continue to grow. Future leaders will not only be responsible for managing tasks but, more importantly, will inspire employees, support their development, and foster a culture of trust in hybrid teams.

Overall, the literature and research agree that the future of work will belong to individuals with both strong interpersonal skills and advanced digital skills. The ideal employee is one who can learn, adapt, and collaborate in an ever-changing environment. In the table 1 there is presented the analysis of the secondary data. Table 1 highlights several key challenges facing the labour market regarding the expected competencies and skills of future employees, particularly in an era of rapid

social, economic, and business change. Sources repeatedly emphasize the importance of cognitive and social skills. Almost all sources analyzed emphasize the importance of creative thinking (innovative thinking, thinking outside the box, and innovation). Problem-solving skills, even complex ones, are just as crucial as the frequently mentioned abilities to make decisions and take responsibility. The vast majority of reports emphasize the importance of interpersonal skills related to communication, negotiation, and teamwork, across a variety of environments, including fixed, virtual, and cross-cultural teams. Furthermore, as emphasized in many sources, the dynamic nature of the workplace demands flexibility, adaptability, and the ability to learn quickly. Data from these reports demonstrate that technical and digital skills are becoming increaseeingly important in a technology-driven world.

Table 1. Future competences according to different analyses – desk research

Title of report, author, year	Research methodology	Key competences/skills that will increaseee in importance in the future / competences of the future
"Industry Balance of Human-capital resilience II: Marketing Communications Sector" (in Polish), Krygowska-Nowak et al. (2022)	Qualitative survey: Employers, industry experts, education and HR experts, employees and clients. Quantitative survey: Employers (n=813) and employees (n=819) in the key jobs of marketing communication sector, from February to August 2021.	Competences to have greater significance in the future: • Effective/efficient communication (including brand trust building and negotiation skills) • Analytical (including trend analysis) • Specialized, i.e. handling specific tools and processes • Conduct in accordance with ethical principles • Creativity
"Talent shortage in Poland" (in Polish), ManpowerGroup (2022)	Quantitative survey with a sample of over 40,000 employees from 40 countries, including Poland.	Top 5 soft skills most difficult to acquire: • Resistance to stress and adaptability • Reliability and discipline • Creativity • Analysis and critical thinking • Ability to solve problems
"Competences of the future: How to shape them in a flexible education ecosystem?" (in Polish) Włoch & Śledziewska (2023)	Non-representative survey (n=1062). Questionnaire included questions on competences identified in the WEF and McKinsey analyzes as key competences for employees in the changing labour market.	Competences of the future divided into three groups of skills: cognitive, social and technical: • Cooperation with others (s) • Emotional intelligence (s) • People management (s) • Entrepreneurship (s) • Cognitive flexibility (c) • Critical thinking (c) • Creativity (c) • Solving complex problems (c) • Engineering competences (t) • Advanced digital competences (t) • Basic digital competences (t)
"Young Poles in the labor market" (in Polish), PwC, Well.hr, & Absolvent Consulting (2022)	Online quantitative survey (n=3207), the analysis takes into account the responses of individuals up to 27 years of age (n=2023), conducted March–April 2022.	The most important competences on the labour market in the future according to young people: • Openness to change and quick adaptation in new conditions • Combining different skills • Fast learning • IT and knowledge of programming languages • Effective time management • Dealing with stress • Interdisciplinarity

		• Big Data analysis and its understanding • Communication skills • Application of artificial intelligence • Self-management of one's own work • Teamwork • Remote work skills • Managing virtual teams • Ability to use new media • Trend watching • Operation of advanced robots
"Employee competences today and tomorrow" (in Polish), Dębkowska et al. (2022)	Quantitative survey (CATI, n=1000) among enterprises, Representative in terms of size and indicated code of Polish Classification of Activities, November 2021.	Competences of the future: • Acting in a situation of uncertainty • Cooperation with others • Creativity • Taking responsibility • Industry-specific professional competences • Critical thinking • Negotiation skills • People management • Systemic thinking • Technical competence • Balancing tensions and solving problems • Basic digital competences • Emotional intelligence • Solving complex problems • Cognitive flexibility • Advanced digital competences
"The employee of the future" (in Polish), infuture.institute (2019)	Quantitative survey (CAWI, n=1327), and qualitative survey (3 FGI and 10 individual interviews).	Competences of the future: • Creativity • Negotiations • Ability to cooperate • STEM Science Skills • Ability to share knowledge • Design thinking • Critical thinking • Digital skills • Problem-solving mindset • Ability to actively learn
"Forecasts of the Future: Know How 2021" (in Polish) OLX Praca (2021)	Quantitative survey (CATI, n=302), representatives of small, medium and large enterprises, conducted September–October 2020. Qualitative survey (TDI) with employers and HR employees of HR consulting companies.	Key competences of the future: • Social competences (substantive exchange of opinions without interpersonal conflicts, multi-threaded communication, acceptance and openness to diversity and differences, acceptance and learning to work in an environment where relationships are not as intimate as before) • Self-awareness regarding occupational health and safety, self-monitoring (management of your working time, energy balance management, self-discipline, responsibility for yourself and your work) • Learning and critical thinking • Self-motivation • Flexibility in acting, acceptance of change and uncertainty • Solving complex problems • Acquiring information from different places • Building mutual trust in teams

		Key soft skills in the future: • Communication, relationality • Openness, flexibility, ability to adapt quickly to changes • Emotional intelligence and empathy • Good organization of work, independence • Knowledge of cultural differences and the ability to navigate them • Resistance to stress
"The future of education: Scenarios 2046" (in Polish), infuture.institute (2021)	Quantitative (CAWI, n= 4023) and qualitative survey (CDV, 2020), including university undergraduates & teachers, secondary school students & teachers.	Competences of the future: • Collaboration within a team • Digital and technical competences • Data analysis • Solving complex problems • Creativity
"The study of competences in the modern labor market: survey report" (in Polish) UpSkill (2021)	Quantitative survey (CAWI, n=304), conducted October–November 2020.	Key competences for future development: • Dealing with stress • Negotiations • Public speaking • Assertiveness • Planning and self-management in time • Influence • Decision-making • Self-presentation • Logical and critical thinking • Building relationships and trust • Leadership skills • Team building • Interpersonal communication • Emotional intelligence • Creativity • Teamwork
"Foresight of the competences of the future" (in Polish), Dębkowska et al., (2022)	Quantitative survey (CAWI, n=65) of experts representing science, business, public administration etc. Foresight research methodology.	Competences of the future in relation to the four (1-4) scenarios for the development of the labour market (s.). • Advanced digital competences (s. 1) • Transformational competences (s. 1) • Acting in a situation of uncertainty (s. 1) • Creativity (s. 1) • Technical and digital competence (s. 2) • Systems thinking skill (s. 2) • Ability to find and interpret signals of change in the environment (s. 2) • Creativity (s. 2) • Industry-specific professional competences (s. 3) • Responsibility for one's own actions (s. 3) • Competences in the scope of use of pro-ecological and pro-social solutions (s. 3) • Ability to act in a situation of uncertainty (s. 3) • Ability to work in stationary and distributed teams (s. 4) • Care for work-life balance (s. 4)
"Report on empirical research in the field of competences and professions of the future" (in Polish),	Quantitative survey (online, n=104), among management staff and managers of various levels coming from industrial enterprises operating in clusters	Looking ahead to 2030, the following competences are projected to be highly important and increaseeingly gaining in significance: • Unconventional thinking • Analytical skills using technology

Łapińska et al. (2022)		• Risk analysis and assessment and responsible decision-making • Ability to find deeper significance of phenomena • Ability to see and assign meaning that is not evident at first glance • Interdisciplinarity, that is, proficiency in understanding and combining ideas and concepts from different fields • Proficiency in handling new media • Managing information overload • Ability to integrate robotic workstations • Ability to work in multicultural teams • Social entrepreneurship
"The Future of Skills: Employment in 2030", Bakhshi, et al. (2017).	Workshops with experts from industry, government, academia, and the social sector (Boston and London); data then used to prepare a machine learning model utilized in turn to estimate future demand for occupations and competences.	The ten most important competences of the 21st century in the context of the greatest demand: The United Kingdom: • Judgment and decision-making • Ingenuity • Active learning • Learning strategies • Originality The United States: • Learning strategies • Instructing • Social observation skills • Coordination • Originality
"An analysis of the demand for skills in the labour market in 2035, " Dickerson et al. (2023)	First stage: literature review. Second stage: producing forecasts and projections of the size and composition of the labour market in 2035.	Fundamental competences needed for employment in 2035: • Collaboration • Communication • Innovative thinking • Information acquisition • Organizing, planning and prioritizing work • Problem solving, troubleshooting and decision-making
"The Skills Imperative 2035: what does the literature tell us about essential skills most needed for work? ", Taylor et al. (2022)	Study using the desk research method, reviewing 200 thematic reports, 30 items were included in the final analysis.	Essential competences of the future: • Problem solving, troubleshooting and decision-making • Critical thinking / analysis and evaluation • Communication • Collaboration / teamwork • Creativity/innovation/originality • Leadership/Management • Self-motivation/learning orientation • Flexibility/adaptability • Resilience/optimism/persistence • Empathy/social perceptiveness
"The Future of Jobs Report 2020", World Economic Forum (2020)	Quantitative survey (n=291) of global companies collectively representing more than 7.7 million employees worldwide.	Key competences in the next 5 years (to 2025): • Critical thinking and analysis • Problem solving • Self-management • Active learning • Resilience • Stress tolerance • Flexibility

		The top 15 skills for 2025: •Analytical thinking and innovation •Active learning •Complex problem-solving •Critical thinking and analysis •Creativity, originality and initiative •Leadership and social influence •Technology use, monitoring and control •Technology design and programming •Resilience, stress tolerance and flexibility •Reasoning, problem-solving •Emotional intelligence •Troubleshooting and user experience •Service orientation •Systems analysis and evaluation •Persuasion and negotiation **Results for Poland:** Skills identified as being in high demand within an organization (from most to least important) •Creativity, originality and initiative •Active learning strategies and self-development •Resilience, stress tolerance and flexibility •Complex problem-solving •Analytical thinking and innovation •Technology use, monitoring and control •Service orientation •Critical thinking and analysis •Technology design and programming •Reasoning and problem-solving •Management of personnel •Emotional intelligence •Management of financial, material resources •Leadership and social influence •Instruction, mentoring and teaching
"The Future of Jobs Report 2023", World Economic Forum (2023)	Quantitative survey (n=803) of global companies collectively representing more than 11.3 million employees worldwide.	Essential competences in 2023: •Analytical thinking •Creative thinking •Resilience, flexibility and agility •Motivation and self-awareness •Curiosity and lifelong learning •Technological literacy •Dependability and attention to detail •Empathy and active listening •Leadership and social influence •Quality control Expectations about employee competences (2023-2027): •Creative thinking •Analytical thinking •Technological literacy •Curiosity and lifelong learning •Resilience, flexibility and agility •Systems thinking •Artificial intelligence and big data •Motivation and self-awareness •Talent management •Service orientation and customer service

"The Future of Jobs Report 2025", World Economic Forum (2025)	Quantitative survey (n=1000) of global companies collectively representing more than 14 million employees worldwide.	Essential competences in 2025: •Analytical thinking •Resilience, flexibility and agility •Leadership and social influence •Creative thinking •Motivation and self-awareness •Technological literacy •Empathy and active listening •Curiosity and lifelong learning •Talent management •Service orientation and customer service •AI and big data •Systems thinking Expectations about employee competences (2025-2030): •AI and big data •Networks and cybersecurity •Technological literacy •Creative thinking •Resilience, flexibility and agility •Curiosity and lifelong learning •Leadership and social influence •Talent management •Analytical thinking •Environmental stewardship •Systems thinking •Motivation and self-awareness •Empathy and active listening •Design and user experience •Service orientation and customer service •Teaching and mentoring

Source: own study besed on: Mruk-Tomczak, Jerzyk (2024).

Results and discussion

The research findings indicate that future critical competencies are complex and multidimensional, encompassing both hard and soft (technical) domains. Key competencies include adaptability to change, flexibility, and an openness to new challenges. Both lists indicate that the future workforce must be versatile, possessing not only technical skills but also interpersonal and ethical perspectives. Both the desk research and in-depth interviews revealed a consensus on the role and importance of lifelong learning and intrinsic motivation. Critical thinking was also crucial in both groups. A comparison of the research findings highlighted the importance of creativity, innovative thinking, and problem-solving in a dynamic business environment. Interpersonal skills, such as effective communication, negotiation skills, and collaboration, are crucial in fixed jobs and are becoming increaseeingly important in virtual and cross-cultural teams, a fact particularly emphasized in the interviews. Given the emergence of new technologies, the research emphasizes the importance of digital skills, the ability to apply them, and the flexibility to adapt to changes in the digital environment. The findings also indicate a focus on the key skills required in the future workforce:

- solving complex problems, including those related to sustainability;
- improving analytical skills;
- assuming decision-making responsibility.

As it can be seen in the last report of World Economic Forum (2025) on the top of the list there are: technical skills, empathy and active listening, curiosity and lifelong learning, talent management, and service orientation and customer service. These competencies reflect the importance of technical knowledge, strong interpersonal skills, emotional intelligence, and a willingness to continuously learn. They reflect respondents' expectations that employees need a balance of technical and soft skills to succeed in today's workplace – Figure 4.

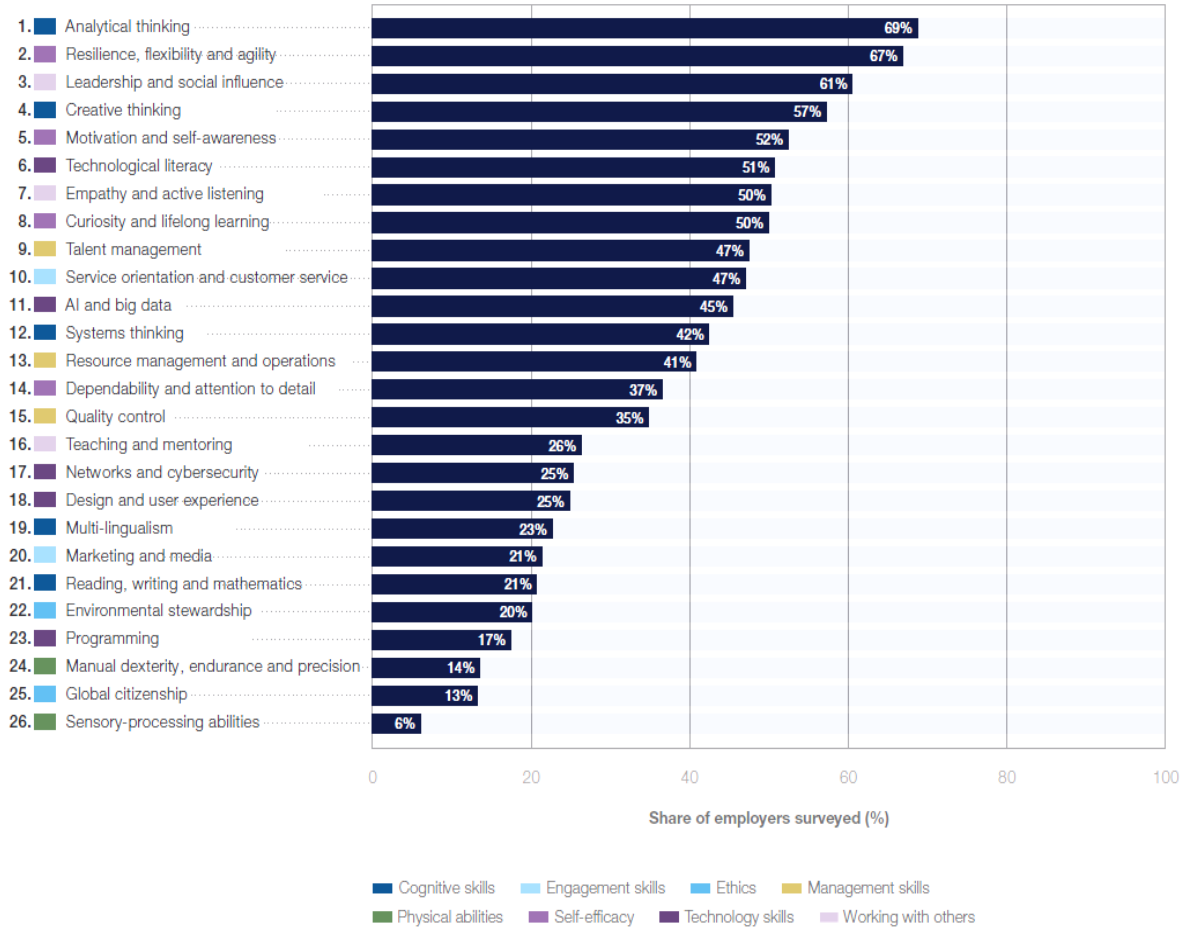

Figure 4. Core skills in 2025 (share of employers who consider the stated skills to be core skills for their workforce)
Source: World Economic Forum (2025).

Overall, leadership and social influence, resilience, flexibility and agility, and artificial intelligence and big data have increaseeed most significantly in importance: compared with the 2023 edition of the report, the proportion of respondents who consider these skills to be core competencies increaseeed by 22 percentage points, 17 percentage points, and 17 percentage points respectively. According to employers' expectations for skills development over the next five years (see Figure 5), technical skills are projected to grow in importance faster than any other skill. Artificial intelligence and big data are among the fastest-growing skills, followed closely by networking, cybersecurity, and technical literacy. Complementing these technical skills are creative thinking and two socio-emotional skills - resilience, flexibility, and agility, as well as curiosity and lifelong learning - also seen as increaseeingly important. Other top ten skills rising in importance include leadership and social influence, talent management, analytical thinking, and environmental stewardship. These skills

highlight the need for employees who can lead teams, effectively manage talent, and adapt to sustainability and ecological changes in an increaseeingly complex and interconnected world.

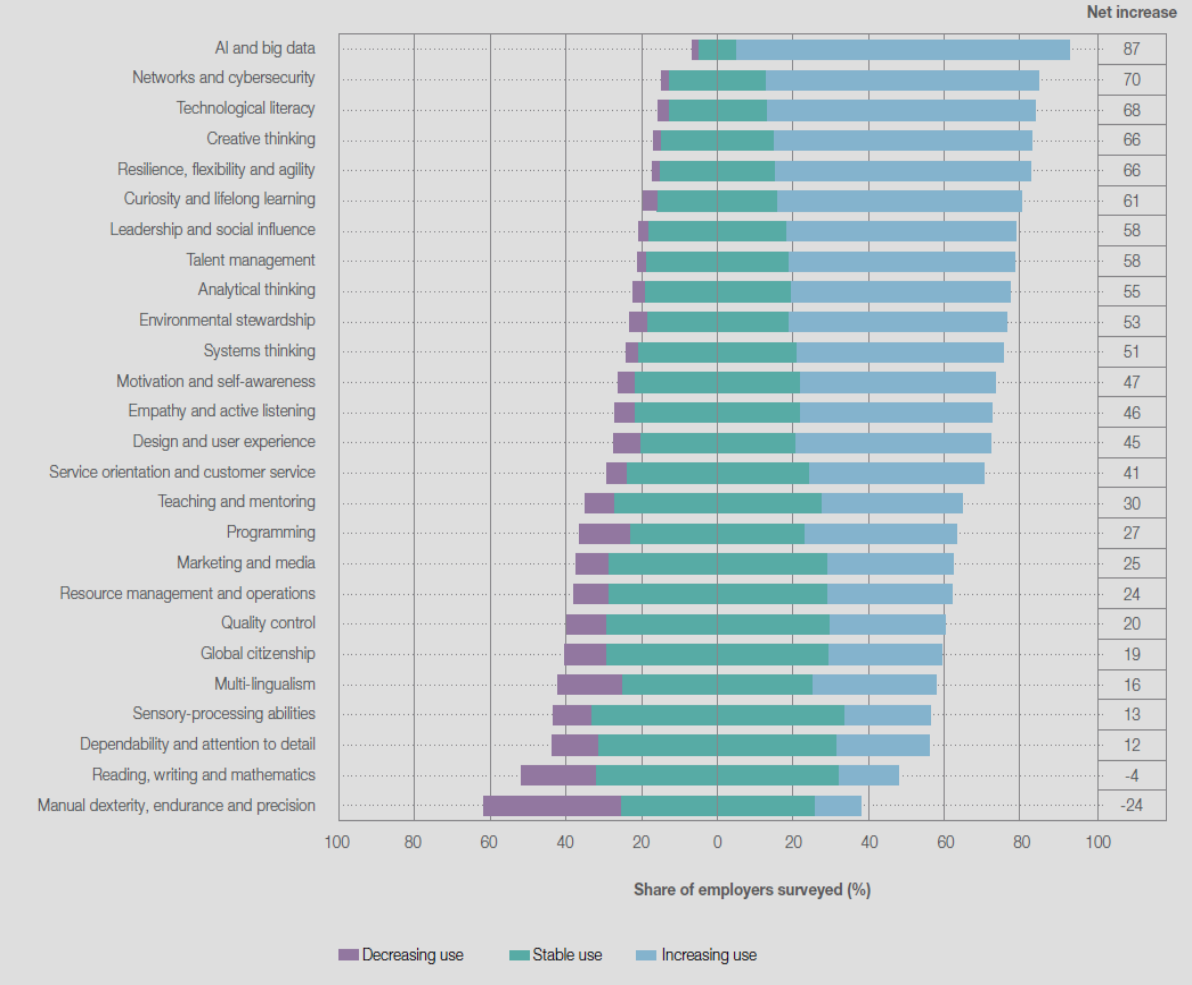

Figure 5. Skills on the rise, 2025-2030 (share of employers that consider skills to be increaseeing, decreasing, or remaining stable in importance. Skills are ranked based on net increaseee, which is the difference between the share of employers that consider a skill category to be increaseeing in use and those that consider it to be decreasing in use)
Source: World Economic Forum (2025).

On the other hand, respondents believe sensory processing skills, reading, writing, and math, reliability and attention to detail, quality control, and global citizenship are the most stable skills. However, reading, writing, and math are expected to see slight net declines. Of particular note are manual dexterity, endurance, and precision, which are projected to see significant net declines: 24% of respondents expect their importance to decrease.

The general conclusions

Based on experience, benchmarks, good practices and solutions implemented by companies, as well as development programs and specialized diagnostic tools, but also by following the latest reports and referring to global trends, it is worth identifying competence areas that will be key in a few years. According to CERTES (2024) the first competency area that should undoubtedly be called the meta-competency of the future is innovation and the ability to solve complex problems. The second, extremely important competency area is developing emotional intelligence and strengthening

mental resilience. The realities of a changing reality, the constant lack of cause-and-effect relationships, which are the foundation of the changing reality of VUCA and BANI, require abandoning stagnation and comfort. The coronavirus pandemic has positively influenced the accelerated digital transformation of societies and, paradoxically, has provided new experiences, such as remote work. And although more and more companies are already recognizing the advantages of this work mode, along with the hybrid model, experts believe that in the near future, remote work will not only be a benefit but also a leading, fully-fledged work mode. The fourth area, inherent to innovation, ongoing digitalization processes, and, above all, new technologies, is the ability to adapt agilely to change. The fifth area is the constant need for self-development and the ability to cross-skill, or combine skills. According to Pracuj.pl, it is precisely this cross-skilling - the ability to find connections between competencies and the art of utilizing knowledge from various fields - that will be paramount in professions and industries that utilize and prioritize a wide range of competencies. The sixth area is dedicated to leaders and broadly understood management staff. This area combines issues such as future leadership. As part of development activities and competency areas, managers acquire knowledge in areas such as: exercising future leadership, with particular emphasis on: the ability to collaborate and share knowledge, cross-skilling in interdisciplinary teams, empowerment in agile adaptation to change, data integration in the ongoing value chain and analysis of artificial intelligence algorithms, strengthening market orientation and customer centricity, the ability to build smart workplaces (the ability to work with data, automation, robotization, artificial intelligence), and cybersecurity.

Future managers will likely need a combination of traditional management skills and new competencies to navigate the evolving landscape of work and business. Here are some competencies that future managers may find essential (Grudzien-Molenda, 2024):

- digital literacy: understanding emerging technologies and their potential applications in business will be crucial for future managers to make informed decisions and drive digital transformation within their organisations;
- data literacy: proficiency in data analysis and interpretation will enable managers to make data-driven decisions, identify trends, and leverage insights for strategic planning and problem-solving;
- adaptability and change management: with rapid technological advancements and shifting market dynamics, the ability to adapt to change, lead organisational change initiatives, and foster a culture of agility will be essential;
- emotional intelligence: effective leadership requires empathy, self-awareness, and the ability to manage emotions. Future managers will need strong emotional intelligence to build trust, motivate teams, and navigate interpersonal dynamics;
- cross-cultural competence: as businesses operate in increaseeingly diverse and globalised environments, managers must be able to understand and respect cultural differences, communicate effectively across cultures, and lead multicultural teams;
- strategic thinking: future managers will need to have a holistic understanding of their organisation’s goals, market trends, and competitive landscape. Strategic thinking skills will enable them to develop long-term visions and set clear, achievable objectives;

- innovation and creativity: encouraging innovation and fostering a culture of creativity will be essential for staying competitive in a rapidly changing world. Managers should be able to inspire and support their teams in generating new ideas and solutions;
- resilience and stress management: leadership roles can be demanding, and future managers will need to cultivate resilience to cope with challenges and setbacks effectively. Prioritising work-life balance and promoting employee well-being will also be important.

Main conclusions:

1. Many employers believe that graduates actually learn to perform specific professional roles in the workplace. Therefore, the ability to work in a team and learn quickly is of particular importance to employers, thanks to which they not only acquire specific qualifications in the workplace, but also quickly adapt to a specific organizational culture.
2. Knowledge itself is not the most important thing for entrepreneurs, a young person will learn it in the company.
3. The rapid evolution of job market requirements demands that organisations invest strategically in developing key competences among employees to stay competitive.
4. Simultaneously, individuals must embrace lifelong learning and adaptability to thrive globally. By focusing on both technical and soft skills across continents, a future-ready workforce can be cultivated to meet new challenges and seize emerging opportunities for sustainable growth and innovation.
5. The future of employees will be depending on: the university education, own learning skills, coping with stress, empathy and intuition as well as AI.

CHAPTER IX

HEALTH LITERACY AND HEALTHCARE EXPENDITURES IN POLAND

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Abstract: Since the 1970s, the concept of health literacy has been gaining increaseeing attention in public health discourse. Defined as the knowledge, motivation, and competencies required to access, understand, appraise, and apply health information, health literacy is recognized as a key determinant of individual and population health outcomes. Research demonstrates that insufficient health literacy is associated with higher healthcare expenditures and reduced efficiency of healthcare systems. Comparative international studies, including the systematic review by Sørensen and colleagues, have contributed to clarifying definitions, models, and methods of measurement, yet significant disparities remain across societies. In Poland, this area of inquiry is relatively underdeveloped, with health literacy still emerging as a subject of research and public debate. The chapter discusses the determinants and consequences of health literacy, with particular emphasis on financial implications and social inequalities. It highlights the urgent need for integrated educational strategies and targeted communication adapted to diverse groups, aiming to promote preventive health behaviors and improve patient participation in the treatment process. Enhancing health literacy through campaigns, training programs, and reliable online resources may strengthen public trust in the healthcare system, improve health outcomes, and ultimately reduce the economic burden on both households and the state.
Keywords: health literacy, public health, health education, health promotion, healthcare costs

Introduction

Since the 1970s, increaseeing attention has been devoted to the model of building public health literacy. There are numerous concepts and definitions of health literacy, as well as models for measuring this concept. Attempts are also being made to compare the levels of health literacy across societies in different countries.

Health literacy is a term introduced in the 1970s that has gained growing importance in the fields of public health and healthcare. It concerns the abilities people need to ensure their own health and that of their loved ones. One of the most comprehensive studies analyzing the concept of health literacy is the work *Health literacy and public health: A systematic review and integration of definitions and models*, in which a team led by K. Sørensen conducted an in-depth review of global literature to systematize the term.

Health literacy is linked with literacy and numeracy and encompasses people's knowledge, motivation, and competencies to access, understand, appraise, and apply health information in order to make judgments and decisions in everyday life concerning healthcare, disease prevention, and health promotion (Sørensen; Broucke; Fullam; Doyle; Pelikan; Slonska; Brand, 2012). Consequently, actions in this area are identified as one of the new, fundamental challenges for public health in the

21st century. In some countries, this is reflected in national health strategies; for example, in the USA, one of the goals of "Healthy People 2010" was to improve health literacy. In Poland, however, this issue is currently the subject of research and theoretical deliberation, though such studies were very scarce until recently. For this reason, the aim of this chapter is to familiarize the reader with the concept of "health literacy," its determinants, and its consequences, including financial ones.

Health literacy

The concept of health literacy often appears in literature in reference to individuals – to the behaviors and analytical and decision-making abilities of single persons. However, a broader perspective can also be found, where the subject of discussion is the health literacy of a society. S. Ratzan connects health literacy with human-capital resilience. He argues that people with a higher level of health literacy live longer and invest more in their own and their families' knowledge and development (Ratzan, 2001). This translates into greater productivity in the labor market and less frequent use of healthcare services.

There is a vast body of research and literature worldwide dedicated to the concept of health literacy. It is becoming increaseeingly important in today's world because, as the findings of T. McKeown, J.B. McKinley, S.M. McKinley, and N.S. Kannel suggest, medical progress has a smaller impact on average human life expectancy than environmental factors, including those that can be described as lifestyle elements. Lifestyle, in turn, is largely associated with people's health literacy. A. Ostrowska, referencing the research of J. Siegrist and W.C. Cockerham, points out that while having adequate material resources is significant, education is the strongest single predictor of health status (Ostrowska, 1999, p. 13).

The WHO's 1998 definition of health competencies states that they are the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health (Sørensen, Broucke, Fullam, 2012). Ishikawa and Yano note that the WHO's approach expands on earlier definitions by including, among other things, the possession of social skills—such as communication, negotiation, or organization – which are essential for making practical health-promoting decisions. It should be noted that this definition presupposes that basic literacy and numeracy skills are a prerequisite for achieving health literacy in this sense.

Nutbeam created a different framework for the concept, combining a very narrow perception (i.e., an individual's basic ability to understand health information, thus including reading and writing) with the broad WHO definition (i.e., possessing skills leading to empowerment). Nutbeam proposed a three-tiered division of literacy in relation to health:

1. Basic/functional literacy – the fundamental reading and writing skills necessary for effective functioning in everyday situations (thus, an approach consistent with the narrow understanding of health literacy).
2. Communicative/interactive literacy – more advanced cognitive and literacy skills which, combined with social skills, can be used to actively participate in daily situations, extract information from various forms of communication, understand its meaning, and adapt the type of information used to changing circumstances.
3. Critical literacy – more advanced cognitive skills which, combined with social skills, can be used to critically analyze information and, on that basis, gain greater control over various life events. Thus, this level of literacy is intended to lead to empowerment.

Nutbeam lists potential effects for both the individual and the community, with the latter being primarily a consequence of "critical literacy". The first level of health literacy according to Nutbeam"basic/functional literacy"can be the result of traditional health education, which involves transmitting information about health/illness (e.g., risk factors or how to use the healthcare system) and providing precise instructions for specific behaviors. According to this researcher, this requires the use of classic tools like media or leaflets. The second level "communicative/interactive literacy" is aimed not only at educational training but also at developing specific skills and behaviors in a supportive environment. Don Nutbeam suggests this can be achieved, for example, by enabling the operation and supporting the development of self-help groups and by combining various communication methods and channels. He also points out that examples of such methods for shaping "communicative/interactive literacy" can be found in many contemporary school health education programs focused on developing personal and social skills and changing health behaviors (Nutbeam 2000, Pages 259–267).

The determinants of citizens' health literacy include: demographic factors and socio-cultural factors, such as social status, employment, income level, profession, existing social support instruments, culture, and language. Also influential are factors more closely related to the individual, such as personal experience with illness, individual experiences with the healthcare system, and personal traits like age, gender, race, and general education level, including analytical skills. For adolescents, parents and peers have an impact on health literacy (Sørensen, et al., 2012). D. Nutbeam also notes that the level of health literacy is influenced by activities that promote health knowledge and pro-health behaviors (Nutbeam, 2000).

Assessment of health literacy in Poland

Research conducted in Poland indicates a lack of information about preventive health programs (Report *Zdrowie w Internecie*, Instytut Praw Pacjenta i Edukacji Zdrowotnej, https://ippez.pl/, 26.08.2025). The study involved 1182 respondents aged 18 to 85. The sample was representative in terms of age, gender, and place of residence.

In the survey of 1182 respondents, a staggering 73.37% of participants expressed negative opinions about access to information on preventive health programs in Poland. Only a small fraction of respondents (16.84%) agreed that access to this information is sufficient. This clearly demonstrates a significant gap in access to vital health information. This insufficient awareness of health prevention not only limits individuals' ability to choose appropriate preventive measures but may also lead to unconscious health risks.

The study found that 82.58% of respondents disagree with the statement that Poles have adequate knowledge of patients' rights. A mere 10.21% of participants agreed with this statement. These results highlight that education regarding patients' rights remains inadequate, and the understanding and awareness of these rights are critically low. A lack of awareness of one's own rights can lead to situations where patients do not use the legal protections available to them or fail to report rights violations. This, in turn, can result in abuse and improper treatment of patients by the healthcare system (Report *Zdrowie w Internecie*, Instytut Praw Pacjenta i Edukacji Zdrowotnej, https://ippez.pl/, 26.08.2025).

Although the results showed that 53.61% of respondents agree that they know where to find information about patients' rights, 30.40% of participants disagreed with this statement. This indicates mixed feelings within society regarding access to appropriate resources and information.

Furthermore, the result suggests a certain diversity in access to information, which may stem from regional, educational, or technological differences. Another important issue is whether the available resources are sufficiently clear and understandable to be effectively used by the general public (Report *Zdrowie w Internecie*, Instytut Praw Pacjenta i Edukacji Zdrowotnej, https://ippez.pl/, 26.08.2025). While more than half of the respondents claim to know where to find information on patients' rights, the lack of this knowledge among the remaining participants presents a challenge that must be addressed. Public education should be directed not only at those who are already aware of their rights but also at those who may have difficulty accessing relevant resources.

These findings present Poland with the challenge of increaseeing access to information about health prevention for various social groups. Considering that a significant majority of those surveyed lack access to this crucial data, it becomes clear that specific actions must be undertaken. These could include educational campaigns, training programs, or online platforms providing reliable information. The necessity of understanding and applying health prevention measures in daily life is key to the overall health of society, and its absence can lead to neglect and potential health problems on a larger scale (Report *Ocena świadomości zdrowotnej w Polsce*, Instytut Praw Pacjenta i Edukacji Zdrowotnej, https://ippez.pl/, 26.08.2025).

"As many as one-third of men with higher education and a slightly smaller percentage of women have never encountered the concept of a 'risk factor'" reads the report on a representative study of health awareness and attitudes among adult Poles, published by the National Institute of Public Health-National Institute of Hygiene (NIZP-PZH). The situation is even worse for less-educated Poles. The percentage of adult men with secondary, vocational, or lower education who have not encountered the term "risk factor" or "factor contributing to illness" for conditions like a heart attack, coronary artery disease, stroke, or cancer is nearly 50%. Women with a similar level of education fare only slightly better.

The study revealed that even those who knew the term "risk factor" often could not provide any specific examples or struggled to do so. "The greatest difference among men concerned low physical activity, which was mentioned as a risk factor (in the group familiar with the concept) by 48.2% of men with higher education and only 11% of those with at most a middle school education". It turns out that opinions on this matter also depend most heavily on the level of education, and to a lesser extent on gender. While about 60% of Poles with higher education identified their own behavior as the most important factor influencing their health, among those with the lowest education, this figure was only 40%. As is evident, less-educated individuals are much more inclined than educated ones to blame external factors beyond their control for their health status. This is obviously not beneficial from a health prevention perspective, as such individuals are far less active in consciously building their health and preventing diseases. The research has shown that awareness of health and various health issues is unsatisfactory in Polish society. There is a need to educate Poles on how to care for their own health, what is beneficial for health, and what is harmful. The studies also confirmed significant social inequalities in this area (B. Wojtyniak, P. Goryński: *Sytuacja zdrowotna ludności Polski i jej uwarunkowania* (report of the National Institute of Public Health - National Institute of Hygiene from 2018)).

The study also revealed another unfavorable truth about Poles in the context of health attitudes: adherence to doctors' recommendations by people struggling with various chronic diseases, such as diabetes, hypertension, or high cholesterol. This part of the study shows that a large percentage of Poles only partially adhere to medical advice, meaning they are not systematic.

The least compliant group is poorly educated men with diabetes. As many as 43% of men with vocational education struggling with this disease and 61% with middle school or lower education admitted to not following their doctor's recommendations (Wojtyniak; Goryński, 2018).

In light of the facts presented above, which show significant gaps in knowledge about health and its determinants on the one hand, and reckless, irresponsible, and inconsistent health behaviors of Poles on the other, it should surprise no one that in terms of length and quality of life, as well as premature mortality rates, our country still fares much worse than the EU average. Despite this, Poles generally remain optimistic about their health. The study also asked respondents about their self-assessed general health status, and it turned out that as many as 75% of adult men and 69% of women in our country rate it as good or very good. The authors of the study emphasize that self-assessed health was generally better the higher the socio-economic status of the surveyed individuals (Wojtyniak; Goryński, 2018).

Consequences of low health literacy

Generally, studies on basic health literacy have shown statistical correlations between its low level among respondents and their poorer physical and mental health, as well as worse mortality rates (Baker, et al., 2008; Sudore R., et al., 2006). This includes:

- more frequent hospitalization (Baker 1997; Rudd., et al., 2000);
- more frequent non-adherence to physician-recommended procedures, e.g., in pharmaco-therapy (Kalichmann, et al.,1999);
- more frequent lack of knowledge or insufficient knowledge about their diseases and treatment principles (Kalichmann, et al.,1999);
- respondents constituting a greater financial burden on the healthcare system (Iwanowicz 2009).

In the global literature, there are still relatively few studies analyzing the link between the level of health literacy and the costs incurred by the healthcare system and individuals. J.A. Vernon and his team conducted research showing that low health literacy is a major source of economic inefficiency in the United States healthcare system. They preliminarily estimated the costs associated with low health literacy for the U.S. economy to be between 7% and 17% of all healthcare expenditures. They also estimate that if no action is taken to increaseee health literacy, future generations will bear even greater costs associated with this issue (Vernon, Trujillo, Rosenbaum, DeBuono, 2007).

Healthcare expenditures in Poland

According to preliminary estimates, current healthcare expenditures in Poland in 2024 amounted to PLN 293.6 billion, which represents 8.1% of the Gross Domestic Product (GDP). These expenditures were PLN 47.0 billion higher compared to 2023, when they were PLN 246.6 billion. The increaseee concerned both public and private spending (Preliminary estimates of the National Health Account cover all current healthcare expenditures incurred in the previous year (T-1) and are presented in three main categories: HF.1: Public expenditure, HF.2: Private expenditure excluding direct household out-of-pocket payments, and HF.3: Direct household out-of-pocket payments. Preliminary estimates refer to 2024 data).

Structure of expenditures by function. In the classification of healthcare functions (HC), the stream of current health expenditures in 2023 included, among others:

- curative care services – 58.9% (in 2022 – 60.1%);
- medical goods, including pharmaceuticals – 17.3% (in 2022 – 19.0%);
- long-term care (health) – 7.8% (in 2022 – 8.1%);
- rehabilitative care – 4.6% (in 2022 – 4.7%). (GUS, Wydatki na ochronę zdrowia w latach 2022–2024)

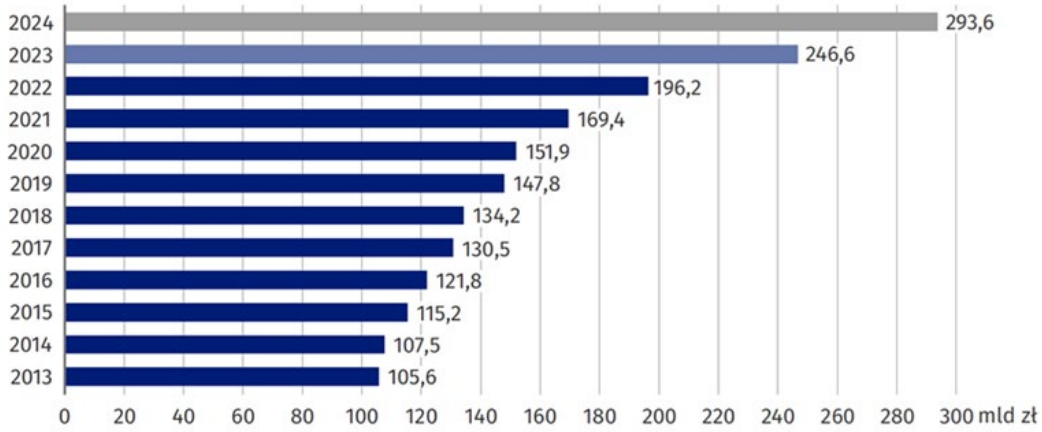

Figure 1. Expenditures included in the National Health Account in 2013-2024

Legend: dark blue - final data, lighter blue - preliminary data, grey - preliminary estimates. Values in PLN billion.

Source: GUS, Wydatki na ochronę zdrowia w latach 2022–2024

The method for estimating the National Health Account is based on the System of Health Accounts, an international tool for analyzing healthcare expenditures that captures them comprehensively, ensuring comparability between countries. National Health Accounts allow for a systematic description of financial flows related to the consumption of healthcare goods and services. Their purpose is to describe the healthcare system from an expenditure perspective. Due to the lengthy, multi-month process of preparing and verifying final data, they are preceded by preliminary data and preliminary estimates, between which significant differences may occur.

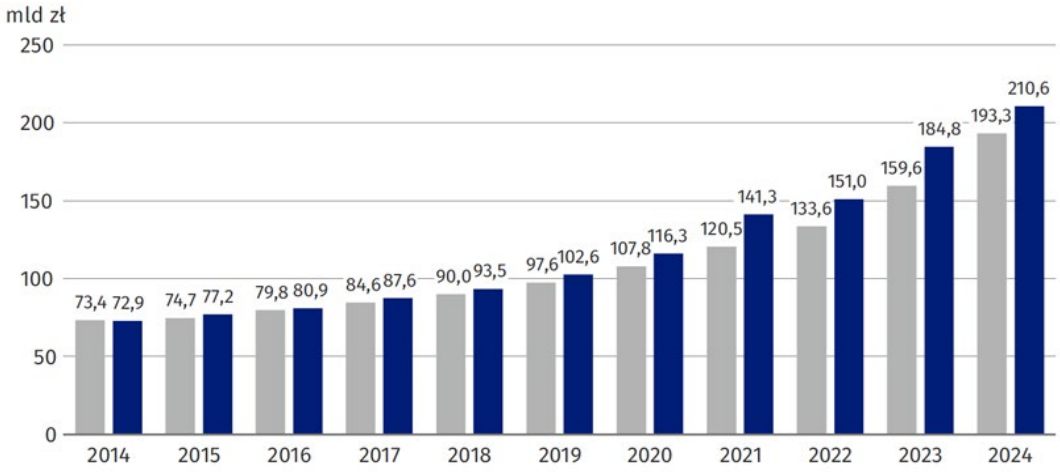

Figure 2. Healthcare expenditures in 2014-2024

Legend: grey - Plan according to the act, dark blue - Execution. Values in PLN billion.

Source: GUS, Wydatki na ochronę zdrowia w latach 2022–2024

According to the 2024 budget act and the National Health Fund (NFZ) plan projection, funds allocated for healthcare for that year were planned at PLN 193.3 billion, which was increaseeed during the year, with the final execution amounting to PLN 210.6 billion. It should be emphasized that these funds in 2024 were PLN 25.8 billion higher (14.0%) than the expenditures allocated to healthcare in 2023. As we can see, healthcare spending has been rising for years and will continue to rise, but it will be all the more insufficient the lower the society's health literacy.

Conclusion

As we can observe, healthcare expenditures are constantly growing, yet they will remain insufficient and their insufficiency will be greater the lower the population's health literacy. Total current healthcare expenditures, including public, private, and direct household spending, will continue to rise if society has low health awareness.

The response to these research findings should involve an integrated approach to education at various levels of society. Educational campaigns are needed to provide clear and understandable information, both in healthcare facilities and in the media. Improving health literacy will increaseee public trust in the healthcare system, but most importantly, it will enable patients to actively participate in their treatment process, which can lead to better health outcomes.

The data on health literacy present Poland with the challenge of increaseeing access to information about health prevention for diverse social groups. Given that a significant majority of those surveyed do not have access to this vital information, it is clear that concrete actions must be taken. These could include educational campaigns, training programs, or online platforms providing reliable information. The necessity of understanding and using preventive health measures in daily life is crucial for the overall health of society, and a lack thereof can lead to neglect and potential health problems on a larger scale. I believe that social media, where reliable health information is increaseeingly appearing, has become very important recently.

There is a need to educate Poles on how to take care of their own health, what is good for it and what is harmful. The research has also confirmed significant social inequalities in this area. Therefore, when planning effective educational and preventive actions, one must always strive to adapt them to the needs and capabilities of the specific target audience, ensuring above all that they are understandable. Investments in health education, information campaigns, and the availability of online resources can be key to increaseeing health literacy in society, thereby contributing to lower private and public financial costs for healthcare.

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CHAPTER V

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CHAPTER IX

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