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Social engineering and design thinking for urban poverty alleviation in low-income communities

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ABSTRACT

This study examines how the integration of social engineering and design thinking can support sustainable livelihood development in urban low-income communities in Bangkok, Thailand. The research focuses on the Wat Sawaswareesrimaram community and applies a participatory action research (PAR) approach involving Rajabhat University students, community leaders, and local residents. A total of thirty participants, including low-income households, public health volunteers, and local entrepreneurs, collaborated to develop context-specific solutions to economic challenges. Several participatory tools—such as cause–effect analysis, the Life Cycle Clock, and the Modify–Improve–Create–Innovation (MICI) model—were used within a four-stage framework adapted from the Four Noble Truths and the design thinking process. Based on this process, the study proposes a nine-stage sustainable livelihood development model to support income-generating activities grounded in local context, co-creation, and cultural identity. An illustrative case highlights a single mother who transformed traditional Thai banana-leaf desserts into a sustainable home-based business, demonstrating the practical value of the model. The findings indicate that multidisciplinary, community-based learning can empower vulnerable groups, strengthen local leadership, and enhance long-term economic resilience. The study also suggests that academic institutions can play an important role in promoting inclusive development through the integration of teaching, research, and community engagement.

1. Introduction

Poverty and hunger remain among the most urgent challenges facing humanity, with over 700 million people still living in extreme poverty. Poverty is not a single, easily defined condition but a dynamic and complex set of circumstances. Poverty is described as poignantly and is not merely the absence of material goods, but the fear and dread of want. Thus, poverty is not merely a lack of income; it encompasses a wide range of economic and social dimensions, including limited access to essential services, restricted social networks, lack of voice and choice, reduced bargaining power, and diminished social status and opportunities (Cleaver, 2005).

People experience poverty when they are denied fundamental rights such as access to food, clean water, education, healthcare, protection, security, public participation, and freedom from discrimination. Therefore, poverty is a root cause of numerous human and labor rights violations, including child labor, forced labor, and human trafficking, issues that are closely tied to economic hardship (Adesina, 2014). Recognizing this, the eradication of poverty has been placed at the core of the Sustainable Development Goals (SDGs), particularly Goal 1: No Poverty.

In Thailand, poverty is officially defined as a condition in which individuals live below an acceptable standard of living, lacking sufficient income to meet basic needs such as food, clothing, and shelter (Hagenaars, 1991; Lister, 2021). It is commonly categorized into two main forms: absolute poverty, which refers to a condition in which individuals are unable to meet the minimum requirements for survival, and relative poverty, which is defined in relation to broader social standards. While absolute poverty can often be reduced through economic growth and technological advancement, relative poverty tends to persist as it reflects deeper structural inequalities and income

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disparities among different population groups. Even when individuals achieve a level of income sufficient to cover basic needs, they may still be considered relatively poor if their standard of living remains significantly below the societal norm.

An analysis of Thailand's poverty landscape shows a positive trend. In 2022, 3.79 million people were classified as poor, a number that dropped to 2.39 million in 2023. This decline is largely attributed to the continued growth of the agricultural sector, where poverty is most concentrated, and to increased registration for state welfare programs. Nevertheless, poor households tend to carry a heavier financial burden in supporting their members compared to non-poor households.

Educational attainment also plays a critical role, with individuals possessing lower levels of education being disproportionately affected by poverty (Milner, 2013). According to the Multidimensional Poverty Index, poor living conditions represent the most prevalent form of deprivation in Thailand, affecting 35.79% of individuals classified as poor (Fig. 1).

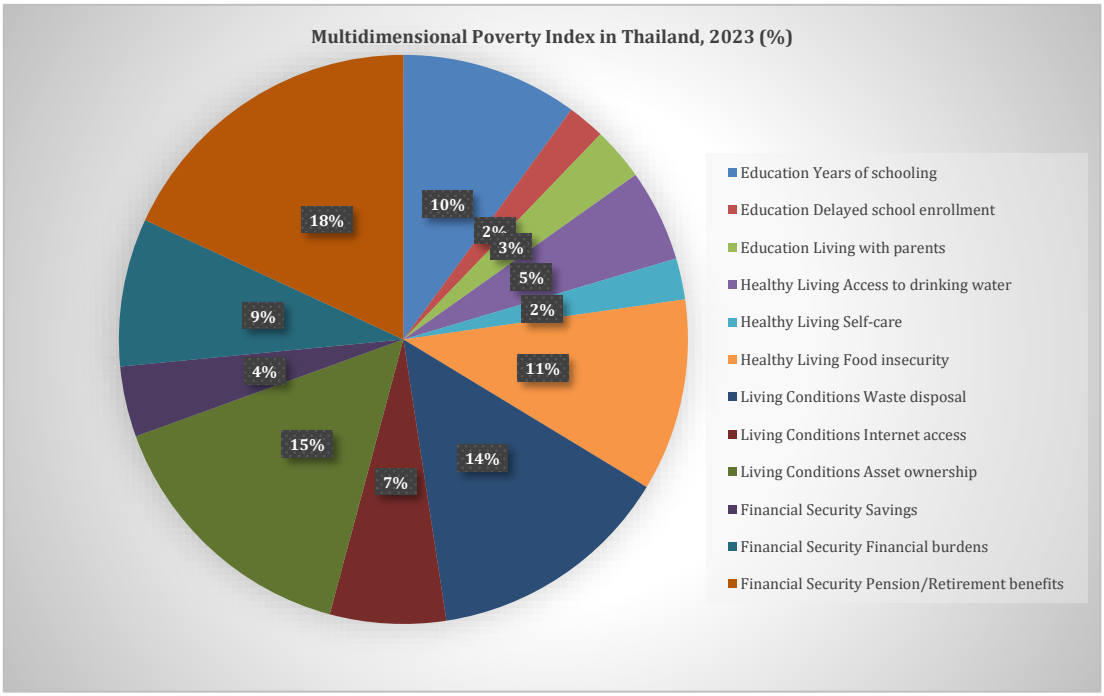

Fig. 1: Multidimensional poverty statistics in Thailand, 2023

Addressing poverty in Thailand is a critical national mission, one in which Rajabhat University students are expected to take an active role. As institutions of higher education dedicated to local development, Rajabhat Universities aim to strengthen national capacity by fostering lifelong learning, preserving local wisdom, promoting the arts, and contributing to sustainable prosperity. Their responsibilities also include managing natural resources and the environment sustainably, advancing professional knowledge, conducting research, providing academic services, transferring technology, and preserving arts and culture—all while producing qualified teachers and enhancing the academic profession.

In alignment with this mission, students across all 38 Rajabhat Universities nationwide have consistently explored new skills and approaches to tackle social challenges. However, a significant gap remained in specialized skill development tailored to student needs until the introduction of the Social Engineer concept in late 2019. This marked the first coordinated effort across all Rajabhat Universities to implement a unified student development model, resulting in the launch of the Social Engineer Project. This initiative transforms local communities into living classrooms by integrating student activities with formal coursework, aiming to cultivate essential soft skills for the 21st century. It shifts traditional pedagogy toward community-based, experiential learning focused on future skills.

The concept of social engineering has roots in earlier theoretical frameworks (Hadnagy, 2010; Torten et al., 2018). Roscoe Pound (1870–1964), a prominent American legal philosopher and pioneer of sociological jurisprudence, developed the Theory of Social Engineering, which offers a legal and political science perspective on human coexistence. According to this theory, society must balance the competing interests of three groups: (1) individual interests, (2) public interests, and (3) social interests. The role of law, in this view, is to reconcile these interests to ensure that individuals achieve a degree of satisfaction across diverse social contexts. The process of social engineering, therefore, aims to minimize conflict and promote social harmony by legally balancing these competing demands. The social engineering approach is defined as a multidisciplinary, active learning process that equips students with social engineering skills through

hands-on, cross-sector collaboration (Nandan and London, 2013; Wang and Horta, 2025). Rooted in community-based social labs, the model brings students together with faculty from various disciplines and local wisdom holders to co-create solutions to real-world, area-specific problems. Throughout this process, students play a central role in identifying and addressing local challenges, developing as critical thinkers, effective communicators, skilled collaborators, and innovative problem solvers.

The term social engineer generally refers to an individual equipped with key competencies such as observation, critical thinking, reflective listening, and relationship-building. These skills shape individuals into effective thinkers, communicators, coordinators, and innovators capable of addressing complex social challenges. A social engineer applies interdisciplinary knowledge and practical tools to drive human and community development, demonstrates strong communication and collaboration skills, and creates social innovations that respond to needs at the community, societal, and national levels.

Despite greater occupational diversity driven by urban economic growth, social and economic disparities persist (Kemeny, 2012). Urban communities now function mainly as residential hubs for working-age individuals, with younger generations often disengaged from local development due to limited financial incentives. Most residents follow fast-paced work routines, leaving early and returning late, while those remaining—primarily older adults, caregivers, and children—face limited opportunities. As living costs rise, relying solely on working-age earners has become increasingly unsustainable, especially given the lack of income-generating activities within the community. A community-based study in the Wat Sawaswareesrimaram area of Dusit District, Bangkok, revealed that rapid socio-geographic changes—driven by urbanization, shifting lifestyles, and structural transformations—have intensified social inequalities and complicated the challenges faced by both long-term residents and migrant workers.

To address these challenges, a holistic approach that integrates knowledge development with vocational advancement is essential. One key strategy involves the application of Design Thinking, a problem-solving process that comprises five stages: (1) Empathize—developing a deep understanding of the target group; (2) Define—clearly framing the problem; (3) Ideate—generating creative and context-specific solutions; (4) Prototype—developing and testing early models; and (5) Test—refining solutions based on real-world feedback. This approach encourages active community participation at every stage—from problem identification and analysis to planning, implementation, evaluation, and benefit-sharing. It promotes collaborative resource allocation, including time, space, and human capital, and emphasizes the co-creation of locally relevant, innovative solutions. The core research challenge lies in identifying income-generating opportunities for low-income residents that are aligned with their existing skills, local wisdom, and community assets, while fostering sustainable livelihoods and strengthening local identity.

Such solutions require a framework that not only enhances household income and quality of life but also revitalizes the local economy. This includes creating pathways for skill development and value addition, encouraging self-reliance guided by the principles of the Sufficiency Economy Philosophy—beginning with frugality, saving, and gradual growth as envisioned by His Majesty King Rama IX. These efforts must prioritize career advancement within the community, enabling vulnerable groups—such as welfare recipients, single mothers, and the unemployed—to earn income from home and support their families.

The central challenge remains: What kinds of careers or community-based enterprises can generate adequate supplementary income for low-income residents? Addressing this question requires a multidisciplinary approach that combines social engineering principles with design thinking methodologies. Collaboration with Rajabhat University students is vital in co-creating viable vocational models that align with both community needs and research objectives. This initiative exemplifies the holistic integration of academic research, teaching, and community engagement, ensuring that knowledge creation directly contributes to social transformation and inclusive development.

2. Literature review

The concept of social engineering first emerged in the early 1890s as a means to address structural irregularities in society. Its philosophical roots can be traced back to Aristotle, who linked design principles with governance, highlighting the role of statecraft in promoting the well-being of citizens through the fair distribution of resources (Reggiani, 2006).

The term social engineer was formally introduced by Dutch industrialist Jacques Van Marken (1845–1906), who argued that modern employers required the expertise of specialists—"social engineers"—to manage human and social challenges, just as technical engineers managed machinery and processes. By 1899, social engineering had appeared in American academic discourse and evolved into the broader concept of social service. Edwin L. Earp's 1911 publication The Social Engineer, associated with the Social Gospel movement, helped popularize the term in the United States. During this era, influenced by the "efficiency craze," social relationships were increasingly viewed as systems that could be designed and managed to drive societal progress (Östlund, 2007). Subsequently, a significant development came from Roscoe Pound (1870–

1964), a leading figure in sociological jurisprudence. Pound conceptualized law as a form of social engineering that balances competing interests—individual, public, and social—through the application of legal tools to minimize conflict and promote the greatest happiness in society (McManaman, 1958). His theory continues to influence legal and policy frameworks globally, including in India, where it is applied in areas such as environmental protection, consumer rights, labor rights, public health, and social welfare. Later on, philosopher Karl Popper advanced the concept of piecemeal social engineering in The Open Society and Its Enemies in 1945 (Popper, 2011), advocating for incremental democratic reforms that address society's most urgent problems, rather than pursuing utopian ideals.

In Thailand, the concept gained traction in late 2019 when all 38 Rajabhat Universities collectively adopted Social Engineering as a student development model. This initiative, known as the Social Engineer Project, transformed local communities into learning spaces where students integrated academic study with real-world experience. The project aimed to foster essential 21st-century soft skills through community-based, experiential learning environments. This approach aligns with the educational philosophy of His Majesty King Rama X, who emphasizes cultivating individuals with sound values, practical life skills, and responsible citizenship (Deenang et al., 2023).

The development of Rajabhat students as social engineers is grounded in three educational principles: Contemplative Education, Systematic Review (Mulrow et al., 1997; Cook, 1997), and Systems Thinking. A social engineer, therefore, is someone who applies multidisciplinary knowledge to create practical tools and methods for resolving social challenges—striving to maximize collective well-being, minimize conflict, and foster community harmony.

Design thinking is a human-centered approach to creative innovation that seeks to align technological capabilities and practical requirements with real human needs in order to drive business and social success. Unlike conventional business logic, design thinking encourages non-linear, intuitive reasoning—often described as "thinking outside the box"—which enables practitioners to break free from rigid, Cartesian logic and methodological skepticism. It emphasizes collaboration, experiential learning, and iterative problem-solving to ensure that products, services, or solutions are effectively aligned with user needs (Brown, 2008).

At its core, design thinking is grounded in hands-on practice and experimentation. It promotes learning through doing, often using Human-Centered Design (HCD) to cultivate empathy and creativity in addressing complex problems. The process involves systematic reasoning and tools such as mind mapping to deeply understand problems, define purpose and meaning, and integrate diverse fields of knowledge. This interdisciplinary approach helps innovators transcend traditional problem-solving frameworks and generate well-rounded, impactful solutions (Brown and Katz, 2011).

In practice, the methodology has been applied to various community development initiatives. For example, it was used in the creation of the urban community product Phayayor Green Oil in the Wat Pracharabuedham Community (Zones 1–4), Dusit District, Bangkok. This project followed the five-stage design thinking process developed by Stanford University (Pakarinen et al., 2023):

- Empathize: Gaining a deep, honest understanding of the target group's needs and context
- Define: Clearly articulating the core problem
- Ideate: Brainstorming a range of creative solutions
- Prototype: Building preliminary models or concepts
- Test: Evaluating the effectiveness of solutions through feedback and iteration

This iterative and participatory approach makes design thinking particularly relevant to complex social contexts, where diverse perspectives and continuous adaptation are key to sustainable innovation. Sustainable Development Goal 1 aims to end poverty in all its forms across the globe. The United Nations' Administrative Committee on Coordination (ACC) recognizes poverty as a global phenomenon affecting both developing and industrialized societies, and is increasingly present in transitional economies. Addressing poverty is essential for achieving sustainable peace and development. Poverty is fundamentally a denial of human dignity—marked by the lack of choices, opportunities, income, access to education and healthcare, secure employment, and inclusion. It also entails living in insecure, overcrowded environments with limited access to clean water and sanitation (Lombardo et al., 2025).

Urban poverty differs from rural poverty in complexity and demands targeted, household-level strategies. These include safety nets, asset-building opportunities, support for income generation, infrastructure provision, and legal environments conducive to economic participation (Rakodi, 1995). In general, urban poverty is shaped by multiple dimensions:

- Economic characteristics: insufficient income, food insecurity, unstable earnings, and excessive expenditures
- Debts and assets: chronic indebtedness, lack of collateral, and absence of land or household assets
- Occupation/personal traits: low education, lack of skills, unemployment, illness, or old age
- Household characteristics: large families, child-rearing burdens, or illness within the household
- Behavioral factors: consumerism, gambling, substance abuse, or social isolation

Perceptions of urban poverty differ across countries. In South Korea, urban poverty is seen as a

barrier to modernization, while in Thailand, it is associated with pollution, crime, and social problems. In the United States, studies on urban poverty began alongside industrialization and intensified by the 1930s. By the 1960s, the Great Society initiative focused on urban poverty, internal migration, family structures, and welfare dependency. In South Africa, urban poverty is more severe than rural poverty, and female-headed rural households are particularly vulnerable, while migrant-headed households tend to fare better (Serumaga-Zake and Naudé, 2002). In Malaysia, urbanization contributes to urban poverty, with human capital, household size, ethnicity, and region as key determinants.

In Thailand, urban poverty is evident in areas of Bangkok. For example, 70% of affected households report expenses exceeding income, 63% live in unstable housing, and 52% face unemployment (Boonjubun, 2019). About 25% of targeted individuals receive no welfare support. The urban poor are officially defined as individuals earning less than 100,000 Baht annually, or under 2,000 Baht per month. They often reside in slums or informal settlements, facing poor living conditions, inadequate welfare access, debt burdens, and risk of eviction. Urban poverty in Thailand can be classified into four groups:

- Income-based poor: those excluded from rights and services, vulnerable to eviction
- Original urban communities: traditional groups negatively affected by state or private development
- Migrant laborers: internal and international migrants, often informal workers
- Marginalized populations: those deprived of rights, recognition, and dignity

This classification reveals that poverty is not solely economic—it includes social and political exclusion, loss of rights, and disempowerment. Moreover, urban poverty can be transient, structural, or chronic. Sustainable poverty alleviation should be people-centered and environmentally responsible, enabling individuals to develop livelihoods and generate income. Later interpretations—such as those found in *Buddhadhamma* and the *Dictionary of Buddhist Terms*—expand the concept to include any occupation involving deceit, fraud, coercion, or harm to others. Similarly, the *Buddhist Monastic Code* emphasizes refraining from livelihoods that exploit or endanger others (Alkire and Foster, 2011).

In Thailand, the government has applied the concept of "right livelihood (*Sammā-ājīvo*)" in poverty alleviation initiatives, promoting occupations that do not harm people or the environment and ensure that income exceeds expenses. This approach shifts focus from subsistence toward ethical, socially just economic practices, prioritizing well-being over profit (Song, 2020). In this study, the Wat Sawaswareesrimaram community is recognized as an area affected by urban poverty, where low-income households experience overlapping forms of deprivation, including economic hardship, limited opportunities, social exclusion, and loss of dignity. The gap analysis requires an integrated approach to poverty alleviation and stakeholder engagement. According to community leaders, the past government project was repetitive and rudimentary, lacking in new concepts, methodology, and practical tools for career development and poverty alleviation. This situation leads to low motivation, cooperation, and participation from stakeholders. This study was motivated by a clear need for knowledge, skills, and strategies for alleviating poverty in educational institutions, with the goal of providing innovative methodologies, vocational development tools, and participatory ways to alleviate the urban poverty problem.

The study pathway design integrates social engineering tools, problem tree, and methods to systematically identify community gaps and problems. This technique is linked to design thinking concepts in the systematic analysis of data, presenting a coherent and systematic path for logical development and transformation. It is conceptualized based on the model of development, theory of change (Funnell and Rogers, 2011; De Silva et al., 2014), and the logic model (Kritsonis, 2005), as shown in Fig. 2.

3. Methodology

This study employed a participatory action research (PAR) design over six months in the Wat Sawaswareesrimaram community, located in Dusit District, Bangkok. The research aimed to co-develop sustainable livelihood strategies with low-income urban residents through the integration of social engineering and design thinking, informed by Buddhist development principles and experiential learning models. Ethical approval was granted by the Suan Sunandha Rajabhat University Ethics Committee (Code: COE.2-030/2023).

3.1. Research participants

The core research group comprised 30 participants, including low-income residents, elderly caregivers, public health volunteers, local entrepreneurs, and a long-standing community leader. An additional 20 stakeholders—such as district officers, temple and school representatives, and student volunteers—were involved during specific phases of the project, particularly in planning and reflection activities. Eight low-income households were selected for deeper engagement based on their existing informal occupations, willingness to participate, and potential for livelihood development. One household, led by a single mother producing traditional Thai banana-leaf desserts, was chosen as a model case for in-depth action research due to her high level of motivation, available workspace, and consistent daily routine.

3.2. Student preparation and community entry

Ten Rajabhat University students from various disciplines—including social development, humanities, and applied sciences—participated in the project. Prior to fieldwork, they completed a five-day training workshop focused on developing core competencies in analytical thinking, communication, innovation, and coordination. The training introduced five participatory tools central to the project's methodology: the Cause-Effect Analysis ("Faprathan"), the Life Cycle Clock (daily time-use analysis), History Timeline, Action Timeline, and the Modify–Improve–Create–Innovation (MICI) Model. These tools were later applied in collaboration with community members. Entry into the field was facilitated by the community leader, who served as a mentor and ensured cultural sensitivity, trust-building, and smooth coordination.

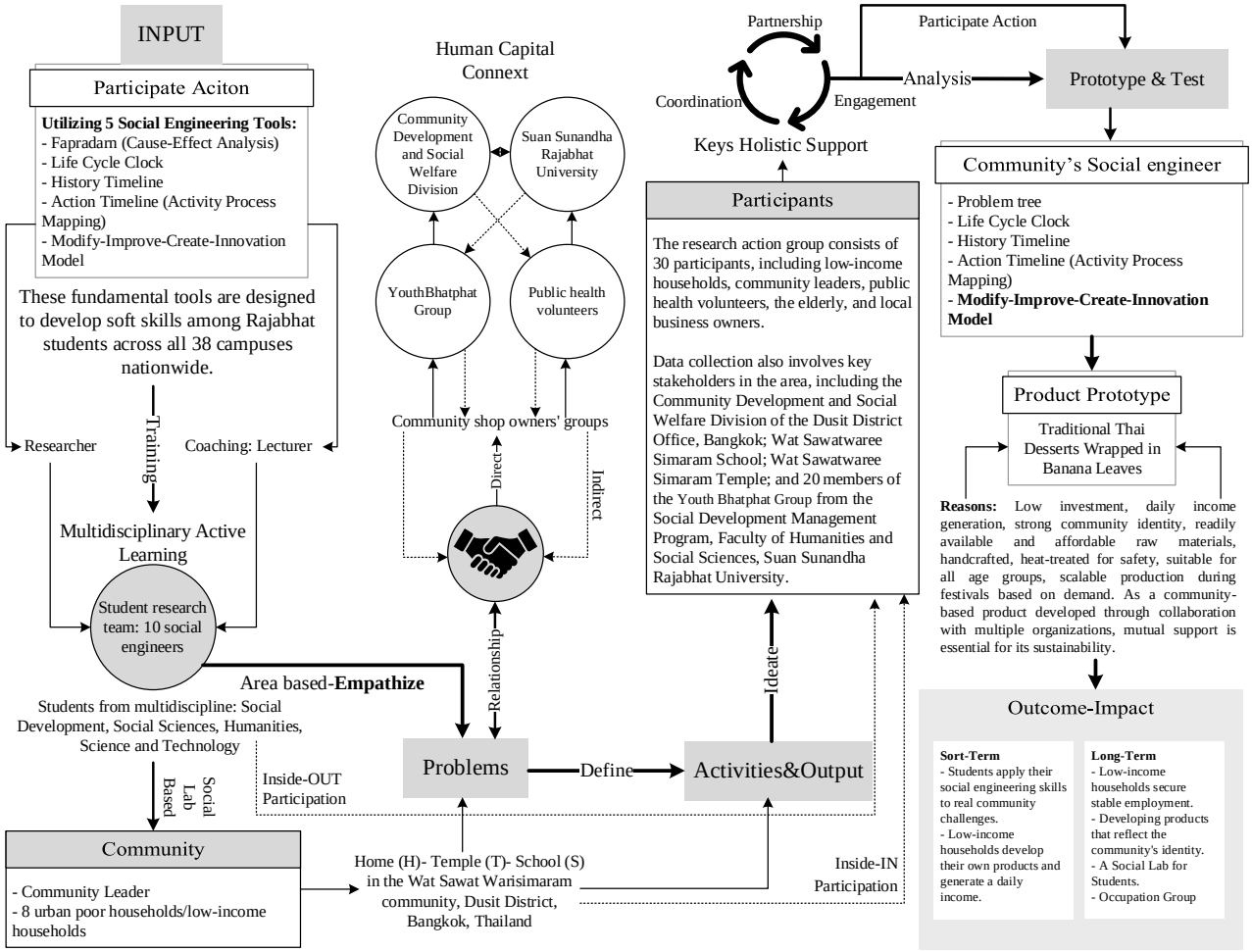

Fig. 2: Study pathway design in an urban community

3.3. Research Framework Synthesis

The study was guided by an integrated conceptual framework combining four main approaches: the Four Noble Truths of Buddhism (Dukkha, Samudaya, Magga, Nirodha). The five stages of Design Thinking (Empathize, Define, Ideate, Prototype, Test), the "Understand–Access–Develop" principle derived from King Rama IX's development philosophy, and community-based research (CBR). These frameworks were synthesized into a four-stage research process (Fig. 3).

Step 1: *Dukkha* ("Suffering") corresponds to Empathize in Design Thinking. Field exploration, interviews, surveys, and focus groups were conducted to identify community needs, strengths, and resources.

Step 2: *Samudaya* ("Cause of Suffering") corresponds to Define. Root causes of problems were analyzed using tools such as the Problem Tree.

Step 3: *Magga* ("Path") includes Ideate and Prototype stages. Community members and researchers co-developed solutions, products, and career models.

Step 4: *Nirodha* ("Cessation") aligns with the Test stage, where prototypes were implemented and evaluated for real-world impact.

In the first stage, corresponding to Dukkha and Empathize, researchers and students engaged with the community through field visits, informal interviews, surveys, and participatory mapping to gain a deep understanding of daily life, challenges, and community dynamics. The second stage, aligned with Samudaya and Define, focused on identifying the root causes of poverty and vulnerability using

participatory tools such as the Problem Tree and issue-based discussions. The third stage, Magga, integrated the Ideate and Prototype phases of Design Thinking, during which students and participants co-created solutions through skill-building workshops and collaborative planning. The final stage, Nirodha and Test, involved implementing selected livelihood prototypes and evaluating their feasibility, cultural relevance, and economic impact within the community.

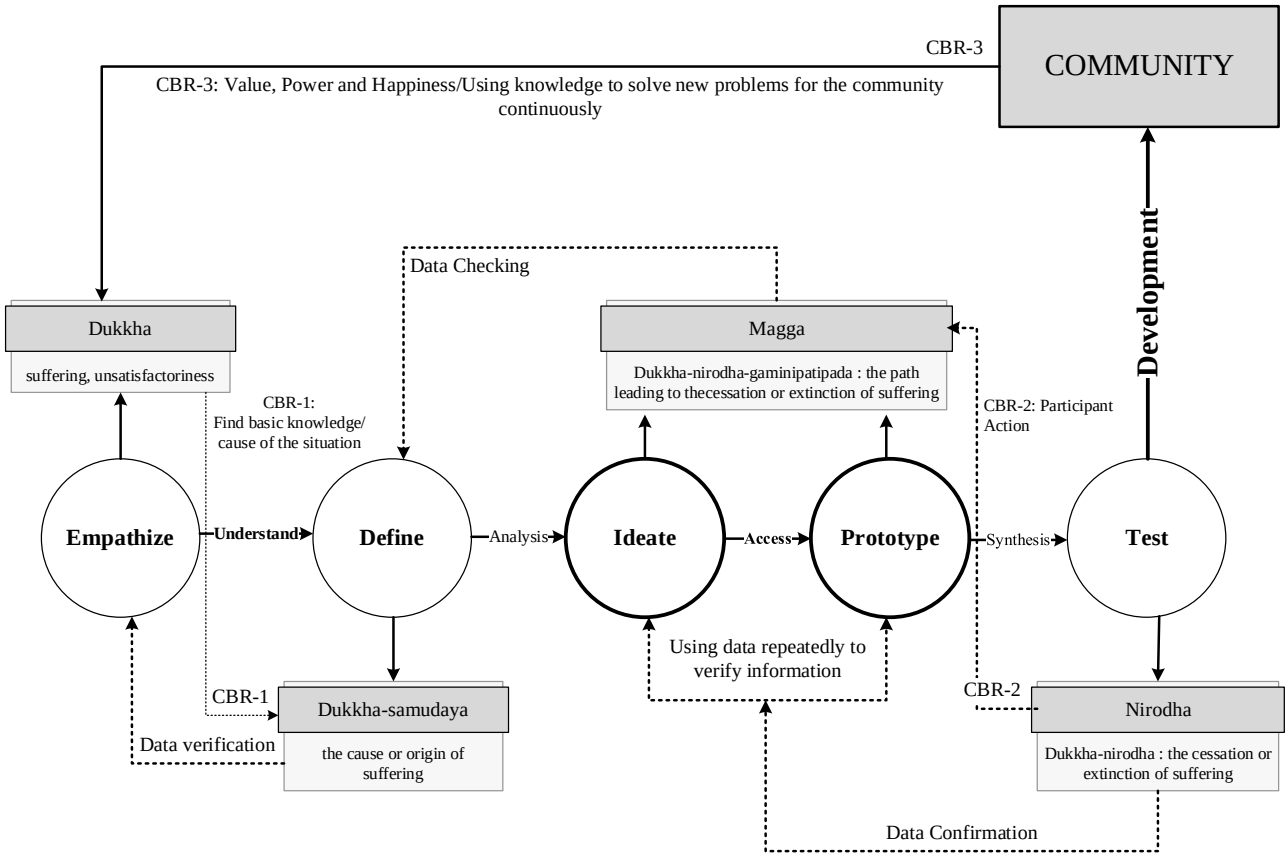

Fig. 3: Integrating SE, DT, CBR, and the four noble truths of Buddhism research framework synthesis

This model allowed the research to operate simultaneously on analytical, cultural, and ethical dimensions, creating an iterative, human-centered process grounded in Thai socio-spiritual contexts.

3.4. Data collection

Data collection combined qualitative, participatory, and visual methods. Semi-structured interviews were conducted with elderly residents, informal workers, and caregivers to explore perceptions of poverty and work. Focus group discussions brought together community members, student researchers, and local officials to co-diagnose challenges and identify opportunities for livelihood development. Community mapping exercises, time-use diaries, and daily activity logs were used to generate a holistic view of household routines and work patterns.

Eight workshops were conducted with participating households to explore and develop viable products and services. These included the production of traditional Thai sweets wrapped in banana leaves, chili paste, herbal drinks, fermented sausages, tailored garments from scrap fabrics, crocheted crafts, ceremonial flowers, and herbal balm. During these workshops, students also facilitated the integration of branding, packaging, and storytelling, drawing from both local wisdom and academic knowledge.

Throughout the project, participant observation, reflective journaling, and visual documentation (e.g., photos, process diagrams) were used to capture changes in behavior, engagement, and learning. A model household was selected for a more detailed case study, with a particular focus on time-use analysis and prototype product development.

3.5. Data analysis

The analysis combined descriptive, interpretive, and participatory techniques. Content analysis was used to code field notes, transcripts, and student reflections, revealing key themes such as motivation, leadership, barriers to work, and informal learning. The Life Cycle Clock helped identify productive windows during the day when households could engage in supplementary income activities without disrupting caregiving or other responsibilities.

The Problem Tree tool enabled the visualization of interconnected community challenges such as debt, housing insecurity, and limited vocational skills. The MICI Model was applied to assess how product designs evolved through cycles of

modification and feedback. Historical and Action Timelines traced the development of products and identified value-adding innovations. After-Action Reviews (AARs) were conducted at each stage of the project, offering opportunities for participants and students to reflect critically on the process, adapt strategies, and build capacity for future development.

Triangulation was achieved by comparing insights from multiple sources—student observations, community feedback, and visual materials—ensuring that conclusions reflected both lived experiences and academic perspectives.

4. Results

This study focused on alleviating poverty among low-income households in the Wat Sawaswareesrimaram community, Dusit District, Bangkok, particularly those near Suan Sunandha Rajabhat University. The research combined participatory tools, design thinking, and student-led engagement to co-create sustainable, culturally grounded livelihood strategies. The findings are organized into five parts: (1) community capital, (2) community issues and needs, (3) social engineering in action, (4) analysis of the *Nine-Stage Livelihood Development Process* using the ToC, and (5) the model of livelihood that alleviates poverty.

4.1. Community capital

The Wat Sawaswareesrimaram community has a rich history dating back 193 years to 1832 (B.E. 2375), during the reign of King Rama III, when a temple was first established in what was then a forested area abundant with Kae trees. Situated along the Samsen Canal near the royal precincts, the temple—originally named Wat Sawaswareesrimaram—was founded by royal petition of Phraya Sawaswaree (Chim), a nobleman engaged in maritime trade and timber taxation. Locals later referred to the temple as Wat Kae, reflecting the area's natural vegetation.

Historically, the settlement was located on the northern bend of the Samsen Canal, a major transport route since the Ayutthaya period. In 1904 (B.E. 2447), King Chulalongkorn (Rama V) granted land in the area to Chao Khun Chom Manda Phae—also known as Chao Khun Phra Prayurawong (Phae Bunnag)—his first royal consort. This marked the first royal land grant along the canal and led to the construction of the Suan Suphan Palace.

The community began with around 10 households as migrants from other provinces settled on vacant land near the temple. As more land was allocated for rent, the settlement expanded.

During the *empathize* phase of data collection, Rajabhat University social engineering students found that the community now comprises 386 households with a total population of 538 people. Most residents work as daily wage laborers, earning between 5,000 and 10,000 THB per month. The community follows an "HTS" (House–Temple–School) model, with residential areas, religious institutions, and educational facilities coexisting in close proximity.

4.2. Community issues and needs

Initial fieldwork by Rajabhat University social engineering students involved walking surveys, interviews, and time-use observations. These revealed that vulnerable groups—particularly homemakers, elderly residents, and caregivers—faced significant barriers to employment. While many were willing to earn supplementary income, they preferred home-based work due to childcare and mobility constraints.

The most pressing issues included economic instability, low civic engagement, and limited local leadership. Vocational training opportunities were sparse, and debt from informal loans placed many households under chronic financial stress. Leadership roles in the community remained vacant or unrewarded, weakening development efforts. In addition, social vulnerabilities—such as youth drug use—were linked to relaxed cannabis regulations and a lack of positive engagement opportunities.

The structural challenges were exacerbated by the community's rental arrangement with the Crown Property Bureau, which increased household financial burdens. High housing density also created vulnerabilities to hazards such as fire and disease transmission. These issues, discussed in interviews and focus groups, pointed to the urgent need for localized, sustainable income generation models.

To analyze these issues systematically, the research team facilitated a Problem Tree Analysis during a participatory workshop with students, community leaders, low-income residents, and local officers. Together, they identified the core problem: persistent poverty and income insecurity among low-income households. Fig. 4 illustrates the full Problem Tree with root causes, central problem, and negative outcomes.

4.3. Social engineering in action

To address the community's economic challenges and deepen student learning, the research team implemented a participatory process grounded in social engineering and design thinking. Ten Rajabhat University students from social development, humanities, and applied sciences disciplines participated in a five-day preparatory workshop before entering the field. They were trained to use four core participatory tools: Cause-Effect Analysis, the Life Cycle Clock, History and Action Timelines, and the MICI Model (Modify–Improve–Create–Innovation). These tools aligned with a broader research framework combining the Buddhist principles of *Dukkha, Samudaya, Magga, and Nirodha* with the five stages of design thinking.

Working closely with eight households engaged in informal occupations—such as tailoring, food

preparation, herbal remedies, and ceremonial crafts—students applied these tools to analyze daily routines, map income opportunities, and identify skill gaps. The Life Cycle Clock was particularly useful in identifying time slots during which caregivers and elderly residents could engage in supplementary work. A 15-day time-use analysis revealed patterns that enabled customized production planning for each household.

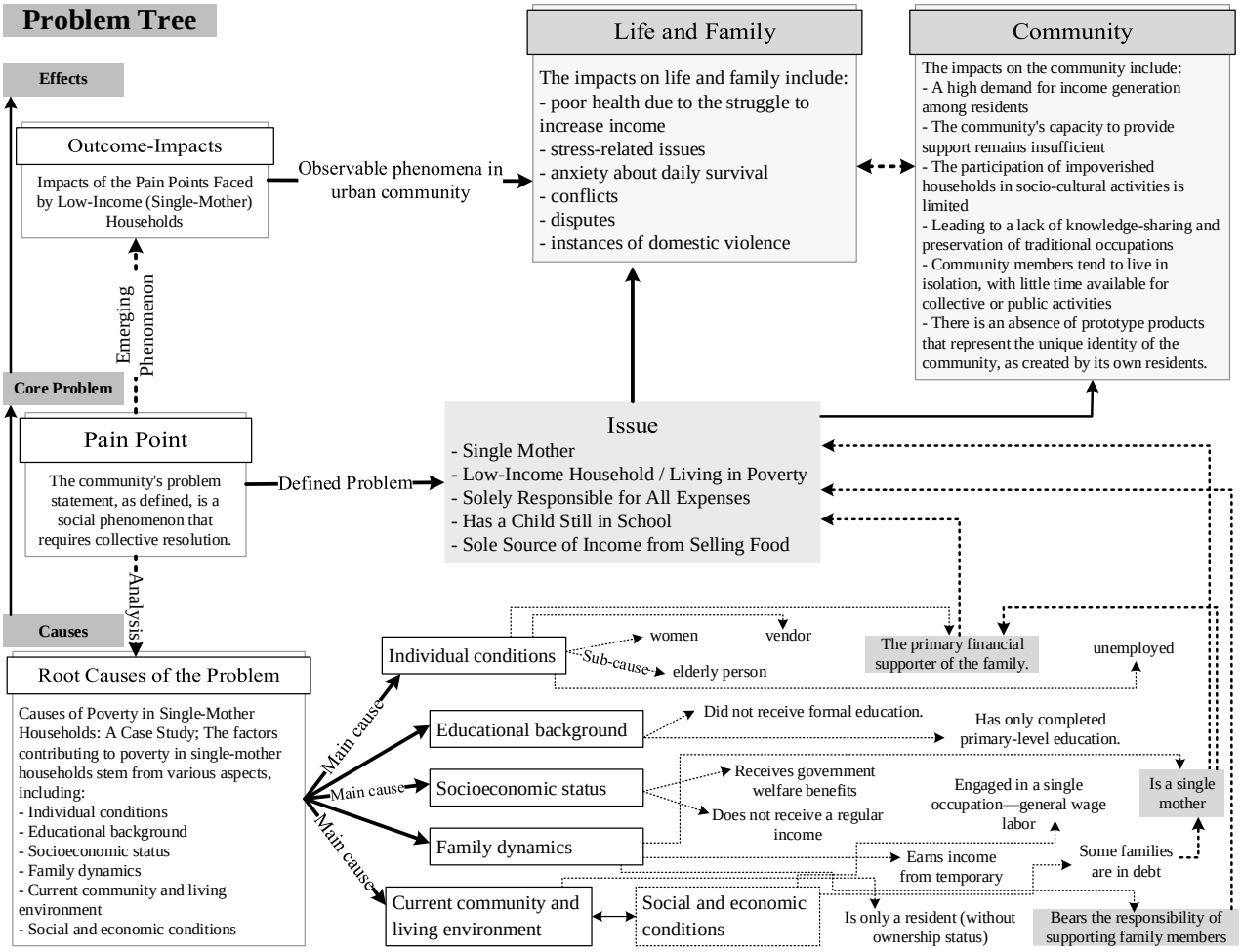

Fig. 4: Urban community problem tree analysis

From this field engagement, a Nine-Stage Sustainable Livelihood Development Model emerged, synthesizing empirical insights into a structured approach for grassroots economic development. This model, developed collaboratively through student-community interaction, provides a roadmap from issue identification to long-term self-reliance. The model consists of the following steps.

Step 1-Understanding and Identifying Community Issues: Through empathetic dialogue and participatory workshops, researchers and participants collaboratively uncovered the root causes of poverty, generating problem trees and shared development goals.

Step 2-Surveying People and Assessing Skills: A baseline understanding of economic constraints, skills, and household conditions was developed through surveys and interviews. Skills mapping was used to match residents with potential livelihood strategies suited to their routines and constraints.

Step 3-Engaging and Empowering Community Leaders: Recognizing the trust placed in local leadership, the model emphasizes training and empowering leaders as agents of change who can coordinate learning, facilitate group action, and bridge academia with practice.

Step 4-Building a Collaborative Work Team: Student researchers, residents, and community leaders co-formed working groups that conducted participatory analysis, prototyping, and testing, ensuring broad inclusion and shared ownership.

Step 5-Integrating the Three Knowledge Rings: The model draws on a triad of knowledge: academic expertise from universities, indigenous knowledge from the community, and practical skills from professionals and entrepreneurs. This integration grounded solutions in both evidence and tradition.

Step 6-Co-creating Community-Based Innovations: Ideas were translated into tangible innovations—improved products, packaging designs, branding strategies, and simplified business models. These reflected both local feasibility and cultural heritage.

Step 7-Applying Innovations in Practice: Innovations were piloted in real-world conditions by households, with students monitoring production, feedback, and financial tracking. This allowed for real-time adaptation and validation.

Step 8-Scaling and Extracting Lessons Learned: Prototypes showing strong economic potential were showcased through exhibitions and shared with other communities. Reflections were documented through After-Action Reviews and collaborative debriefings.

Step 9-Fostering Long-Term Sustainability: Final efforts focused on empowering families to sustain and transfer their livelihood innovations. Knowledge was institutionalized through visual documentation, skill-sharing sessions, and integration into community structures.

By combining design thinking with Buddhist development principles and participatory social engineering, this model offers a holistic, replicable approach for tackling urban poverty. It also served as a transformative learning platform for students, allowing them to apply their academic knowledge in the service of real-world, community-based development.

4.4. Analysis of the nine-stage livelihood development process using the theory of change

The Theory of Change (ToC) framework offers a structured way to link inputs, activities, outputs, outcomes, and long-term goals. This analysis applies ToC principles to the Nine-Stage Livelihood Development Process to clarify how sustainable community development can be achieved. The process aims to build long-term impact by fostering economic self-reliance, knowledge transfer, and innovation, while strengthening local capacity through structured livelihood programs. To reach this goal, several key outcomes, or preconditions, must be achieved. These correspond to the nine stages, each contributing to skill-building, innovation, and resilience. Table 1 outlines these intermediate outcomes. Each stage also involves specific activities that generate measurable outputs, such as community workshops, training sessions, and product development. These are summarized in Table 2. The approach assumes active community participation, committed leadership, access to basic resources, and adaptability to change. Risks include limited engagement, resource constraints, or policy gaps. These assumptions are detailed in Table 3. Progress is tracked through key performance indicators (KPIs) for each stage, such as the number of trained participants, new products, or household income increases, shown in Table 4.

Table 1: Key intermediate outcomes (pre-conditions)

Stage	Process	Intermediate outcome
1	Understanding & identifying issues	Community members recognize real problems and co-design precise solutions
2	Surveying people & assessing skills	Identification of local talents, expertise, and economic constraints to match with suitable livelihood opportunities
3	Engaging & empowering leaders	Community leaders actively drive research, education, and development projects
4	Building a Collaborative Team	Formation of research teams that integrate academic and community knowledge for in-depth problem analysis
5	Integrating knowledge ("three knowledge rings")	Combination of academic, indigenous, and modern knowledge to create structured learning and research-based development models
6	Community-based innovation & development	Concrete solutions and innovations emerge, tailored to local capacities and needs
7	Applying innovations	Implementation and economic validation through community-based enterprises
8	Scaling & extracting lessons learned	Expansion of successful innovations and continuous improvement through knowledge-sharing
9	Sustainable development	Community members achieve self-sufficiency, ensuring long-term sustainability

Table 2: Activities and outputs of the nine stages

Stage	Activities	Outputs
1	Conduct community surveys, stakeholder interviews, and participatory workshops	Clear identification of community problems and needs
2	Household surveys, skill assessments, and collaboration with local leaders	Database of community demographics, skills, and economic constraints
3	Leadership training, community engagement programs.	Active participation of community leaders in the project.
4	Research team formation, collaboration workshops	Functional teams conducting field research and development
5	Integrating academic, traditional, and modern knowledge through workshops and hands-on training	Curriculum and training modules tailored for the community
6	Innovation co-creation, prototyping, and pilot testing	Locally adapted products, services, and processes
7	Market testing, financial literacy training, and micro-enterprise creation	Community-based businesses generating income
8	Knowledge-sharing forums, case study documentation, scaling strategies	Expanded adoption of successful models and continuous learning.
9	Mentorship programs, policy advocacy, and institutionalization of best practices	Self-reliant communities with sustainable economic activities

By applying the ToC model, the nine-stage process becomes a clear roadmap from local action to long-term impact. Its success depends on continuous community engagement, integration of academic and local knowledge, and practical innovation—all supported by ongoing monitoring and reflection.

Table 3: Critical assumptions

Assumption	Potential risks & mitigation strategies
Community members are willing to participate and co-design solutions	Lack of engagement → Use trust-building strategies via community leaders
Local leaders are supportive and capable of driving initiatives	Resistance to change → Provide leadership training and incentives
Knowledge integration leads to applicable innovations	Gaps between academia and community knowledge → Promote co-creation processes
The market is receptive to community-developed products	Market barriers → Conduct market research and provide business training.
Community enterprises can sustain themselves	Lack of financial literacy → Implement financial management education

Table 4: Key indicators

Stage	Key indicators
1	% of community members participating in issue identification
2	% of population assessed for skills and economic needs
3	Number of trained leaders involved in development activities
4	Number of active research teams formed
5	Number of knowledge-sharing sessions conducted
6	Number of community-driven innovations developed
7	% of innovations successfully implemented and generating income
8	Number of new communities adopting the model
9	Long-term sustainability metrics (e.g., self-sufficiency rate, household income growth)

4.5. The model of livelihood that alleviates poverty

To illustrate the practical applicability and effectiveness of the Nine-Stage Sustainable Livelihood Development Model, this study presents the detailed case of a single mother involved in traditional Thai dessert production in Wat Sawaswareesrimaram.

The selected model case was a 54-year-old single mother who prepared traditional Thai banana-leaf desserts *(Khao Tom Mat and Khanom Tian)* and supported her family with a modest income of 4,000 THB per month. Her house, located along a busy footpath, provided a suitable location for product display and direct sales.

The Life Cycle Clock showed that she consistently followed a structured routine: waking early, preparing ingredients in the morning, and wrapping and steaming desserts by noon, leaving afternoons free for sales and family responsibilities. Her dedication and openness to learning made her an ideal partner for innovation.

Through the History Timeline, the research team traced the lineage of her dessert-making skills to her mother-in-law, "Mae Chai," who passed down the craft through hands-on experience. The dessert's signature recipe—*Khao Niew Moon*—was previously featured in the *Daily News* as a "Recommended Delicacy" and had generated enough income for Mae Chai to buy land, build homes, and fund her children's education.

The research team rebranded this heritage as "Mae Chai's Khao Niew Moon Legacy," combining cultural storytelling with product development. Students introduced packaging design, branding elements, and cost analysis. The Action Timeline detailed ten production steps—from ingredient preparation to steaming and wrapping—while the MICI Model supported modifications to improve packaging and marketing.

Financial analysis revealed a strong cost-to-profit ratio. With a 10,000 THB investment, the product could generate a total revenue of 20,000 THB with a net profit of 10,000 THB, making it a viable model for home-based economic resilience.

This banana dessert enterprise exemplifies not only local innovation but also the principle of Right Livelihood *(Sammā-ājīvo)*, as it reflects non-harming, self-sufficiency, and the continuation of cultural wisdom.

Figs. 5–7 document the Life Cycle Clock, historical lineage of dessert production, and step-by-step production timeline.

The importance of the model is demonstrated by its ability to analyze qualitative data combined with social engineering tools and design thinking methods through a participatory process involving stakeholders in poverty alleviation in the form of a social lab. However, its limitations include its ability to alleviate poverty at the individual level and its lack of capacity to alleviate structural poverty in the long term.

5. Discussion

This study explored how Rajabhat University social engineering students use social engineering tools and design thinking to address urban poverty. The meaning is that educational institutions must be accountable to society, applying knowledge and methodological tools to engage students in issue-solving and societal development. This is achieved through the methodical transfer of a body of knowledge, which leads to practical solutions to challenging situations in urban populations. The mechanisms for social development and problem-solving must be based on integrated knowledge, research, teaching, and community engagement, as well as local wisdom, all within the context of the *Nine Stages of Transformation* paradigm. When compared to the development plans of government agencies responsible for community development and social welfare, it is observed that problem-solving approaches continue to use outdated methods and tools, as well as a lack of integrated new knowledge, innovation, and study methods. In addition, when it comes to problem-solving and

solution-building, they prioritize agency performance indicators over effective and long-term public outcomes. What factors contribute to their success? Several key findings emerged.

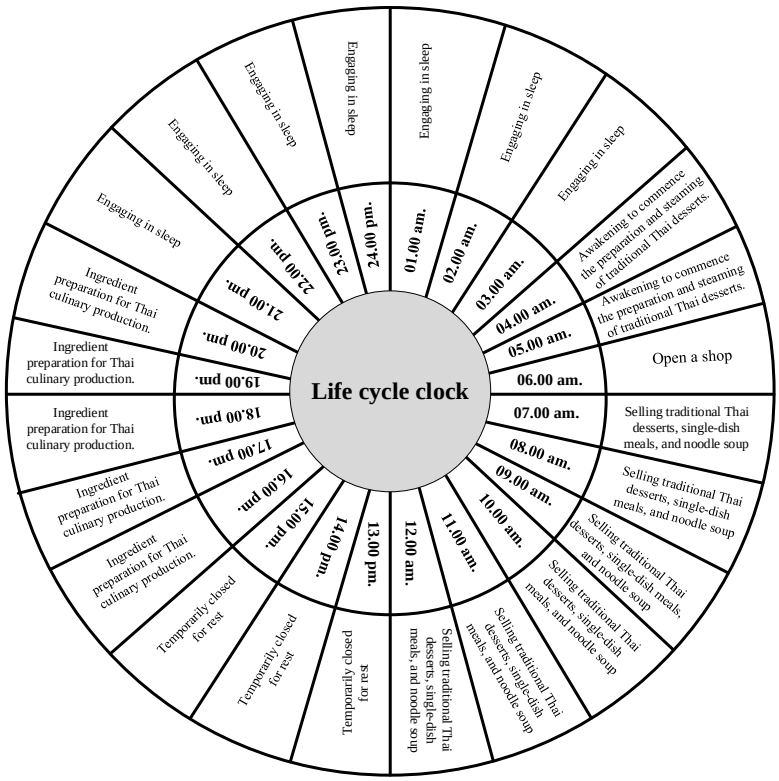

Fig. 5: Life cycle clock

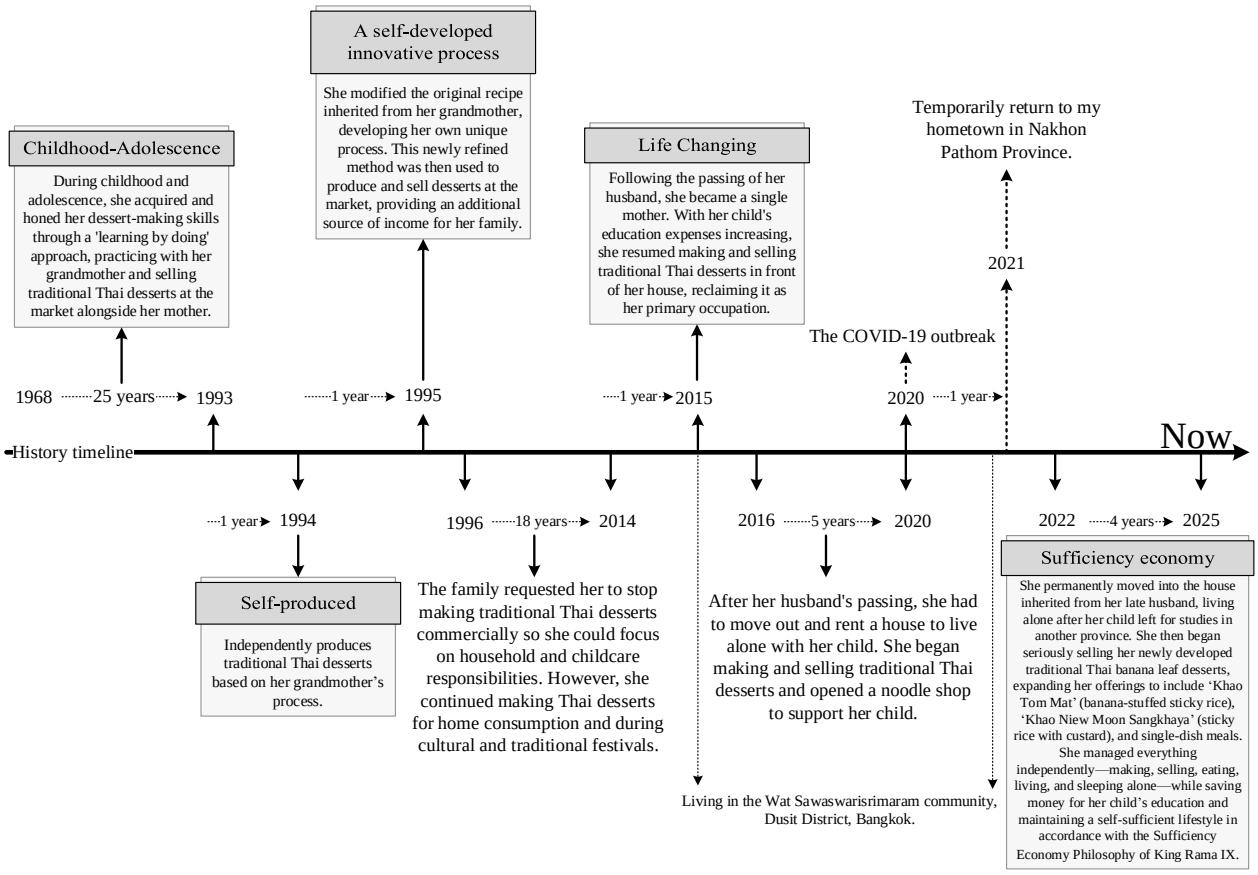

Fig. 6: Historical timeline of traditional Thai banana leaf desserts

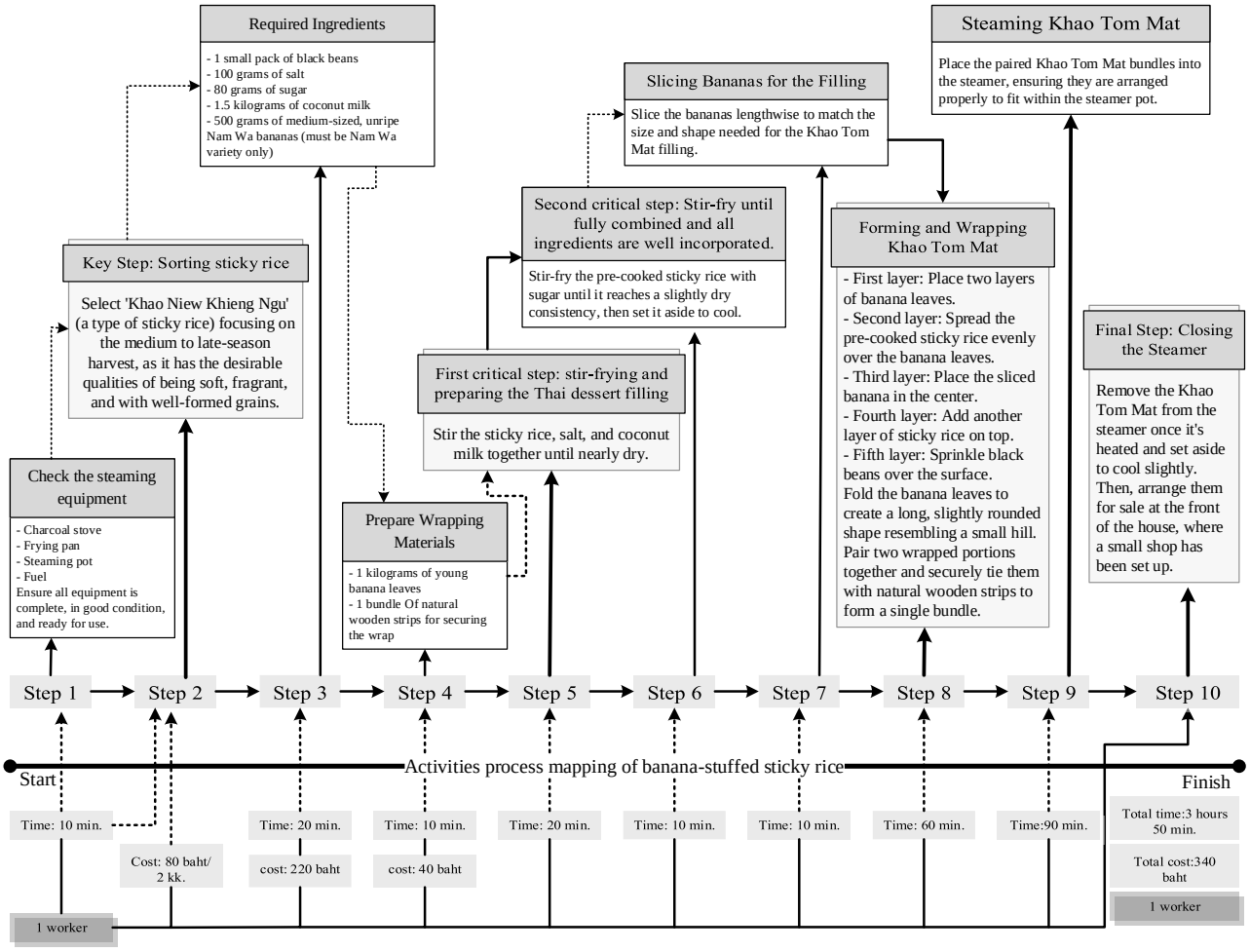

Fig. 7: Production process of banana-stuffed sticky rice

First, Rajabhat students developed their skills through hands-on, multidisciplinary learning. They engaged directly with communities to analyze real-world problems and extract insights from lived experiences. The process emphasized rational and empirical thinking, consistent with the logic of "if this exists, then that must exist," and aligned with the principles of active learning and area-based problem-solving.

Second, tackling poverty required immersive engagement in the community. Students accessed on-the-ground data to understand root causes of hardship, following King Rama IX's development principle of "Understand, Access, and Develop", which parallels the "Empathize" phase in design thinking. In the Wat Sawaswareesrimaram community, the most affected groups were women, middle-aged adults, and elderly residents. Many elderly individuals contributed to social work without receiving adequate financial support. Their shared goal was to earn supplementary income. Students addressed this by applying the Life Cycle Clock to design context-appropriate, income-generating strategies.

Third, root cause analysis was conducted through participatory "community power," involving students, local leaders, entrepreneurs, and welfare officers. The Cause-Effect Analysis tool was used to define and analyze problems collaboratively. This method reflects the Buddhist concept of *Samudaya*, the origin of suffering, and aligns with the "Define" stage of design thinking. Tools like the Problem Tree helped map challenges and identify actionable solutions. Community leaders, with their deep contextual knowledge, played a vital role in identifying needs and proposing relevant responses.

Fourth, the innovation process required full community engagement in co-developing solutions. This stage corresponds to *Magga*, the path toward ending suffering, and the "Ideate" phase in design thinking. Local wisdom and academic knowledge were combined to generate new ideas, followed by prototype development of products and activities that addressed real needs. The integration of teaching, research, and academic services ensured the credibility of solutions. Tools like the History Timeline and Action Timeline were used for structured planning and mapping sustainable interventions.

From this process, the study synthesized the Nine-Stage Sustainable Livelihood Development Model, which emerged directly from field experiences with eight households. The model offers a practical, replicable framework for designing inclusive and culturally grounded income-generation strategies. It begins with identifying issues and mapping community skills, then moves through collaborative innovation and testing, and concludes with long-term sustainability and self-reliance. Each stage reflects the values of co-creation, self-

sufficiency, and knowledge integration—drawing on academic, traditional, and experiential learning. Each stage of the Nine-Stage Model is designed to support livelihoods that are not only economically viable but also socially responsible and spiritually grounded, aligning with the principles of Right Livelihood in Buddhist ethics.

Fifth, testing and implementation were achieved through on-site application and mentoring. The case of the Thai banana-leaf dessert entrepreneur exemplifies this. Her case highlighted the importance of product identity, cultural storytelling, and cost-effective production. Students worked alongside her to develop packaging, branding, and financial tracking systems, enabling her to establish a sustainable home-based business. Her product, rooted in personal heritage and community tradition, was economically viable and symbolically powerful. These outcomes align with the "Prototype" and "Test" phases in design thinking, and reflect the Buddhist principle of *Nirodha*—cessation or the achievement of relief from suffering.

Participatory action research methods underpin this integration, focusing on real-world problem-solving and stakeholder collaboration. Community leaders, researchers, and students work together to ensure that research addresses genuine grassroots concerns. This tripartite approach—teaching, research, and service—functions as a dynamic, self-reinforcing system for sustainable development. Engaging students as external facilitators within the processes that motivate successful participatory research is regarded as a significant challenge and success factor. It is an important paradigm shift that positions students as knowledge workers capable of applying knowledge in professional contexts. Through structured learning and practice, students develop the competencies required to actively contribute to societal development and to assume heightened social accountability as individuals with advanced knowledge relative to local communities. The mechanisms supporting student-led participatory research have been widely accepted and positively embraced by community stakeholders.

Finally, the study highlighted the value of scaling and knowledge transfer. By expanding successful models and promoting peer learning, communities can build long-term self-reliance. Once external facilitators withdraw, families and communities are equipped to sustain themselves. This model supports sufficiency economy principles, which emphasize resilience through balance between people, community, and environment.

6. Conclusion

This study examined how participatory methods, combined with social engineering and design thinking frameworks, can contribute to urban poverty alleviation in the Wat Sawaswareesrimaram community of Bangkok. By engaging Rajabhat University students, community leaders, and local residents in a collaborative process, the research led to the co-creation of sustainable livelihood strategies rooted in real-life experiences, cultural identity, and practical needs.

The findings show that participatory action research, when combined with social engineering techniques and a design thinking approach, can provide an effective framework for alleviating the root causes of poverty in community contexts. Solving poverty at the grassroots level not only strengthens communities but also helps develop national development mechanisms. The collaborative process involving students, community leaders, community members, and officials allows for the creation of a scalable social laboratory model for poverty alleviation, which can be developed and applied to various community settings in future development efforts.

A key outcome of this process was the development of the Nine-Stage Sustainable Livelihood Development Model, which emerged directly from fieldwork. This model outlines a clear pathway from problem identification to long-term economic self-reliance, emphasizing participatory planning, leadership engagement, knowledge integration, innovation, and sustainability. It reflects a culturally grounded and replicable approach to poverty reduction in urban low-income contexts. The model also embodies the Buddhist principles of development—*Dukkha, Samudaya, Magga,* and *Nirodha*—while aligning with the design thinking process of *Empathize, Define, Ideate, Prototype,* and *Test*.

The case of the single mother producing banana-leaf desserts illustrates how this model can work in practice. Her success was enabled by the integration of traditional skills, structured time-use planning, cost-benefit analysis, and branding support. The result was a viable home-based enterprise that generated income while reinforcing cultural identity and self-confidence. Her story demonstrates how the Nine-Stage Model can adapt to the unique constraints and strengths of individuals, and how Rajabhat University students can serve as catalysts for localized development.

At the institutional level, the study reinforces the role of universities—particularly Rajabhat institutions—in integrating *teaching, research,* and *academic services*. Students applied classroom theories in the field and gained real-world problem-solving experience while contributing to sustainable community outcomes. This tripartite model of engagement aligns with the university's mission and reflects the sufficiency economy philosophy promoted in national development discourse.

However, the study also acknowledges limitations. Its scope was limited to a single community, and its success depended heavily on local leadership, participant motivation, and the presence of external facilitators. While the model is adaptable, scaling it to other settings would require context-sensitive adjustments, additional institutional support, and mechanisms for long-term

follow-up. Further research should test the model in diverse communities, explore longitudinal outcomes, and investigate how digital tools or social enterprise networks can expand access to broader markets. A concrete pathway must be taken by building a research and development team of interdisciplinary practitioners to solve challenges holistically. This team should brainstorm and design models that represent a pathway to addressing the root causes of complex problems, beginning with research and development focused on resolving issues within a dynamic social ecosystem that includes individuals, families, communities, organizations, and national policies.

In conclusion, this study affirms that true poverty alleviation involves more than income—it requires dignified, ethical, and community-rooted livelihoods. By promoting right livelihood, development becomes not only a technical intervention but a moral and cultural practice. This study thus contributes both a practical livelihood model and a participatory methodology that may guide future efforts in urban poverty alleviation. When local voices are heard, leadership is nurtured, and knowledge is co-created, sustainable change becomes not only possible—but rooted in the community itself.

List of abbreviations

AARs	After-action reviews
ACC	Administrative committee on coordination
B.E.	Buddhist era
CBR	Community-based research
DT	Design thinking
HCD	Human-centered design
HTS	House–temple–school
KPIs	Key performance indicators
MICI	Modify–improve–create–innovation
PAR	Participatory action research
SDG	Sustainable development goal
SE	Social engineering
THB	Thai Baht
ToC	Theory of change

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Compliance with ethical standards

Ethical considerations

This study was approved by the Ethics Committee of Suan Sunandha Rajabhat University (Approval Code: COE.2-030/2023). All participants voluntarily participated in the study and provided informed consent prior to data collection. Participants were informed of the study objectives, their right to withdraw at any time, and the confidentiality of their responses. Personal information was anonymized to protect participant privacy.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Adesina OS (2014). Modern day slavery: Poverty and child trafficking in Nigeria. African Identities, 12(2): 165-179. https://doi.org/10.1080/14725843.2014.881278

Alkire S and Foster J (2011). Counting and multidimensional poverty measurement. Journal of Public Economics, 95(7-8): 476-487. https://doi.org/10.1016/j.jpubeco.2010.11.006 **PMCid:PMC5511308**

Boonjubun C (2019). Also the urban poor live in gated communities: A Bangkok case study. Social Sciences, 8(7): 219. https://doi.org/10.3390/socsci8070219

Brown T (2008). Design thinking. Harvard Business Review, 86(6): 84–92.

Brown T and Katz B (2011). Change by design. Journal of Product Innovation Management, 28(3): 381-383. https://doi.org/10.1111/j.1540-5885.2011.00806.x

Cleaver F (2005). The inequality of social capital and the reproduction of chronic poverty. World Development, 33(6): 893-906. https://doi.org/10.1016/j.worlddev.2004.09.015

Cook DJ, Mulrow CD, and Haynes RB (1997). Systematic reviews: Synthesis of best evidence for clinical decisions. Annals of Internal Medicine, 126(5): 376-380. https://doi.org/10.7326/0003-4819-126-5-199703010-00006 **PMid:9054282**

De Silva MJ, Breuer E, Lee L, Asher L, Chowdhary N, Lund C, and Patel V (2014). Theory of change: A theory-driven approach to enhance the Medical Research Council's framework for complex interventions. Trials, 15: 267. https://doi.org/10.1186/1745-6215-15-267 **PMid:24996765 PMCid:PMC4227087**

Deenang E, Thanyasunthornsakun K, and Paisan T (2023). A development of social engineer skills indicators for students' Udon Thani Rajabhat University. Interdisciplinary Academic and Research Journal, 3(4): 371-388.

Funnell SC and Rogers PJ (2011). Purposeful program theory: Effective use of theories of change and logic models. John Wiley & Sons, San Francisco, USA.

Hadnagy C (2010). Social engineering: The art of human hacking. John Wiley & Sons, Indianapolis, USA.

Hagenaars AJM (1991). The definition and measurement of poverty. In: Osberg L (Ed.), Economic inequality and poverty: 134-156. 1st Edition, Routledge, New York, USA.

Kemeny T (2012). Cultural diversity, institutions, and urban economic performance. Environment and Planning A: Economy and Space, 44(9): 2134-2152. https://doi.org/10.1068/a44385

Kritsonis A (2005). Comparison of change theories. International Journal of Scholarly Academic Intellectual Diversity, 8(1): 1-7.

Lister R (2021). Poverty. 2nd Edition, John Wiley & Sons, Cambridge, UK.

Lombardo R, Durand JF, Camminatiello I, and Cuccurullo C (2025). Exploring poverty and SDG indicators in Italy: An identity spline approach to partial least squares regression. Econometrics, 13(4): 50. https://doi.org/10.3390/econometrics13040050

McManaman LJ (1958). Social engineering: The legal philosophy of Roscoe Pound. St. John's Law Review, 33: 1.

Milner HR (2013). Analyzing poverty, learning, and teaching through a critical race theory lens. Review of Research in Education, 37(1): 1-53. https://doi.org/10.3102/0091732X12459720

Mulrow CD, Cook DJ, and Davidoff F (1997). Systematic reviews: Critical links in the great chain of evidence. Annals of Internal Medicine, 126(5): 389-391. https://doi.org/10.7326/0003-4819-126-5-199703010-00008 **PMid:9054284**

Nandan M and London M (2013). Interdisciplinary professional education: Training college students for collaborative social change. Education + Training, 55(8-9): 815–835. https://doi.org/10.1108/ET-06-2013-0078

Östlund D (2007). A knower and friend of human beings, not machines: The business career of the terminology of social engineering, 1894-1910. Ideas in History, 2(2): 43-82.

Pakarinen A, Lemström T, Rainio E, and Siirala E (2023). Design thinking in healthcare: From problem to innovative solutions. Springer, Cham, Switzerland. https://doi.org/10.1007/978-3-031-24510-7

Popper K (2011). The open society and its enemies. 1st Edition, Routledge, London, UK. https://doi.org/10.4324/9780203439913

Rakodi C (1995). Poverty lines or household strategies?: A review of conceptual issues in the study of urban poverty. Habitat International, 19(4): 407-426. https://doi.org/10.1016/0197-3975(95)00037-G

Reggiani AH (2006). God's eugenicist: Alexis Carrel and the sociobiology of decline. Berghahn Books, New York, USA. https://doi.org/10.1515/9781800733985 **PMCid:PMC1856607**

Serumaga-Zake P and Naudé W (2002). The determinants of rural and urban household poverty in the North West province of South Africa. Development Southern Africa, 19(4): 561-572. https://doi.org/10.1080/0376835022000019392

Song HC (2020). Sufficiency economy philosophy: Buddhism-based sustainability framework in Thailand. Business Strategy and the Environment, 29(8): 2995-3005. https://doi.org/10.1002/bse.2553

Torten R, Reaiche C, and Boyle S (2018). The impact of security awareness on information technology professionals' behavior. Computers & Security, 79: 68-79. https://doi.org/10.1016/j.cose.2018.08.007

Wang Y and Horta H (2025). University-based social innovation and entrepreneurship education in Hong Kong: A curriculum analysis. Studies in Higher Education, 50(6): 1248-1267. https://doi.org/10.1080/03075079.2024.2369202