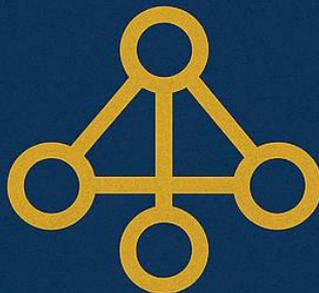


SMART BUSINESS ECOSYSTEMS

INTEGRATING TECHNOLOGY,
PEOPLE, AND STRATEGY



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*Rudy C Tarumingkeng: Smart Business Ecosystems - Integrating
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SMART BUSINESS ECOSYSTEMS: Integrating Technology, People, and Strategy

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I. Introduction: The Rise of Smart Ecosystems in the Digital Age

In the contemporary era of technological disruption, businesses are no longer isolated entities operating in linear supply chains. They have evolved into interconnected systems—**smart ecosystems**—where technology, people, and strategic intent converge to create value far beyond the boundaries of traditional firms. These ecosystems represent the synthesis of digital transformation and human collaboration, bridging artificial intelligence, big data analytics, Internet of Things (IoT), and human-centered design into one coherent architecture of business growth.

A **smart business ecosystem (SBE)** can be defined as a *dynamic network of organizations, individuals, technologies, and processes that co-create value through digital connectivity and shared intelligence*. Unlike traditional ecosystems that rely primarily on transactional relationships, SBEs operate through **interdependence, data-driven decision-making, and strategic adaptability**. They thrive on continuous learning, agile collaboration, and open innovation.

In an age defined by *Industry 4.0 and Society 5.0*, the logic of competition has shifted from “firm vs. firm” to “**ecosystem vs. ecosystem.**” The future winners are not necessarily those with the largest assets, but those with the most *integrated and adaptive*

ecosystems—where human creativity meets artificial intelligence, and where business models continuously evolve through strategic alignment between technology, people, and vision.

This paper explores the conceptual foundations, architecture, and managerial implications of Smart Business Ecosystems, structured across eight main sections: theoretical grounding, technological dimension, human dimension, strategic dimension, case analyses, leadership and governance implications, challenges and risks, and future perspectives.

II. Theoretical Foundation: From Networks to Smart Ecosystems

1. The Evolution of Business Systems

The concept of ecosystems originates from biology—referring to a community of living organisms interacting with their environment. In management, the term was popularized by James F. Moore (1993), who defined a business ecosystem as *an economic community supported by a foundation of interacting organizations and individuals*. Moore emphasized that competition increasingly takes place between ecosystems rather than individual firms.

Traditional business networks (e.g., supply chains, clusters) were largely static and linear. However, **digital transformation** has redefined the boundaries of collaboration. The diffusion of digital technologies has created *platform ecosystems* (such as Amazon, Google, or Alibaba), where multiple actors—producers, consumers, developers, and regulators—co-create and share value through digital interfaces.

Smart business ecosystems, therefore, represent the next evolutionary stage—**Ecosystem 4.0**—characterized by:

- Real-time data exchange;
- AI-based decision-support systems;
- Cross-sector integration (finance, logistics, education, health, etc.);

- Human-centered adaptability;
- Strategic alignment around sustainability and innovation.

2. Conceptual Models

Several theoretical models illuminate the dynamics of SBEs:

- **Systems Theory (von Bertalanffy, 1950s):** Emphasizes interdependence and feedback loops—each component affects the others dynamically.
- **Complex Adaptive Systems (CAS):** Highlights emergence, self-organization, and non-linear adaptation—key features of digital ecosystems.
- **Dynamic Capabilities Theory (Teece, 1997):** Firms must sense, seize, and transform to remain competitive amid changing environments.
- **Platform Leadership Model (Gawer & Cusumano, 2002):** Success depends on orchestrating complementary innovations by ecosystem partners.

Integrating these models, an SBE functions as a *living system of technology, people, and strategy* that evolves continuously toward higher levels of intelligence and collaboration.

III. The Technological Dimension: Intelligence as the New Infrastructure

1. The Role of Digital Technologies

Smart business ecosystems are enabled by a constellation of **emerging technologies** that form their digital backbone:

- **Artificial Intelligence (AI):** Provides predictive analytics, pattern recognition, and automation of complex decision processes.

- **Big Data and Analytics:** Transform raw data into actionable insights for personalized services and real-time optimization.
- **Internet of Things (IoT):** Connects physical assets—machines, vehicles, sensors—to digital platforms for continuous monitoring and feedback.
- **Blockchain:** Enables transparency, trust, and decentralized coordination across ecosystem actors.
- **Cloud Computing:** Offers scalability and connectivity for data storage and computation.
- **5G Networks:** Ensure ultra-fast, low-latency communication across distributed systems.

The integration of these technologies creates a “**digital nervous system**”—a metaphor for how smart ecosystems perceive, process, and respond to information stimuli.

2. The Architecture of Digital Integration

In smart ecosystems, technology serves as both the *infrastructure* and *intelligence layer*. The architecture typically consists of:

- **Edge Layer (Sensors & IoT devices):** Collects data from the environment.
- **Platform Layer (Cloud & Data Hubs):** Stores, aggregates, and processes information.
- **Analytics Layer (AI & Machine Learning):** Extracts insights and automates responses.
- **Application Layer:** Delivers value to users via apps, dashboards, or services.
- **Governance Layer:** Ensures cybersecurity, privacy, and ethical AI compliance.

The ecosystem functions like a *cyber-physical-social system*—bridging the physical world, the digital realm, and human cognition.

3. Digital Twins and Intelligent Platforms

A key innovation in SBEs is the **Digital Twin**—a virtual replica of a physical system that enables simulation and optimization. In manufacturing, logistics, and energy management, digital twins allow continuous improvement through predictive maintenance and resource efficiency.

Moreover, **platforms** (such as Amazon Web Services, Grab, or GoTo in Indonesia) act as *ecosystem orchestrators*, hosting multiple services while sharing data across partners. This *platformization* enables **network effects**—the more participants join, the more valuable the ecosystem becomes.

4. Cybersecurity and Trust

As data flows increase, so do vulnerabilities. The success of smart ecosystems depends on **trust**—both technological (secure data protocols) and social (ethical AI, fairness, accountability). Cyber resilience becomes a strategic imperative; hence, blockchain-based auditing, encryption, and zero-trust architectures are essential for sustainable operation.

IV. The Human Dimension: People as the Core of Smart Ecosystems

1. From Technology-Centric to Human-Centric

Although technology powers the ecosystem, it is **people**—leaders, innovators, and users—who give it meaning. The *human dimension* involves:

- Creativity and problem-solving;
- Collaboration and communication across boundaries;

- Ethical decision-making;
- Continuous learning and adaptability.

The transition from *Industry 4.0* to *Society 5.0* emphasizes that smart technologies must serve humanity, not replace it. Therefore, **human-machine symbiosis** becomes the defining paradigm: technology augments human intelligence, and humans guide technology with wisdom.

2. Organizational Culture and Learning

For an SBE to thrive, organizations must cultivate a **learning culture**. Peter Senge's concept of the *Learning Organization*—where people continually expand their capacity to create desired results—applies directly. Digital tools accelerate learning through:

- Knowledge-sharing platforms;
- AI-based talent analytics;
- Personalized learning paths;
- Cross-functional innovation teams.

Firms like Google, Microsoft, and Tokopedia use *collaborative intelligence systems* to enhance creativity through hybrid human-AI feedback loops.

3. Human Capital and Digital Skills

Building a smart ecosystem requires **digital fluency** across all levels—leaders who understand AI ethics, employees skilled in data interpretation, and customers capable of engaging in co-creation.

Governments and universities play a crucial role in developing **STEM + Humanities** education that balances technical proficiency with empathy, ethics, and creativity.

4. Leadership in Smart Ecosystems

Leadership evolves from *control* to *coordination*, from *hierarchy* to *network orchestration*. Smart ecosystem leaders act as:

- **Visionary integrators:** Articulating shared purpose;
- **Collaborative architects:** Enabling partnerships;
- **Ethical stewards:** Ensuring transparency and inclusivity;
- **Data translators:** Bridging analytics with human insight.

The moral arc of smart leadership moves *from Power → Trust → Empathy → Collaboration → Humanity*.

V. The Strategic Dimension: Alignment, Adaptation, and Advantage

1. Strategic Integration

Smart ecosystems require alignment among three critical pillars:

1. **Technology Strategy** — building scalable, secure digital platforms.
2. **People Strategy** — fostering culture, skills, and collaboration.
3. **Business Strategy** — defining value propositions, market positioning, and sustainability goals.

The **Strategic Fit Model** emphasizes the harmony between internal capabilities (resources, culture, processes) and external opportunities (markets, technologies, regulations). Misalignment among these dimensions can lead to ecosystem failure.

2. The Triple Helix and Quadruple Helix Frameworks

In smart ecosystems, collaboration transcends corporate boundaries. The **Triple Helix Model** (Etzkowitz & Leydesdorff, 2000) describes innovation through interactions among *universities, industry, and government*. The **Quadruple Helix** adds *civil society* as a fourth actor. This multi-actor collaboration underpins sustainable innovation in areas like fintech, healthcare, and smart cities.

3. Strategic Tools for Ecosystem Management

Modern strategy tools such as:

- **Balanced Scorecard (BSC)** – measures financial, customer, internal process, and learning perspectives;
- **Porter’s Value Chain** – reinterpreted as *Value Network* in ecosystem contexts;
- **Blue Ocean Strategy** – creating uncontested market spaces through ecosystem co-innovation;
- **PESTEL and SWOT** – adapted for inter-organizational networks.

Moreover, **OKR (Objectives and Key Results)** frameworks enable cross-company goal alignment—ensuring collective focus on ecosystem growth metrics rather than siloed KPIs.

4. Dynamic Capabilities in Smart Ecosystems

According to Teece (2018), *dynamic capabilities*—sensing, seizing, and transforming—are essential for sustaining advantage in turbulent environments. In smart ecosystems:

- **Sensing:** AI-driven analytics detect opportunities and threats.
- **Seizing:** Strategic partnerships exploit emerging technologies.
- **Transforming:** Continuous learning and digital reinvention ensure adaptability.

Thus, competitive advantage stems from *ecosystem agility* rather than resource ownership.

VI. Case Studies: Smart Ecosystems in Action

1. Amazon: Platform Leadership and Data Intelligence

Amazon represents a prototypical **smart ecosystem**, integrating technology, logistics, and human expertise. Its cloud platform (AWS) connects millions of developers and firms, while its logistics network uses AI and IoT for predictive delivery. Through continuous feedback loops, Amazon aligns *customer obsession* with *algorithmic efficiency*—an exemplar of technology–people–strategy integration.

2. Gojek–Tokopedia (GoTo): Indonesia’s Digital Synergy

In Indonesia, GoTo exemplifies the fusion of fintech, e-commerce, and mobility into a **localized smart ecosystem**. Gojek’s ride-hailing and payment systems, integrated with Tokopedia’s marketplace, generate cross-platform data intelligence. The ecosystem benefits not only users but also millions of MSMEs (micro-small-medium enterprises), supporting financial inclusion and national digital transformation.

3. Tesla: Cyber-Physical Integration

Tesla’s ecosystem spans electric vehicles, batteries, solar energy, and AI-powered autopilot. It demonstrates **vertical integration with digital intelligence**, where feedback from millions of cars enhances algorithms in real time. The strategy integrates *sustainability*, *innovation*, and *data monetization*.

4. Apple: Design-Driven Ecosystem

Apple’s success lies not merely in technology, but in harmonizing **design, user experience, and strategic control**. Its ecosystem—iPhone, iCloud, App Store, and developers—operates as an interconnected organism. Apple’s strategic orchestration ensures both *customer loyalty* and *partner profitability*.

5. Smart City Bandung: Public–Private–Citizen Ecosystem

Bandung, Indonesia, has pioneered **smart city governance**, integrating IoT-based traffic management, citizen participation apps, and data dashboards. The collaboration among government agencies, startups,

and universities represents the local adaptation of smart ecosystems for urban innovation.

VII. Governance, Ethics, and Sustainability in Smart Ecosystems

1. Governance Models

Ecosystem governance determines how decisions are made, data are shared, and benefits are distributed. Key governance archetypes include:

- **Orchestrated Model (Platform-Leader):** One central entity sets rules (e.g., Apple).
- **Collaborative Model:** Decision-making is distributed across partners (e.g., open-source ecosystems).
- **Hybrid Model:** Combines centralized direction with decentralized innovation.

Governance mechanisms—contracts, APIs, or blockchain smart contracts—ensure fairness and accountability.

2. Ethical AI and Data Responsibility

The integration of AI introduces moral complexities: bias, privacy, and algorithmic opacity. Ethical frameworks (such as OECD AI Principles) emphasize **transparency, accountability, and human oversight**.

A *Smart Ecosystem Ethics Charter* should include:

1. Data fairness and inclusivity;
2. Algorithmic explainability;
3. Informed consent and data sovereignty;
4. Human oversight in automated decisions.

3. Sustainability and the Triple Bottom Line

Smart ecosystems should not only optimize profit but also *enhance people and planet*. The **Triple Bottom Line (3P)** framework—Profit, People, Planet—guides strategy toward environmental and social responsibility.

For instance:

- Using AI for energy efficiency (Planet);
- Digital inclusion for rural entrepreneurs (People);
- New circular-economy business models (Profit).

4. ESG Integration

Investors increasingly evaluate ecosystems through **Environmental, Social, and Governance (ESG)** criteria. Smart ecosystems that align with ESG principles attract *sustainable capital* and public trust. Thus, ESG becomes not just compliance, but *strategic differentiation*.

VIII. Challenges and Risks

Despite their promise, smart ecosystems face multifaceted challenges:

1. Technological Risks

- Cyberattacks and data breaches;
- Dependence on proprietary platforms;
- Rapid obsolescence and interoperability issues.

2. Human and Organizational Risks

- Skill gaps and resistance to change;
- Digital fatigue and information overload;
- Ethical dilemmas in AI decision-making.

3. Strategic and Governance Risks

- Power asymmetry between large and small partners;
- Unclear value-sharing mechanisms;
- Regulation lagging behind innovation.

Effective risk management requires **adaptive governance**, **ethical leadership**, and **continuous capability renewal**.

IX. The Future of Smart Business Ecosystems

1. From Smart to Wise Ecosystems

The next frontier moves beyond *smartness*—defined by data and efficiency—toward **wisdom**, characterized by ethical, sustainable, and human-centered intelligence. The moral arc of ecosystems evolves:

Data → Intelligence → Strategy → Ethics → Wisdom.

2. AI-Driven Ecosystem Evolution

Emerging trends include:

- **AI-enabled predictive collaboration;**
- **Autonomous organizations (DAOs);**
- **Digital sustainability metrics (e.g., AI for ESG scoring);**
- **Quantum computing for ecosystem optimization.**

3. Inclusive and Global Ecosystems

Future ecosystems will be:

- **Inclusive:** Empowering MSMEs, local communities, and women entrepreneurs;
- **Global yet local (Glocal):** Adapting global technology to local culture and values;

- **Collaborative:** Shared value creation across public–private–civil domains.

X. Reflection and Discussion: Toward a Humanized Ecosystem Paradigm

The concept of Smart Business Ecosystems challenges traditional management paradigms. It calls for *rethinking competition as co-creation, leadership as orchestration, and strategy as adaptation.*

Philosophically, it invites reflection on the relationship between **technology and humanity**. As digital systems grow more autonomous, the question is not only “What can technology do?” but “What should it do?” The future belongs to organizations that combine **technological intelligence with moral imagination**.

A truly *smart* ecosystem is one that learns, evolves, and regenerates—where every node (human, digital, or institutional) contributes to the collective good. It embodies the shift:

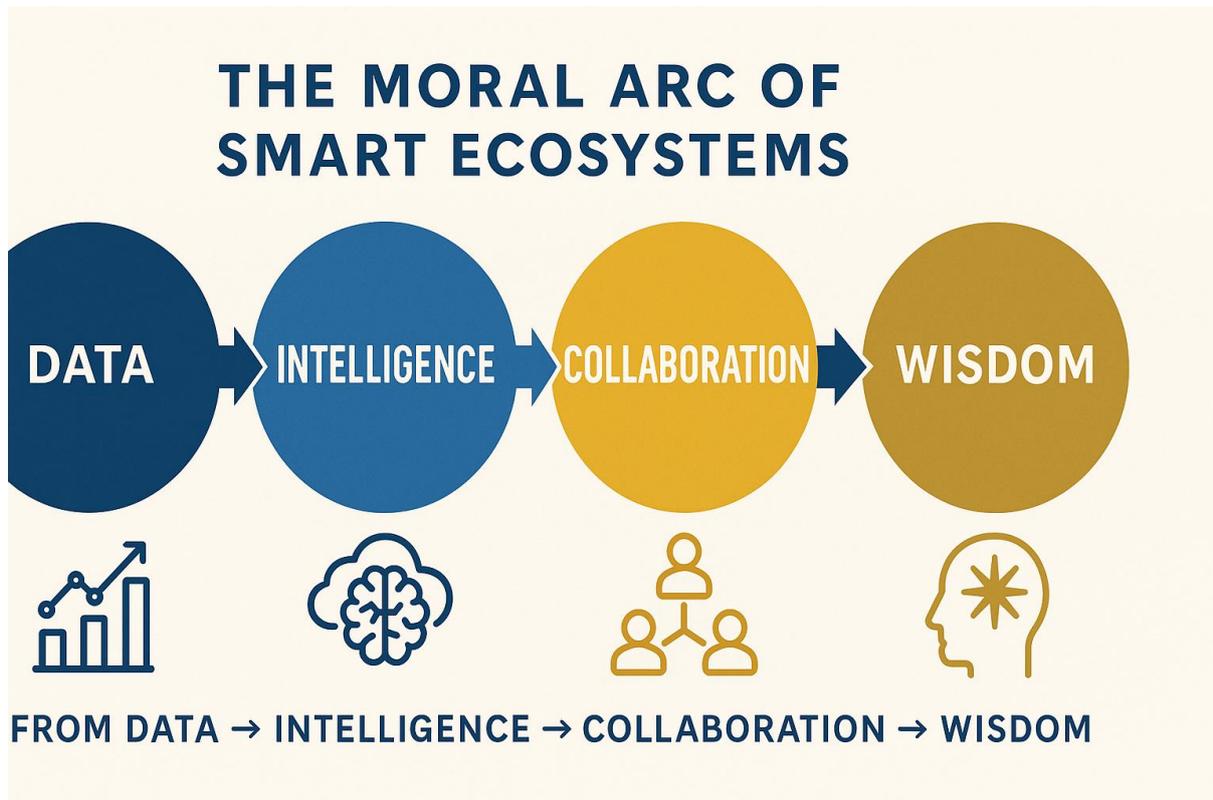
From control → collaboration

From efficiency → empathy

From growth → regeneration

From intelligence → wisdom.

In this sense, smart ecosystems represent the moral and strategic architecture of a new civilization—*a society that integrates technology, people, and strategy into a living, ethical, and sustainable whole.*



Reflection and Discussion

The concept of **Smart Business Ecosystems** invites us to rethink not only the structure of modern enterprises but also their moral and strategic orientation. When data, intelligence, collaboration, and wisdom form a continuum—as represented in *The Moral Arc of Smart Ecosystems*—we begin to see management as an **evolutionary process** of consciousness and connectivity rather than mere efficiency.

1. From Mechanistic Thinking to Systemic Wisdom

Traditional management systems often viewed organizations as machines: predictable, measurable, and controllable. However, smart ecosystems remind us that organizations are more like **living**

organisms—complex, adaptive, and interdependent. This shift from **mechanistic thinking** to **systemic wisdom** represents a profound transformation: decision-making becomes contextual, leadership becomes participatory, and growth becomes sustainable rather than exploitative.

In this ecosystem view, no single entity dominates. Each actor—supplier, customer, innovator, policymaker—contributes unique value. The moral and intellectual challenge for 21st-century leaders is to *orchestrate diversity into harmony* through a shared digital and ethical architecture.

2. The Moral Arc: From Data to Wisdom

The infographic visualizes a moral arc that moves from **Data** → **Intelligence** → **Collaboration** → **Wisdom**.

Each stage represents not only a technological function but a **moral and epistemological evolution**:

- **Data** symbolizes awareness—the raw perception of reality.
- **Intelligence** represents comprehension—turning signals into meaning.
- **Collaboration** denotes relationship—turning meaning into shared purpose.
- **Wisdom** embodies transformation—turning shared purpose into moral progress.

This arc suggests that *smartness without wisdom* risks becoming manipulation; *intelligence without collaboration* risks isolation; and *data without ethics* risks surveillance. Hence, a truly smart ecosystem is not just efficient—it is **enlightened**.

3. Human-Centered Digital Transformation

One of the central insights of this study is that technology alone cannot sustain innovation. Algorithms, cloud systems, and AI engines may process information, but it is **human imagination and ethical**

reasoning that give those processes purpose. When human dignity, creativity, and empathy are placed at the heart of digital design, ecosystems move from being *smart* to being *humane*.

As Japan's *Society 5.0* vision emphasizes, the goal is a society where digital technology solves social problems and enriches human life. Similarly, Indonesia's digital transformation roadmap (Bappenas, 2024) calls for synergy between **innovation, inclusion, and integrity**—a triad that perfectly mirrors the essence of smart ecosystems.

4. The Challenge of Leadership and Ethics

Smart ecosystems call for **Leadership 5.0**—leaders who integrate analytical precision with moral sensitivity. The new leader must think like a data scientist, act like a strategist, and feel like a humanist. Leadership thus becomes the art of balancing **efficiency with empathy**.

Ethically, the ecosystem must uphold **transparency, accountability, and fairness**. The governance of AI and data should follow not only compliance rules but **ethical reflection**—asking whether each decision contributes to collective well-being. The ecosystem is “smart” only when it aligns technological growth with the moral growth of society.

5. Toward Regenerative Strategy

A critical insight emerging from this reflection is that future business ecosystems must evolve from *sustainability* to *regeneration*.

Sustainability maintains equilibrium; regeneration **restores** and **enriches** the system. This principle applies to both the environment and the digital economy. Smart ecosystems should not merely minimize harm—they should **maximize human flourishing** and **planetary health**.

This regenerative vision aligns with the **Triple Bottom Line (People, Planet, Profit)**, expanded into a new paradigm:

Purpose, Partnership, and Progress.

Purpose gives direction, partnership creates synergy, and progress ensures continuity.

6. Implications for Education and Policy

For educators and policymakers, the emergence of smart ecosystems suggests the need for **interdisciplinary curricula** that blend management, data science, ethics, and human-centered design.

Universities must serve as **learning nodes** within national innovation ecosystems—collaborating with government, industry, and civil society to produce “wise technologists” and “ethical entrepreneurs.”

At the policy level, governments must cultivate regulatory frameworks that enable **open innovation** while safeguarding privacy and inclusivity. A healthy ecosystem requires not only competition but also **collaboration for the common good.**

7. Final Reflection: The Wisdom of Connection

The ultimate lesson of smart ecosystems is that connection itself is wisdom.

When data connects with insight, technology connects with empathy, and strategy connects with values, the result is not only business growth but **human progress.**

Smartness becomes wisdom when it serves life.

As we move deeper into the age of AI and digital transformation, this moral arc reminds us that the most advanced system is not the one that thinks the fastest—but the one that **cares the most.**

From data to wisdom, from intelligence to humanity — the journey of the smart ecosystem is the journey of civilization itself.

Glossary

Term	Definition
Smart Business Ecosystem (SBE)	A dynamic network of organizations, technologies, and people co-creating value through digital platforms, data integration, and collaborative intelligence.
Digital Transformation	The process of using digital technologies to create new—or modify existing—business processes, culture, and customer experiences to meet changing market requirements.
Artificial Intelligence (AI)	Computational systems that simulate human cognitive processes such as learning, reasoning, and problem-solving.
Internet of Things (IoT)	A network of interconnected physical devices equipped with sensors and software for data collection and exchange.
Big Data Analytics	Techniques for processing large and complex datasets to identify patterns, correlations, and insights for decision-making.
Platform Leadership	A strategy where a central firm orchestrates a digital platform enabling other firms to innovate and co-create value.
Dynamic Capabilities	The firm's ability to sense opportunities, seize them, and transform resources to maintain competitive advantage in changing environments.

Term	Definition
Cyber-Physical System (CPS)	Integration of computation, networking, and physical processes to enable real-time control and feedback.
Blockchain	A decentralized digital ledger that records transactions across many computers to ensure transparency and immutability.
Digital Twin	A virtual representation of a physical object, process, or system that allows simulation, analysis, and optimization.
Ecosystem Orchestration	The management of relationships, roles, and resources among multiple actors to ensure synergy and shared outcomes in a digital ecosystem.
Learning Organization	A company that facilitates continuous learning and transformation among its members (Peter Senge, 1990).
Quadruple Helix Model	An innovation framework involving interaction among government, academia, industry, and civil society.
Triple Bottom Line (3P)	A sustainability framework balancing Profit, People, and Planet dimensions of business performance.
ESG (Environmental, Social, and Governance)	Non-financial factors measuring the ethical and sustainable impact of businesses.

Term	Definition
Ethical AI	Artificial intelligence designed and deployed following principles of fairness, transparency, privacy, and accountability.
Regenerative Strategy	A business approach that not only sustains but restores and enriches ecosystems—social, economic, and environmental.
Society 5.0	A Japanese socio-economic vision emphasizing a human-centered society that balances economic advancement with solutions to social challenges through technology.
Leadership 5.0	A leadership paradigm combining digital intelligence with emotional, ethical, and spiritual dimensions to guide human-centered innovation.

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