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Considerations on the Knowledge Integration Management (KIM) in the Knowledge-Based Society/Economy (KBS/E)

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Abstract: *The paper proposes a transdisciplinary approach to knowledge integration within the knowledge-based society and economy (KBS/E), positioning universities as ideal spaces for the synergy of education, research, and industry. Emphasizing a "global village" perspective, it highlights the university's role in fostering sustainable development by integrating diverse disciplines and deep research in specialized fields. Practical examples of transdisciplinary spaces include Technopolis centers, knowledge factories, and mobile mechatronic platforms, which serve as innovative clusters for knowledge creation, transfer, and application. The Knowledge Integration (KIM) paradigm underpins this process, enabling the efficient exploration of ideas and advancing expertise as wisdom and skills. This approach breaks traditional academic boundaries, encouraging rational debate, problem-solving, and lifelong learning in a sustainable, integrative framework.*

1. INTRODUCTION

The global community engages in a collective effort aimed at addressing fundamental issues tied to common economic principles and guidelines within the knowledge-based societal and economic framework (KBS/E) (Arnold Stuart, 2008; Adamsson, 2007). Challenges in overcoming these issues primarily arise due to the multifaceted and complex nature of global economic growth. Addressing these types of challenges demands moving *"beyond that is known"*, particularly given the emergence of innovative integrative approaches, including multidisciplinary, interdisciplinary, and transdisciplinary methods (Nicolescu, 2006; Berte, 2004; Ertas, 2010). Addressing the challenges presented by an evolving global business context requires shifting perspectives to more thoroughly understand foundational integrative knowledge (Calantone et al., 2002). Within this context, knowledge management is increasingly becoming a central and significant topic in contemporary discussions (Nonaka & Takeuchi, 1994; Berends et al, 2007; Jashapara, 2011).

For the informergical society (information acting as intentionality incorporated in mattergical intelligent products), as the knowledge-based society/economy (KBS/E) was stated, the main question is the way the advanced knowledge is produced, shared and implemented (Zeleny, 1987). Given that data is plentiful and essential, innovative methods must be applied to transform it effectively into valuable insights, through synergistic communication, as contextual messages in education, as top-down approach, and in practice as bottom-up perspective in sustainable all life teaching/learning processes, to achieve the final goal, expertise as wisdom and skills (Pop & Soritau, 2022). Advanced knowledge, defined as the understanding of facts, truths, or principles acquired through research or study, relies on the semiophysical contextual message model, where each stage of attaining knowledge is examined using a synergistic and systemic perspective through the knowledge paradigm consisting of seven guiding questions: where, when, who,

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with whom, what, how, and why (Pop & Soritau, 2022). The framework for understanding the knowledge-based society/economy (KBS/E) is established by the space-wise-spatial participative sequence (where, who, with whom), time-wise-temporal connective sequence (when, who, with whom) and act-wise-interactive actionable sequence, (who, with whom, what, how and why) (Pop, 2008; Šlaus & Jacobs, 2001).

2. TRANSDISCIPLINARITY AND INFORMERGIC INTEGRATION OF KNOWLEDGE

The image of the World as the Whole is the basis for the holistic world outlook, but in the light of the transdisciplinarity of "the One World", the world's economy is perceived and understood as *"the one orderly medium"* in which national economies, as components of the specific societies, are considered to work as an aggregate of its natural fragments (Arnold, 2008; Pop et al., 2021). In this sense it is important to understand the intricate nature of the society grounded in advanced knowledge, as a natural part of this medium, working in an integrative informergic pattern (information as intentional information embedded in mattergy as energy and matter) of what is the rational "by doing" and relational "by being". The image of the transdisciplinary "One World" will help to form the very "new viewpoint" in order to define the direction for creative thinking in solving the problem of designing a new order of global economic relationships (Nicolescu, 2008). From this point of view, it's essential to identify human needs alongside the products and services that meet those needs. Equally important is defining global standards for how goods are produced, exchanged, and distributed. These processes should be guided by the understanding that people are organic to the world, they are interconnected, and play a vital, living role in the shared global system (Nicolescu, 2008). The updated model of a knowledge-based society and economy (KBS/E) proposes a different perspective. It introduces an alternative path that complements existing ones, with its foundational principles and specific boundaries for where and how it can be applied. Within epistemology, certain academic disciplines appear closely related. Others, however, are viewed as more distant, marked by a clearly defined epistemological separation/distance.

A discipline, when approached in depth, represents a field of knowledge, education, or inquiry that is unified by a common epistemological foundation. This foundation consists of shared beliefs about the nature of knowledge and distinct methodological boundaries. These methods are accepted as valid means for producing and accumulating knowledge (Nicolescu, 2008). Disciplines tend to group based on *epistemological distance*—how closely they align in terms of foundational assumptions. These groups, or knowledge subsystems, often include fields such as the natural sciences (e.g., physics, biology, chemistry), social sciences (e.g., psychology, sociology, economics), and the humanities (e.g., languages, visual arts, music). Some rely on quantitative approaches, others on qualitative ones. Disciplines within the same subsystem are typically more connected. Those from different subsystems are generally more distant. The disciplinary structure of knowledge operates at a thematic and curricular level. At this level, it may be embedded in predisciplinary, mono-disciplinary, or codisciplinary settings. In contrast, academic programs and research collectives often follow a multidisciplinary or pluri-disciplinary structure, primarily at the methodological level. These are not confined to traditional disciplines and sometimes span multiple knowledge subsystems. Such approaches function at a synergistic level, facilitating structural interdisciplinarity, functional cross-disciplinarity, and generative transdisciplinarity. This reflects a *multiple disciplinary thinking perspective on knowledge* (Pop & Soritau, 2022).

The transdisciplinary approach demands a change in the attitude of all the actors from the position of co-evolutionary development (Nicolescu, 2006), providing the opportunity for fundamental changes in the economic relationships (Brazell et al., 2009). Identifying a problem is often seen

as more critical than finding its solution. Re-examining existing issues from a fresh perspective requires creativity and is regarded as a genuine scientific achievement. In order to become competitive, companies must develop new technologies to design and manufacture their products, as a rapid reaction to change, for products with new smart properties in shortened product cycles (Arnold, 2008). The transdisciplinary method offers fresh viewpoints on development. It continuously incorporates new ideas that aim to improve how we act and adapt to the changing world. This is especially relevant in today's complex environment, where needs evolve rapidly. Innovations and technologies must constantly be refined to keep pace with these fast-moving changes.

A key focus in knowledge management is how knowledge can or cannot be measured, stored, and made explicit. To examine how tacit knowledge can be transformed into a usable format, traditional methods are often employed. This happens through transdisciplinary integration processes that include various stages: hands-on (passive knowledge), hands-in (a mix of passive and active), and hands-off (fully active knowledge). It's essential to distinguish between different types of knowledge. For instance, *know-what* involves selecting the right content to communicate. *Know-how*, on the other hand, refers to how this content is encoded and shared. This is considered implicit knowledge (Berends et al., 2007; Pop, 2008). Such procedures become formalized and serve as structured ways of guiding people through specific tasks. Organizational knowledge, especially the kind that feels like shared understanding or tacit communion, goes beyond just knowing *what*. It is about developing true *know-how*—the actual ability to apply what is known in practice (Gomes et al., 2003; Hildreth & Kimble, 2004).

To build knowledge through interaction within a specific setting—where learning is initiated, supported, and sustained—people must operate in a well-structured environment (Wenger & Snyder, 2000; Hildreth & Kimble, 2004). This approach enables new ways of thinking, with greater chances of successful outcomes. It also allows for better management and application of knowledge, as well as faster development of useful concepts. Moreover, communication with other knowledge domains becomes more effective. In this context, the main objectives of the new economy revolve around client satisfaction and market relevance (Arnold, 2008).

Understanding how knowledge works in real-world settings requires a broader view. One must examine how information spreads within large, interconnected systems. Real practices tie together things, people, and events that may seem unrelated or only partly aligned. This is important because such practices make room for both stability and transformation, helping to manage change and disorder while preserving continuity. To enable knowledge growth through collaboration, individuals must engage in environments where learning is actively created and maintained. Such environments must be purposefully designed to support these processes (Wenger & Snyder, 2000; Hildreth & Kimble, 2004).

Within this kind of setting, we find what is called *transactive knowledge*—a form of organizational self-awareness (knowing what one knows). There is also *resource knowledge*, which refers to knowing who possesses specific information. Together, they emphasize the importance of understanding the *knowledge landscape of an organization*—that is, who knows what and why, and how that knowledge is connected (Hildreth & Kimble, 2004).

In a knowledge-driven society and economy (KBS/E), education and training rely on a transdisciplinary strategy. This approach is essential in today's educational landscape, offering a pathway to success. It encourages active participation, adaptability, and context-specific flexibility. With this mindset, even challenges can be turned into opportunities (Berte, 2004; Pop & Mătieș, 2010).

Transdisciplinarity emphasizes both doing and being. It views learning as an ongoing process where those involved in education play an active role—similar to a *teaching factory* (Alptekin, 1996). The goal is to help learners understand and apply information, question it, or even reshape and adapt it as needed. To remain competitive, organizations must continually create new products and refine their manufacturing processes. This allows them to keep up with fast-changing demands and shortened product cycles. These cycles now align with a broader concept of sustainable, lifelong learning systems—*"all life learning systems" (long life learning, wide life learning and learning for life*) (Arnold, 2008). The transdisciplinary approach brings fresh insights to development. It draws in a growing number of ideas aimed at improving how we act and adapt in a constantly shifting world. In a context full of complexity and change, new technologies must be improved and developed rapidly (Pop & Mătieş, 2010).

The integrated models discussed here show that *informergy*—the energy of knowledge—relies on a transdisciplinary understanding of learning within a knowledge-based society. This is grounded in a semiophysical communication model that answers "What? How? Why?"—a method for achieving the advanced knowledge. Transdisciplinary models offer a richer perspective than traditional teaching-learning systems. They center on identity as synergy and view learning as a thematic and generative process. These models help explain how different disciplines can be connected. They support codisciplinary and multidisciplinary collaboration, as well as interdisciplinary and transdisciplinary blending. This approach seeks to balance the external (practical and observable knowledge) and the internal (reactive and intuitive knowledge) dimensions of learning. It supports rational understanding through active engagement ("doing") and relational insight ("being"). Ultimately, advanced knowledge can only be achieved through transdisciplinary practice—an open, integrative system for understanding the world.

The transdisciplinary approach to exploring knowledge introduces a new research paradigm. It operates by integrating both top-down and bottom-up streams of knowledge in a complementary way. In this model, the teacher—seen as a mentor—typically guides from a top-down angle, while learners contribute insights from the bottom up. Rather than maintaining rigid hierarchies, the roles of teacher and learner shift within a balanced and cooperative dynamic. This fluid interaction adapts based on the context of synergy between participants. The goal is to prevent conflict, encourage mutual understanding, and create meaningful links across different viewpoints. This model promotes bridge-building, breaks down barriers, and supports collaboration in learning and living environments. It reflects a vision of humans as constantly connected—not only with each other but also with intelligent systems, technologies, and the products they engage with.

It is proposed to introduce a new transdisciplinary perspective on the informergical integration of knowledge in the context of the new framework, knowledge based-society. This new perspective to explain the achieving of knowledge, giving the openness to a better understanding of the world, through *informergy*, which refers to purposeful action and information (*informaction*) combined with *mattergy*—energy that is embedded within matter. This approach provides multiple ways to comprehend, transfer, and embed knowledge within the framework of an informergical, knowledge-based society. The multi-layered transdisciplinary model integrates informergically—meaning it blends intentional action with embodied energy (*mattergy*)—the dimensions of creativity (both adaptability and innovation), performance (through competition and outcomes), and authenticity (involving character and capability). All of this is accomplished through active engagement and collaborative learning, viewed as *apprenticeship in communion*. Within this updated methodological approach, the "knowledge search window" helps to clarify the interaction between bottom-up and top-down learning processes. These mechanisms are central to the integration of knowledge

within teaching and learning frameworks, especially in fields such as mechatronics. This entire process is interpreted through a transdisciplinary lens (Pop & Mătieş, 2008).

Disciplinary research, which focuses on *depth*, and transdisciplinary research, which emphasizes *breadth*, are not in conflict with each other. Instead, they function as complementary strategies—described as working through a model of *"breadth through depth."* This model supports a renewed perspective in the pursuit of knowledge. The concept of *informergy* offers a range of integrative methods to explore how knowledge can be gained, shared, and embedded within the framework of a knowledge-based society. It promotes a synergistic approach to understanding that combines two key elements: rational knowledge (gained through action—*by doing*) and relational understanding (developed through presence and meaning—*by being*). Together, these form the dual paths of the informergic learning process. To meet the growing need for high-level expertise, it is essential to rethink vocational education. New training systems must reflect the demands of an evolving, knowledge-driven world. This includes combining theoretical learning (a top-down approach) with practical experience (a bottom-up approach). Through this blend, learners gain essential skills and continuously improve through a lifelong learning mindset. To reach long-term goals, three complementary strategies are proposed: *raising the expertise to an advanced knowledge level (as wisdom and skill achievement)*; *sustainable strategies as "all life learning" educational process* (*lifelong learning, wide life learning and learning for life), and the knowledge triangle for creativity (education, research and innovation)* (Pop, 2009).

Informergic professionals—whether engineers, managers, technicians, or others—demonstrate strong motivation and capability across diverse technological domains. They work across disciplinary lines and apply a *multi-disciplinary mindset* to identify and apply the right mix of technologies to address complex challenges. This approach leads to more suitable and effective solutions and supports alternative strategies for problem-solving. The goal of this emerging methodology is to support informergic learning. It encourages individuals to gain skills through a process of learning, understanding, and practicing. This process is *active-reactive,* meaning it can occur either through intentional effort or spontaneously. It allows learners to engage deeply with knowledge—managing information, questioning it, reorganizing or adapting it, and even deciding to reject it if needed. It is also essential to develop a conceptual framework for working with dynamic systems. This framework should span both naturally occurring systems and intentionally designed ones. Understanding how to apply these models effectively—especially within layered, vertically structured systems—helps create harmony between theoretical understanding and practical application. This balance is achieved through a *included-middle approach* to knowledge integration.

3. INNOVATION NETWORKING AND KNOWLEDGE BASED SOCIETY / ECONOMY (KBS/E)

The transdisciplinary informergical framework integrates a rational mode of acquiring knowledge (*by doing*) with a relational way of being (*by being*). It relies on collaboration, creativity, and clearly defining and shaping problems. This model is especially relevant in contexts that involve uncertainty, change, and distributed intelligence across different cultures, disciplines, and technological tools. In this context, educational programs should aim to cultivate transdisciplinary abilities. These competencies are essential for helping individuals lead meaningful and productive lives in a world shaped by complexity and integration (Derry & Fischer, 2005; Nicolescu, 2006).

Informergical education is centered on equipping learners with practical expertise in areas such as smart systems integration, design, and maintenance. The newer educational strategies

emphasize concurrent creative processes throughout system development (Pop et al., 2018). It is also important to help learners strike a balance between top-down instruction and bottom-up engagement. This balance lies at the core of transdisciplinary knowledge development. Students must explore technological fields in depth while applying this knowledge in hands-on settings. The goal is to support modern vocational education that functions like a *knowledge factory*—bridging theoretical understanding with practical implementation (Pop, 2009). The perspectives of the research in the field are related to the creativity centres in the process of the eco-economical implementation of intelligent products, for sustainable development of an integrated and continuously integrative society, through transdisciplinary technopolis centres, the educational platforms being an original system for achieving, transferring and implementing knowledge in intelligent products, technologies and systems (Papoutsidakis et al., 2008). The transdisciplinary perspective in informergical education is built on encouraging original thinking, making reasoned decisions, solving complex problems, and fostering responsible dialogue. It promotes a learning process that goes beyond the constraints of conventional academic norms (Nicolescu, 2008). In this view, hands-on experience is vital and cannot be replaced by simulations alone. Instead, a combined use of virtual tools—such as design software, modeling, simulations—and real-world representations, like prototypes and smart systems, is necessary (Mândru et al., 2008).

Rather than being seen as conflicting forces, tradition and innovation are treated as complementary. The most creative individuals are those who, through a transdisciplinary lens, go beyond established frameworks. They are capable of recognizing and expressing entirely new concepts that push beyond current structures (Berte, 2007). To truly innovate, creative systems must detect new ideas and explore them using intelligent strategies. These systems help shift smoothly between different potential solutions or knowledge states. Since knowledge is rooted in human interaction rather than in objects or documents, it becomes essential to recognize the spiritual side of learning. This is often understood through the concept of "being"—a key idea in the informergical and integrative knowledge paradigm (Reason, 1998; Pop, 2009). Today's learner is seen as an active participant in the process of acquiring knowledge. This involves balancing rational understanding (by doing) with meaningful relationships and reflection (by being), in order to make sense of the world (Nicolescu, 2008; Pop, 2008). The evolving knowledge landscape calls for a transformation in education. This includes identifying and supporting essential changes, acknowledging innovation critically and creatively, and addressing new educational priorities. These priorities now require rethinking the curriculum within a more creative and future-oriented context (Boden, 1994).

In order to reconfigure the traditional monodisciplinary learning space in a new sustainable educational pattern, was introduced the all life learning principle – with its three components, lifelong learning, life wide learning and learning for life. These components support the continuous development of specialized professionals who gain new competencies through adaptive, real-world engagement. This involves learning that responds to contextual needs and takes place in collaborative, transdisciplinary environments where integrated knowledge is processed through networking. Informergy serves as a model of generative, synergistic synthesis within this framework. It combines *Scientia*—a symbol of new educational transdisciplinary thinking (a fresh epistemology)—with *Techne*, which represents practical, integrative design methods. Together with *Praxis*—reflecting meaningful action—this model shapes the emerging economy centered on intelligent products, grounded in the concept of *mattergy*, where energy and information are embedded into matter. This is supported by a newly developed system of thought and behavior, rooted in social interaction and aligned with an updated ontological perspective. The resulting knowledge environment is seen as a *metacognitive space*—a platform where open, transdisciplinary

learning systems thrive. Within the interconnected worlds of education, research, and industry, the university is viewed as the most suitable environment for this kind of learning. It offers both structure and adaptability, which are essential in today's knowledge-based society and economy (KBS/E). This space allows for continuous evolution, where learners can develop highly specialized knowledge while also gaining a broad, interdisciplinary understanding. Achieving this balance is essential for success in both academic and professional domains (Kaynak, 1996).

The proposed sustainable vision aims to apply developed knowledge within intelligent systems, technologies, and products. This vision is grounded in a transdisciplinary model that introduces new ways of thinking and fosters the adoption of innovative ideas. These ideas help refine how we live and work in an increasingly complex and rapidly evolving world. In this context, technological progress and innovation must keep pace with continuous change. Creative environments such as *transdisciplinary technopolis centers* (Albert & Lukas, 1999; Pop et al., 2018), *teaching factories* (Alptekin, 1996), *mobile educational platforms* (Papoutsidakis et al., 2008), and *reform-oriented schools* (Berte, 2007)— along with *entrepreneurial communities of practice* — are contributing to the emergence of integrated learning ecosystems. These models support the creation of a sustainable society where knowledge is both continuously generated and applied. Their role is to foster the ongoing development and implementation of informergical knowledge, positioning these environments as foundational to the future of transdisciplinary knowledge spaces. Informergical knowledge transcends standard methods, promoting a transdisciplinary identity that fosters new fields through flexible, real-world-relevant, co-disciplinary frameworks and adaptable curricula.

It is important to make a reevaluation by reshaping (Pop et al., 2024) or redefining (Prisac & Pop, 2023) sustainable development in permacrisis with the transdisciplinary approach integrating knowledge through Knowledge Integrating Management (KIM) in order to give contextual adequate solutions to our problems in a challenging troubling world. Innovation hubs are contributing to the sustainable advancement of a continuously evolving, integrated society. These centers enhance collaboration across various domains of knowledge. In the context of the emerging informergical society, the primary objective is to focus on product innovation and technology development aimed at fulfilling both customer and market demands. To maintain competitiveness, companies must innovate rapidly. This includes creating and producing new technologies that respond efficiently to change, ensuring products remain competitive and production cycles are reduced (Arnold, 2008). The transdisciplinary model introduces fresh insights into how development should evolve. It supports the integration of diverse ideas to improve everyday practices and adapt to shifting realities. In a world defined by constant transformation and increasing complexity, the need to update and refine technologies and innovations is more critical than ever (Pop & Mătieş, 2010).

To foster the creation, nurturing, and long-term sustainability of knowledge, a supportive environment must be established. This is often achieved through structured social interactions, particularly in Communities of Practice (CoPs). These groups are seen as emerging, creative hubs that function as centers of synergistic and generative activity. Within them, *transactive knowledge* (knowing what one knows within the organization) and *resource knowledge* (knowing who knows what) are especially centered on the organizational setting (Wenger & Snyder, 2000; Hildreth & Kimble, 2004). On the other side, it would be possible to approach entrepreneurial learning in the family business as a community of practice synergistic/generative transdisciplinary pattern working as a specific knowledge space. Within a knowledge-based society, education and training must be grounded in the principles of transdisciplinarity. This is essential in today's evolving educational

landscape, as it ensures the capacity to adapt, actively engage, and succeed in the future. A new mindset is required—one that embraces flexibility, context-awareness, and the potential to turn challenges into opportunities (Pop & Mătieş, 2010). In the transdisciplinary context, the main question is what creativity as novelty does bring innovation in the business life and activity for business people offering the path to determine whether the chosen type of activity is a major type, or it has to be changed, and how can this be done effectively (Jashapara, 2011).

4. CONCLUSION

The research has successfully fulfilled its proposed goals, presenting original contributions. Informergy is understood as a dynamic and integrative synthesis that combines multiple knowledge dimensions. It brings together *Scientia*, envisioned as a new educational paradigm rooted in transdisciplinary thinking; *Techne*, which reflects a creative approach to design; and Praxis, which signifies intelligent action in real-world contexts. Together, they support the development of a new economy centered on smart products and processes, grounded in the concept of *mattergy*—where energy and information merge. This framework is shaped by a socio-interactive system that integrates thought, behavior, and ontology. Within it lies a shared cognitive space—metacognitive and generative in nature—that supports open and transdisciplinary knowledge creation. Informergical knowledge, within this context, does not function as a traditional methodology. Instead, it uses synergistic synthesis approaches that go beyond multidisciplinarity or interdisciplinary overlap. It creates new fields of knowledge within a codisciplinary setting, guided by flexible, real-world-relevant curricula. The *all-life learning model*—consisting of lifelong learning, life-wide learning, and learning for life—enables the continual development of expert capabilities. It supports the adaptive evolution of competencies in response to real-world demands. This process unfolds in innovative environments such as *technopolis centers* and other transdisciplinary hubs, where learning is integrated, networked, and contextualized.

The sustainable strategies presented here offer a practical pathway for applying developed knowledge within intelligent products, technologies, and systems. This is made possible through a transdisciplinary approach that opens new directions for innovation. It enables the integration of an increasing number of ideas that contribute to better ways of working and living—especially in a world that is constantly evolving and facing complex challenges. In today's rapidly shifting environment, where technologies must continuously advance, creativity centers play a crucial role. These centers promote sustainable development within a continuously integrative society. Initiatives such as mobile education units, acting as networked teaching factories, exemplify how practical knowledge environments can function. Their mission is to support the transfer and application of informergical knowledge, serving as models for future knowledge spaces—such as technopolis centers—now also emerging in places like Romania. This inclusive and flexible approach provides a solid framework for turning theoretical knowledge into real-world impact. It ensures knowledge remains relevant and adaptable, regardless of how fast external conditions change. It enhances confidence in the steady growth of the business and strengthens the entrepreneur's expertise in strategic planning. This is achieved by using precise data on critical milestones and control points, enabling tailored recommendations for improving business operations, equipment and machinery use, marketing, and sales strategies. Understanding the business's orientation toward certain types of innovation is crucial, as it allows the entrepreneur to effectively adapt the original business concept—timely and accurately—while refining the core operational principles.

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