

International Conference on Fourth Industrial Revolution (4IR) Technologies for Sustainable Development, organized by Department of International Cooperation of the Ministry of Science and Technology, People's Republic of China and the Asian and Pacific Centre for Transfer of Technology (APCTT), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), 22 July 2021, Guangzhou, China.

Leveraging open innovation knowledge flows for co-creation of 4.0IR technologies

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1. Key points

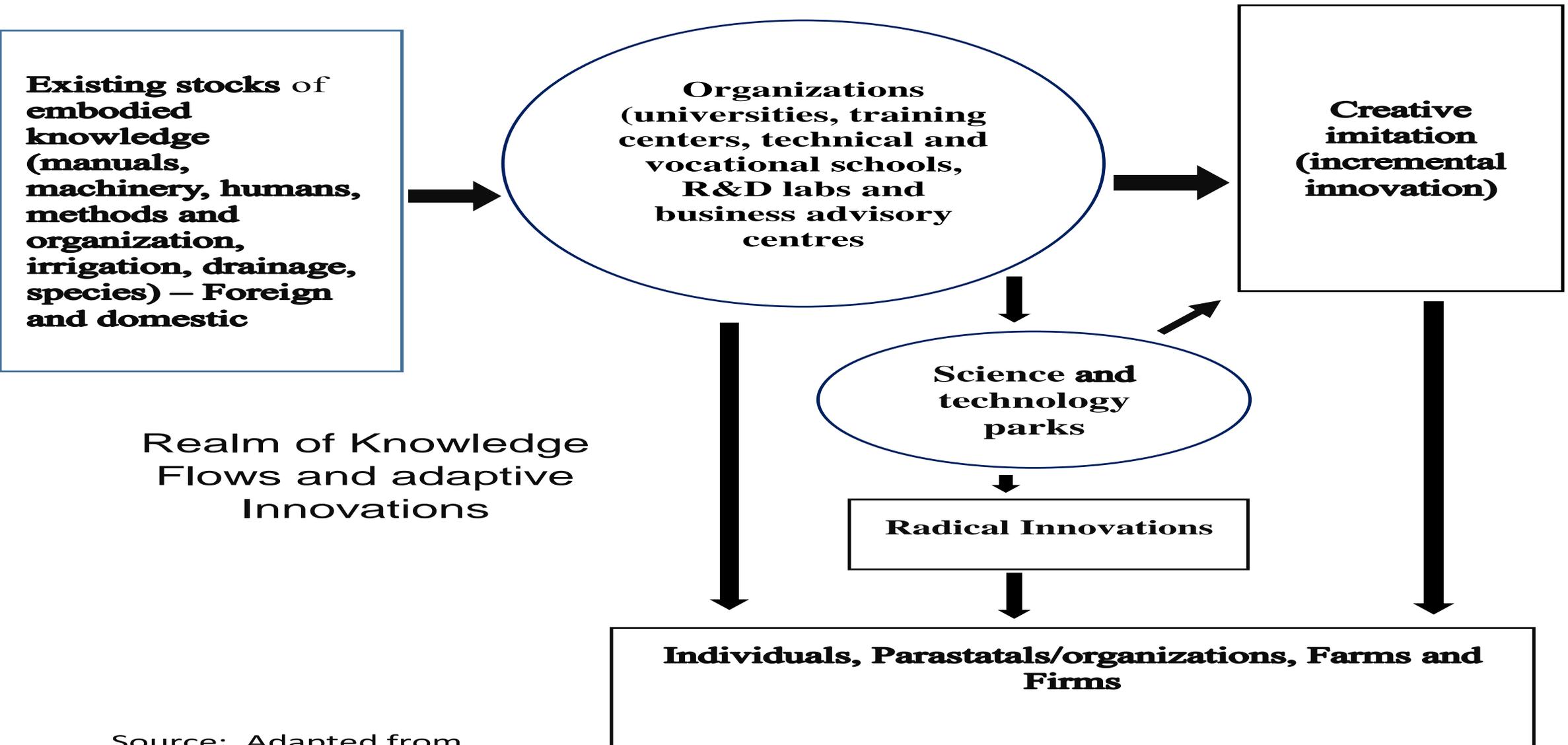
- The critical convergence of open innovation framework, Industry 4.0 technologies, sustainable development practices, and the ecosystem essential to drive intra-national and international economic and social synergies
- Transition from quadruple helix to absorb open innovation principles – distinction between private and public goods and services.
- Striking a balance between material progress, and public goods, and public utilities
- The role of intermediary organizations in the ecosystem to promote economic and social synergies - basic infrastructure, STI infrastructure, international integration, and connections and coordination between them and firms.
- Potential and promotion of R&D inclusive of IR4.0 technologies

2. Towards an Open Innovation Model

- Governance framework to stimulate economic upgrading (Figure 1)
- Institutions – formal and informal – blend of economic and social influences
- Incremental and radical innovations
- Adaptive learning and innovation
- Coevolution of technologies
- Latecomers and First movers
- The Quadruple Helix
- Governance of IPRs in Open Innovation Systems
 - Public goods (publicly held patents for societal benefit)
 - Public utilities (publicly regulated ownership to ensure supply clears needs rather than demand only)
 - Normal goods (privately governed patents but with safety and security measures)

Figure 1: Open System of Innovations

Institutional change driven by Monetary, Fiscal, and Technology policies

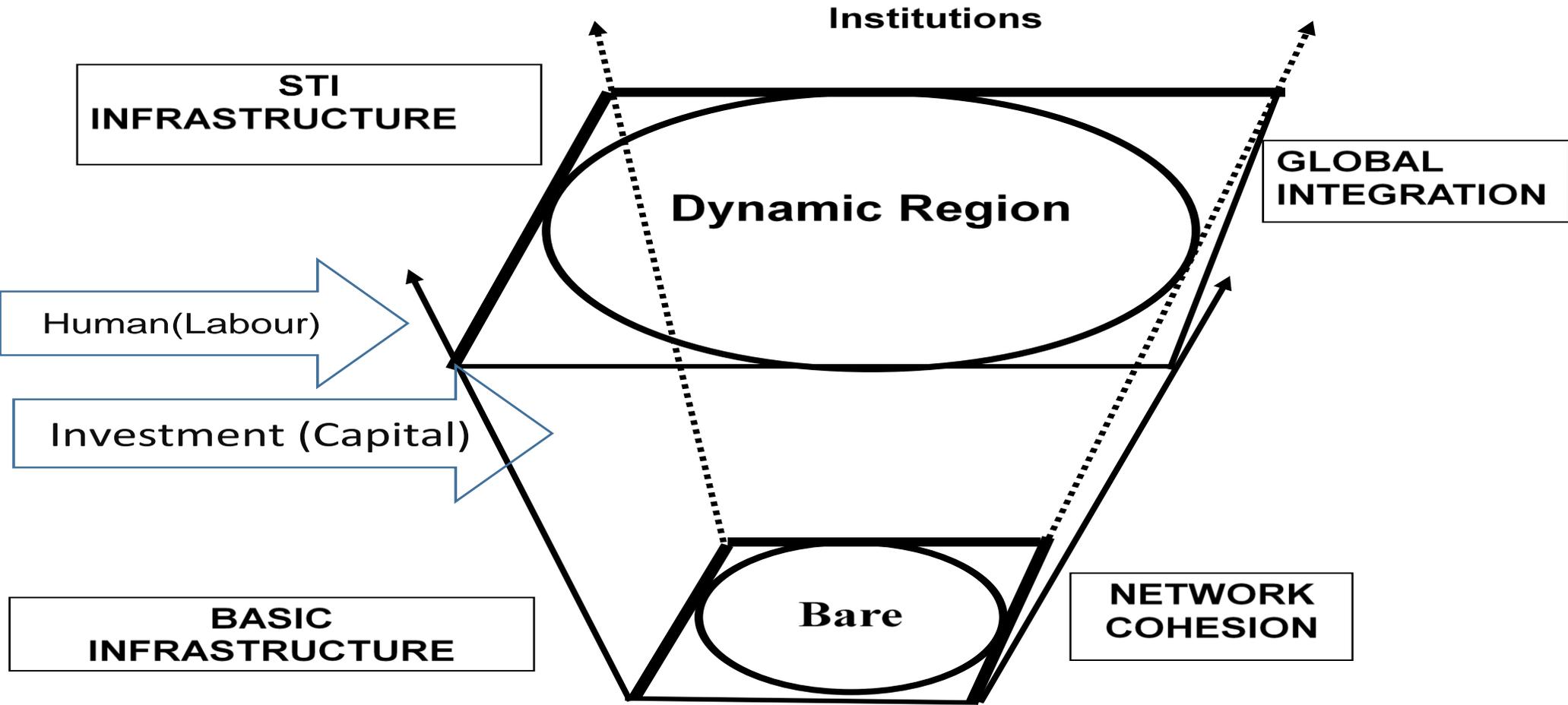


Source: Adapted from Rasiah (2007)

3. The Systemic Quad to Strengthen the Ecosystem

- The propellants of economic and social synergies in particular geographical spaces is best captured by focusing on the following four systemic pillars (Figure 2):
- **Basic infrastructure**
 - All essential services that constitute public utilities, such as transport, telecommunications, healthcare, basic education, power, and water.
- **STI infrastructure**
 - Infrastructure that produces public goods that are non-excludable and non-rivalrous, such as knowledge, environment, and security. The infrastructure involved for knowledge upgrading – embodied and disembodied – include science parks, incubators in them, research universities, testing centres, skills development centres, broadband infrastructure to support digitalization (and spread of IR4.0 technologies), and standards organizations
- **Network cohesion**
 - Connectivity and coordination between individuals, firms, and parastatals with each other and basic infrastructure, STI infrastructure, and global actors.
- **global integration**
 - Integration with global suppliers and buyers, knowledge networks, and logistic firms.,

Figure 2: The Systemic Quad

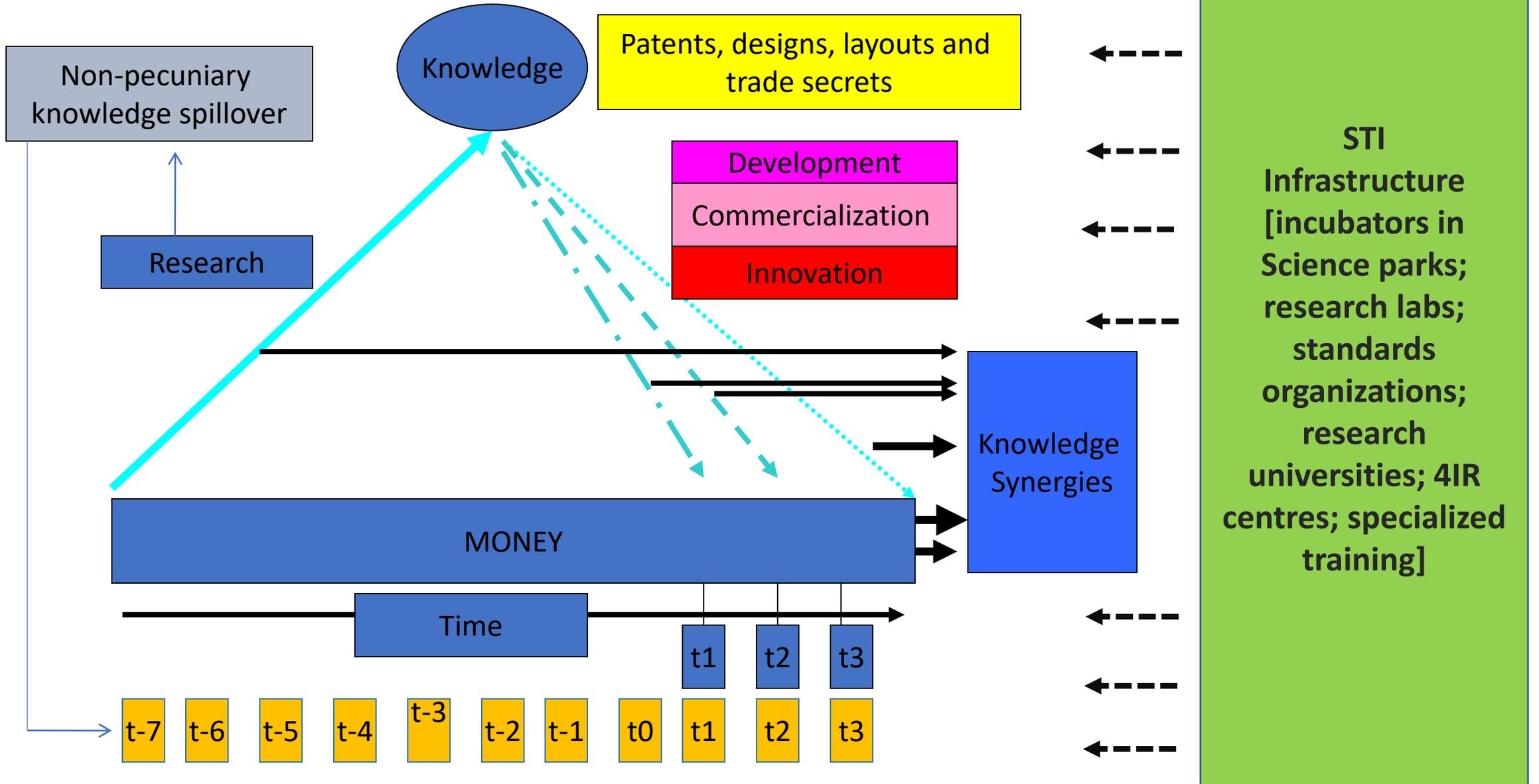


Source: Adapted from Rasiah (2007)

4. R&D Synergies and IR 4.0 Technologies

- Digital infrastructure and IR4.0 to synergize R&D and innovations (Figure 3)
- Artificial intelligence transferred to robots and drones to raise spread, speed, accuracy, and autonomous control through merging virtual reality and augmented reality.
- Critical infrastructure instruments required: digital infrastructure, internet of things, cloud computing, big data analytics, 3D printing, and blockchain technologies
- Inter-sectoral spread
 - Increased cross-migration of adapted technologies inter-sectorally
 - Inter-sectoral specializations
- Between mass production and mass-customization
 - Economies of scale and scope
 - Scale-based uniform specialization to scope-based customised specialization that is aggregated to provide the scale
- Smart schools and life-long learning
 - From directed to participative (inclusive) learning

Figure 3: Knowledge Synergies Associated with R&D



5. Concluding Points

- Having explained the material potential expected from the co-evolution of IR4.0 technologies and sustainability issues associated with striking a balance between technological upgrading, and the provision of public goods and utilities, we offer inter-country policy direction recommendations here to appropriate the social and economic synergies effectively.
- The role of intermediary organizations in the ecosystem to promote economic and social synergies - basic infrastructure, STI infrastructure, international integration, and connections and coordination between them and firms.
- Potential and promotion of R&D inclusive of IR4.0 technologies (coevolution) need emphasis on adaptive(incremental) innovations to absorb the transformation essential to usher in the takeover by IR4.0 technologies.
- The transition to a quadruple helix framework with the critical pillars of industry, university, government, and civil society but with the need to absorb open innovation principles – distinction between private and public goods and services.
- As is seen now with a mad scramble by the big pharma businesses and governments struggling to obtain COVID19 vaccines to vaccinate all members of society, it is pertinent that the United Nations (including the WHO) seek alternative funding to support public ownership of patents associated with essential goods and services, such as the COVID19 vaccines. As public utilities must reach all members of society, attempts to exclude them from the poor should be discouraged.
- Where R&D and innovations are involved (including patents and designs) the promotion of public goods and utilities must emphasize the open systems of innovation framework. Significant international collaboration existed on this before – e.g. jasmine rice from IRRI (Manila).