Design of a Workshop Training Course based on the Sufficiency Economy Philosophy for Sustainable Electricity use for Provincial Electricity Authority Employees

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ABSTRACT: *The study aimed to assess the effectiveness of a workshop training course on social innovation or the sufficiency economy (SEP) principles for sustainable innovation (SI) of sustainable electricity use among provincial electricity authority personnel. The results revealed that the quality of the content (M = 4.78, SD = 0.58) and the media (M = 4.50, SD = 0.58) of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel by the 9 experts was at the greatest level. The design of a workshop training course based on SEP for SI of sustainable electricity use for provincial electricity authority personnel to enhance learning achievement was efficient by E_1/E_2 (82.40/81.33) by the specified hypothesis 80/80. The significant difference between pretest (M = 14.44, SD = 0.88) and posttest (M =16.11, SD = 1.05) scores of a workshop training course based on SEP for SI of sustainable electricity use for provincial electricity authority personnel were at the 0.01 level. Then, the provincial electricity authority personnel's satisfaction with a workshop training course based on the SEP for sustainable electricity use was at the highest level (M =4.90, SD = 0.12)*

Keywords: Workshop training, Sufficiency economy philosophy, Sustainable innovation, Sustainable electricity, Provincial electricity authority

1. Introduction

The rising demand for electricity and the constraints of energy sustainability have emerged as significant worldwide concerns. Thailand's Provincial Electricity Authority (PEA) is essential for overseeing electricity distribution and advocating for energy conservation among consumers and enterprises. Integrating SEP into power management is crucial to comply with national policies on sustainable energy use and promote responsible energy consumption. The SEP, promulgated by His Majesty King Bhumibol Adulyadej, promotes moderation, rationality, and self-reliance while advocating for Knowledge and ethical integrity (Lehtonen & Heikkurinen, 2021; Prayukvong et al., 2024). SEP has been effectively implemented across multiple sectors, such as agriculture, business, and education, resulting in sustainable

development and resilience. Applying this attitude to energy use can assist PEA personnel in cultivating a mindset of responsible power usage, enhancing energy efficiency, and fostering sustainable habits among consumers. This training session aims to augment the capabilities of PEA personnel by providing them with the information and skills required to apply SEP concepts in their everyday operations and decision-making processes. The course will emphasize the utilization and applications of SEP in energy conservation, promoting sustainable electricity utilization, and advocating for adopting efficient and renewable energy solutions. Integrating SEP into the business culture enables PEA to advance national energy sustainability objectives while enhancing operational efficiency and customer engagement. This training will enhance employees' comprehension of the relationship between sustainable energy utilization and SEP, empowering them to become proactive proponents of energy conservation in their professional capacities and communities. The program seeks to establish a lasting influence by fostering a sustainable mindset, minimizing electricity waste, and enhancing energy efficiency throughout the firm. These studies suggest that SEP enhances sustainable development and business performance by promoting moderation, ethical integrity, and Knowledge across various sectors, including agriculture, logistics, and public services (Rungruang et al., 2023).

The PEA focuses on SI to advance the Sustainable Development Goals (SDGs). The PEA's strategy aligns with Thailand 4.0, advocating for digital clean energy technology. SI is crucial for promoting sustainable and economically viable solutions, such as innovative grid technology, renewable resources, and low-carbon emissions. The PEA's Smart Meter and EV charging stations help residential property owners monitor their energy use habits. Renewable energy technologies, such as solar and wind, are essential for reducing emissions in the power sector. SI requires integrating economic, environmental, and social goals at the national level. The PEA's SEP is an innovative development strategy integrating economic, social, and environmental factors. The SEP aims to establish a prudent balance between production and consumption while safeguarding against internal and foreign disturbances. The confluence of SI and SEP is a significant topic of study, but this study can enhance sustainable value generation (Prayukvong et al., 2023). This paper analyzes the interconnected factors influencing sustainable innovation (SI) from the perspective of the Thailand Provincial Electricity Authority (PEA), a nonprofit governmental organization providing electrical services to public and commercial sectors. This study examines the internal and external factors that impact GHG emission reductions, aiming to uncover critical elements impacting SI and bolstering the Sustainable Development Goals (SDGs). We seek to understand how many elements affecting these programs coalesce to foster sustainable behaviors in Thailand. Global organizations can leverage the findings to advance their sustainable development strategies. The PEA has aligned its objectives with Thailand 4.0, which advocates transitioning to digital clean energy technology.

SI is integral to the PEA's strategy, fostering sustainable and economically feasible solutions. Innovative grid technology, renewable resources, and low-carbon emissions are crucial for sustainable development. Smart grids are designed to minimize energy consumption and decentralize electricity production. The PEA Smart Meter in Thailand allows residential property owners to actively monitor their energy use habits. Similarly, the PEA Care and Service and Smart Plus initiatives have established electric vehicle (EV) charging stations at strategic locations like hotels, apartments, and resorts. Renewable energy (RE) technologies, including solar and wind, are crucial for reducing emissions in the power sector, the primary source of CO2 emissions. In Asian countries, a 1% increase in energy innovation is associated with an estimated 0.67% decrease in greenhouse gas emissions (Altıntaş & Kassouri, 2020). The International Energy Agency (IEA) projects that by 2050, approximately 90% of global energy production will originate from renewable sources, in alignment with its net zero trajectory, which signifies a balance between greenhouse gas emissions produced and those removed from the atmosphere. Solar photovoltaic (PV) and wind energy will comprise around 70% of that supply (Cillo et al., 2019).

Developing Sustainable Indicators requires the integration of economic, environmental, and social goals at the national level (Hananto & Srinivasan, 2024). Varied perspectives on eco-innovation, encompassing clean technology with improved ecological effectiveness, contribute to SI (Hariguna & Chen, 2024). SI encompasses ideation, prototyping, and creative exploration to generate new products, processes, strategies, business models, and profitable ventures (Hayadi & Emary, 2024; Saputra & Yadav, 2024). By leveraging institutional voids, such as inadequacies in legal systems, regulatory frameworks, and governance structures, along with resource constraints like financial capital, human resources, and technological infrastructure, SI creates opportunities for innovative methodologies. Internal and external factors influencing SI in the PEA have been analyzed to identify improvement areas and address barriers to innovation, hence promoting a culture that supports sustainable practices (Berlilana & Mu’amar, 2024) The results validate that Thailand's SEP is an innovative development strategy that integrates economic, social, and environmental factors. It advocates a holistic approach emphasizing moderation, competitive advantages, low risks, and suitable investments. The SEP seeks to establish a prudent balance between production and consumption while safeguarding against internal and foreign disturbances. It conforms to the principle of the middle path for all social strata and

administration. Knowledge, contemplation, prudence, and ethical purity are essential to this paradigm. The convergence of SI and the SEP constitutes a compelling area of investigation; however, targeted research on their combined effects is few. Consequently, this study can integrate these components to promote sustainable value production.

2. Purposes of Research

2.1 To develop the quality of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel.
2.2 To determine the efficiency of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel.
2.3 To compare pretests and posttests of provincial electricity authority personnel learning achievement on a workshop training course based on the SEP for sustainable electricity use.
2.4 To evaluate provincial electricity authority personnel satisfaction with a workshop training course based on the SEP for sustainable electricity use.

3. Literature Review

3.1 The Sufficiency Economy Philosophy (SEP)

Introduced by Thailand's King Bhumibol Adulyadej is a guiding principle for sustainable development. It emphasizes moderation, reasonableness, and self-immunity in decision-making. This study reviews the application of SEP in designing a workshop training course to promote sustainable electricity use among Provincial Electricity Authority (PEA) employees. SEP has been widely applied in various sectors, including agriculture, business, and energy conservation. Effective training programs are essential for instilling sustainable practices within organizations. The workshop design should align with adult learning principles, emphasizing self-directed learning, problem-solving, and relevance to real-world applications. Key components include interactive lectures, case studies, hands-on activities, group discussions, and post-training evaluation. Studies show that organizations integrating SEP principles improve energy efficiency and reduce operational costs. Integrating SEP in a workshop training course design offers a holistic approach to promoting sustainable electricity use. This study examines how adopting a Thai Sufficiency Economy philosophy improves sustainability performance in a Small-Medium-sized Enterprise (SME). Using the Sufficiency Thinking model, the study finds a close fit between collected data and the model, revealing that sustainable leadership actions lead to social and environmental innovation. Implications for practicing managers and future research directions are discussed (Kantabutra & Punnakitikashem, 2020).

3.2 Energy Conservation, Sustainable Practices, and Workshop Design: SEP's Importance Today

Energy efficiency and sustainability. The global sustainability and environmental mitigation initiative relies on energy conservation and sustainable practices. SEP includes methods, strategies, and technologies that reduce energy use and waste and promote renewable energy. SEP promotes sustainability through energy-efficient technologies, building designs, behavioral changes, and regulatory measures. Recently, energy conservation has expanded beyond engineering and technology to include social and behavioral factors. According to numerous studies, energy management systems (EMS) help businesses monitor and optimize energy consumption. These systems often use IoT and AI to create intelligent environments that dynamically adjust energy use based on real-time data and prediction algorithms. SEP has expanded into demand-side management (DSM), smart grids, and energy storage systems as these technologies improve and energy usage behavior becomes more important. Trends in research (1) Intelligent Structures and Energy Optimization; a growing body of literature emphasizes smart buildings' energy conservation potential. These buildings use IoT sensors, automated lighting, and real-time HVAC systems. Research suggests these innovations can cut energy use by 30% (Xia et al., 2023). (2) Energy-Efficient Appliances: Recent studies show that energy-efficient appliances, especially in homes, significantly reduce energy use. New smart appliances like refrigerators, washing machines, and air conditioners that autonomously optimize energy use are reducing domestic energy consumption. (3) Energy Conservation Behavioral Interventions: Research recognizes the psychological and behavioral factors affecting energy use. Energy-saving campaigns like turning off lights and lowering thermostats have had mixed results (Johnson et al., 2024). This technique acknowledges that technical solutions alone cannot change behavior. Sustainable practices and environmental accountability go beyond energy conservation to reduce carbon footprints, resource usage, and ecological imbalance. SEP helps circular economy concepts advance sustainable production and consumption systems by reducing waste and encouraging resource reuse and recycling. Recent movements have linked sustainability with innovation. Companies are implementing green construction standards like LEED (Leadership in Energy and Environmental Design), which require energy reduction, water efficiency, and

sustainable materials. Companies are also using eco-design to make products energy-efficient, recyclable, and made from sustainable materials. Recent research has studied how SEP might reduce waste, reuse resources, and reduce environmental externalities to support circular economy operations. Companies and sectors are studying SEP's use in manufacturing, logistics, and waste management to improve sustainability (Stefanou et al., 2023). Corporate Sustainability Projects: Sustainability is now essential to corporate strategies. CSR and sustainability reports show that SEP reduces costs and boosts brand reputation and consumer loyalty (Pereira et al., 2024).

3.3 Knowledge and Skill Acquisition via Workshop Design and SEP

Energy conservation, sustainability, and SEP workshops for individuals and businesses are becoming more important. These courses provide the tools, information, and skills needed to adopt SEP in household, commercial, and industrial settings. Workshop design is crucial for behavior modification, technology adoption, and sustainable practices. Recently, SEP seminars have changed their design. Modern workshops combine theory with hands-on activities. Simulations, case studies, and practical demonstrations help participants understand and apply complex sustainability ideas. Additionally, collaborative learning experiences and best practices in a group have grown in popularity. This collaborative approach boosts participation and adoption of sustainable practice beyond the session. Research trends, adult education, SEP workshops, and research on adult learning principles informed SEP seminars. These studies emphasize active learning, which involves problem-solving and practical applications. Recent research shows that incorporating adult learning theories like experiential learning and constructivism might boost SEP workshop effectiveness (Robinson et al., 2024). Online workshops and webinars on sustainability have grown in popularity due to digital platforms. Recent research has studied how online learning spreads SEP information. Digital workshops reach more people, but interactive online tools and virtual simulations improve participation and outcomes (Nguyen et al., 2025). To understand the influence of SEP seminars, evaluate their effectiveness. According to this research, workshops affect participants' attitudes, behaviors, and sustainable practices. Future workshops are better designed and more sustainable with this research (Harris et al., 2023). New research in Sustainable Energy Practices (SEP) highlights contemporary trends and developments that promote energy savings, sustainable practices, and successful workshop design. A recent study emphasizes the necessity of incorporating smart grids, energy-efficient appliances, and IoT devices into sustainability initiatives. Behavioral therapies and corporate sustainability initiatives are also becoming SEP components. Blending adult learning theories with interactive and hands-on experiences in workshop design is a promise for long-term sustainability. By adopting these trends, SEP can transform human and organizational behaviors to create a more sustainable future.

3.3 Sustainable Innovation (SI), Adult Learning Principles, and Training Program Sustainability

SI provides environmentally, socially, and commercially sustainable value-creating goods, services, processes, and business models. SI promotes sustainability over market value or technological advancement. Its goals are environmental protection, resource efficiency, climate change, and inequality. Recent academic and commercial research has focused on SI. Businesses are prioritizing innovation for sustainability and competitiveness. SI sustainable energy, waste management, and green supply chain innovations shift industries toward sustainability. Research trends recently: innovation in sustainable technology: Researchers say renewable energy (solar, wind, geothermal), energy storage, and sustainable agriculture are crucial to sustainability. Improved efficiency, cheaper costs, and less fossil fuel use reduce climate change (Lacy & Rutqvist, 2023). Sustainable Business Model Innovation: Technology and business model improvements are rising. SI increasingly uses circular economy principles to reuse and recycle products. Shared value creation links company growth to social good (Porter & Kramer, 2024). Policy and regulatory innovations: Markets and governments promote sustainable innovations. This study explores how carbon pricing, green technology subsidies, and sustainability reporting criteria may inspire enterprises to innovate for sustainable development. Adult Learning Sustainability Principles. Adult learning theories are crucial to sustainability training program design. Unlike traditional schooling, adult education emphasizes self-directed, experiential learning. Adult education must consider past Knowledge and life experiences. Adult learning concepts can boost engagement and sustainability. Adult sustainability education principles include experiential learning: Based on David Kolb's research, individuals learn best by doing, reflecting, conceptualizing, and applying. Sustainability workshop participants address environmental issues through case studies, role-playing, and field projects (Kolb, 1984). Transformational Learning: Jack Mezirow encourages adults to question their assumptions, attitudes, and beliefs. Students learn to respect sustainability through transformational learning. Social responsibility, environmental justice, and global connectedness can change this (Mezirow, 2000). Self-Directed Learning: Individuals appreciate studying alone when it matches their personal or professional goals. Allowing participants to choose sustainable training themes that reflect their views or work goals can increase engagement and retention. Interactive seminars, sustainable webinars, and online learning platforms illustrate self-directed learning (Knowles, 1975). Constructivism: Students actively learn through environmental

interaction. Participatory environmental evaluations and community-led sustainability projects are constructivist techniques. Training affects sustainability. Training programs that promote sustainability combine academic and practical expertise. Successful sustainability training programs engage participants and teach technical skills for sustainable activities. These efforts encourage long-term environmental and social change by raising awareness, developing skills, and changing behavior. Current research, behavioral change, and sustainability education: Training methods that stress behavior modification over Knowledge improve sustainability. Nudging and goal-setting programs have promoted energy-saving, waste-reduction, and sustainable consumption (Gifford, 2024). Corporate Sustainability Training: Studies demonstrate that sustainability-educated personnel are more likely to support firm sustainability goals. Sustainability leadership, green marketing, and supply chain management training can boost firm sustainability (Bocken et al., 2023). Sustainability training emphasizes cross-sector collaboration. Government, business, academia, and civil society can collaborate on training programs to promote a holistic sustainability approach that serves the needs of varied sectors and communities. This strategy also teaches participants how their actions affect sustainability goals (Bohm et al., 2024). Assessment of long-term sustainability impacts training program efficacy. Research shows that training programs with follow-up, mentorship, and ongoing learning and networking are more sustainable. Feedback loops and continuing learning help retain and apply Knowledge (Leithwood & Sun, 2023). Solid Sustainability Education Theory. A solid theoretical framework for sustainability-focused research and activities requires integrating Sustainable Innovation (SI), adult learning, and training program effects. SI's sustainable goods, services, and business strategies create value and enable large-scale environmental and social change. Adult learning principles need sustainability education to be engaging, practical, and relevant to adult learners' experiences. Finally, training programs encourage sustainable behaviour by applying information. SI, adult learning, and training effectiveness can improve sustainability education. This technique encourages sustainable practices and structural changes to address our biggest environmental concerns.

3.4 SEP in Energy Conservation, Sustainable Practices, and Workshop Design

SEP energy conservation, sustainable behaviors, reducing greenhouse gas emissions, and climate change depend on SEP. SEP promotes sustainable energy use with novel technologies, energy efficiency methods, policy frameworks, and behavioral changes. This study examines contemporary SEP research on energy conservation, renewable energy, efficiency, and innovative technology integration. It also studies SEP in workshop design, especially for adult learning to promote knowledge transfer and practice. Sustainable SEP energy conservation. Conservation saves energy by optimizing resources. Sustainable methods save energy, decrease pollution, and promote ecological balance. SEP approaches for energy saving and sustainability are growing fast due to technology, law, and behavior control. Over the past decade, energy conservation has expanded to include smart technology, energy-efficient buildings, demand-side management, and better monitoring. These innovations save individuals and company money, energy, and the environment. Solar, wind, and geothermal energy integration research is growing. Energy storage technologies help electrical grids integrate intermittent renewable sources. Latest Energy Conservation and Sustainability Research: 1. Energy-Efficient Technologies: Innovation and implementation have considerably decreased energy use. LED lighting, HVAC upgrades, energy-efficient appliances, and automated energy management systems save households and businesses electricity. Smart Grids and Demand-Side Management: Digital technology and enhanced sensors in power distribution networks offer real-time energy monitoring and management. Homes with smart meters and automation use 40-50% less energy (Gartner et al., 2024). Demand-side management (DSM) systems balance supply and demand, offering users energy control. Zhao et al. (2023) found that DSM programs lower peak demand, increase grid stability, and save consumers money. Energy Conservation Obstacles: Although SEP has numerous benefits, energy conservation measures, especially in corporations, often fail. Change aversion, high upfront costs, and energy-saving ignorance remain challenges. Many industries value production efficiency or cost-cutting over energy conservation. Research reveals these obstacles require particular technical and behavioral methods (Anderson & Tushman, 2023). Practice and SEP Technology Evolution Advanced SEP technologies have revolutionized the energy industry and the way people approach sustainability. These advances include energy-efficient technologies, renewable energy integration, and new business methods. Recent Technological Advances: One of the biggest advances in SEP is incorporating renewable energy sources including solar photovoltaics (PV), wind turbines, and hydroelectric electricity. Affordable, efficient, and scalable technologies have improved. Solar PV costs have plummeted by 80% in the past decade, making it cheaper for homes and businesses (IRENA, 2024). Advances in offshore wind and tidal energy offer new prospects for large-scale renewable energy production. Energy Storage Solutions: Intermittent renewable energy sources have low grid integration. This challenge requires energy storage technology like lithium-ion batteries. These systems store excess energy during high generation and release it when high demand or low renewable output. Recent studies have improved energy storage technology efficiency, capacity, and cost to encourage SEP and renewable energy adoption (Li et al., 2024). The Internet of Things (IoT) and digital technologies have

transformed energy system management. Sensors, networked devices, and data analytics provide real-time energy usage and performance monitoring with SEP. Smart homes, energy-efficient buildings, and industrial automation systems use IoT to save energy and improve sustainability. Machine learning algorithms forecast energy usage and recommend optimization solutions in energy management (Huang & Zhang, 2024). The circular economy—reusing, recycling, and minimizing waste—has grown in SEP. New business models include product-as-a-service and closed-loop supply chains that reduce resource extraction, improve sustainability, and conserve energy. Studies show that circular economy principles in manufacturing and construction can reduce energy use and waste (Stefanou et al., 2023). The Role of Workshop Design in SEP Implementation: Workshops are essential in educating and training individuals, organizations, and communities on SEP principles, energy conservation, and sustainable practices. To ensure that participants learn and practice SEP methods in their daily lives and workplaces, workshop design is crucial. These seminars often succeed by incorporating adult learning principles including active, experiential, and self-directed learning. Recent Trends in SEP Workshop Design; Hands-On and Interactive Learning; Adult learning research emphasizes experiential learning in sustainability education. Practical demonstrations, field excursions, and interactive simulations let trainees apply SEP concepts in real life. Energy-saving workshops may assess home energy use, create energy-efficient building layouts, or test renewable energy technology (Robinson et al., 2024). The advent of digital platforms has led to the development of online and hybrid (online and in-person) workshops that expand SEP education. According to recent studies, online according to recent studies, online SEP workshops can reach a global audience and allow flexible learning. To succeed, these programs must include hands-on experiences and practical applications (Nguyen et al., 2025). Collaborative Learning: Models where participants solve sustainability problems jointly are becoming more common. Group conversations, problem-solving, and peer-to-peer knowledge sharing boost sustainability understanding and community. This collaborative approach empowers and motivates individuals to adopt SEP practices personally and professionally (Leithwood & Sun, 2023). Comprehensive Understanding of SEP; this literature review highlights the evolving nature of Sustainable Energy Practices (SEP) in energy conservation, sustainable practices, and workshop design. Renewable energy, energy-efficient, and smart technology advancements are transforming SEP. Despite these developments, SEP techniques can be difficult to implement in organizations because of cost constraints, change resistance, and lack of understanding. Integrating modern engineering, environmental science, policy, and other interdisciplinary research into SEP theory is vital. This holistic approach will reveal SEP's potential to promote sustainability and energy reduction across sectors. SEP can help create a sustainable, energy-efficient future by concentrating on breakthrough technologies, energy conservation hurdles, and effective training programs.

3.5 The Delphi Method

Delphi, developed by Olaf Helmer and Norman Dalkey in the 1950s, is a structured, iterative procedure that uses a panel of experts to obtain consensus forecasts. The method, also known as the Delphi technique or Estimate-Talk-Estimate (ETE), is a systematic and qualitative forecasting method that uses experts to predict outcomes, evaluate probabilities, and reach consensus on certain topics. Delphi is a qualitative approach that consolidates perspectives from a diverse group of specialists without a physical meeting and is anonymous. Delphi theses and expert selection must be carefully considered to avoid methodological flaws. The Delphi method surveys a panel of experts, where anonymous responses are collected and shared. The group's opinion is presented to the panel, and experts revise their answers based on panel input. The technique is complete when forecasts agree. The steps include defining the problem and goals, choosing a moderator and panel of experts, and providing opening questions from the facilitator. The first round of a survey involves open-ended questions to help experts develop and evaluate their ideas. The facilitator summarises the results, hiding the experts' identities for honest discussion. The second round involves analyzing first-round responses, identifying commonalities, and removing unnecessary text. The third round analyzes second-round responses, and the facilitator provides a summary report. Delphi method suitability assessment helps study controversial topics. Delphi is a method that simplifies group scheduling, reduces peer pressure, and encourages innovation. It consolidates ideas from diverse experts without physical assembly, easing anxieties and leading to consensus. However, it produces different interactions than live discussions and may be worthless. Thailand's Sufficiency Economy Philosophy (SEP) promotes self-sufficiency and resilience for sustainable development, offering courses on sustainable agriculture, ethics, and community development. The Sustainable Economic Program (SEP) in Thailand is a community-based initiative that promotes economic empowerment, preservation of local Knowledge and culture, and strengthening of community networks through theoretical instruction, site visits, practical workshops, and experiential applications.

4. Methodology

4.1 Theoretical Framework.

The micro- environment, which includes relational, structural, and communicative data among supply chain participants, and the macro- environment, which encompasses information regarding legal and political frameworks, as well as social, environmental, economic, demand, and technological factors (Wang et al., 2014). A company cannot concentrate exclusively on a single facet without considering others. Internal elements such as organizational transformation, culture, and managerial changes impact employee performance, and external factors, including societal influences and external stakeholders, affect external conditions (Rozanna et al.,2019). (1) Disruptive Leadership (DIL) embodies a complex perspective on leadership in the 21st century. Dumas and Beinecke described leaders' behaviors as multidimensional, emphasizing competencies such as motivation, communication, and team building as indications of effective organizational change (Dumas et al.,2018). Leaders who possess and demonstrate these characteristics are more effective in implementing change. This leadership style must be developed externally and internally within the organization to demonstrate inclusivity, collaboration, and service to individuals. Social good and ecological sustainability involve enhancing "the quality of life for all humans, the liveability, and aesthetic value of the environment (Sutton, 2004), and (2) The PEA Digital Utility (PDU) aims to provide efficient electricity services and promote economic and social sustainability. It transitions to a value-based economy and focuses on renewable energy sources. The PDU is dedicated to combating climate change and promoting sustainable living. The company's "connected customer service" and "Workforce of the Future" initiatives aim to maintain strong client relationships and meet digital management needs. (Alternative Energy Institute of Thailand Foundation, 2022).

4.2 Extrinsic Factors.

From a decision-making standpoint, addressing global change is a problem in which policymakers must adjust to issues limited by societal values, principles, regulations, conventions, and the current state of Knowledge. demonstrated that "the values embedded in a rule may incentivize individuals to adhere to that rule; alternatively, the integration of new knowledge may alter the expression of values through actions, which may subsequently influence the interpretation of rules." Consequently, adaptation is essential for confronting external environmental difficulties (Goddard et al., 2016). (1) Thailand 4.0 (THAI) is an industrial model based on values that foster innovation, research, and development while integrating social and environmental welfare into its objectives. THAI involves the creation of a value- driven and innovation- focused economy through the application of advanced green technology. The approach emphasizes economic sustainability and a human- centered development strategy, leveraging technological developments while fostering environmentally sustainable practices to reconcile economic progress, ecological conservation, and human needs. Purvis et al. contended that "the three- pillar structure of social, economic, and environmental sustainability, commonly depicted by three overlapping circles with overall sustainability at the center, has become ubiquitous" (Purvis, et al., 2019), (2) Industry 4.0 (IND) has influenced the industrial sector by offering opportunities for sustainable production through widespread information and communications technology (ICT) (Stock & Seliger, 2016). IND prioritizes sustainable manufacturing, creating commodities via economically feasible methods that mitigate negative environmental impacts while conserving energy and natural resources. Expediting manufacturing typically requires businesses to innovate or face increased expenses (Gilchrist, 2016). Thus, IND seeks to reduce expenses while maximizing profits; its slogan is "better, not cheaper." (3) Information & Communication Technology and Digital Innovation Investments in developing and adopting ICTs and digital innovations represent a global challenge, as they are essential for improving productivity. Narmanov stated that "the modern concept of digital economy is characterized by the rapid progress of digital technology, a shift in the domain of information, and the acceleration of economic globalization" (Narmanov, 2022). Information and Communication Technology enhances industry efficiency and effectiveness through innovation (Mihardjo et al., 2020). Cross- cultural differences in digital leadership represent a substantial issue in the globalized environment (Wilson et al., 2004). THAI, ICT, and IND are interrelated in utilizing network technology and sustainable, efficient energy resources. Both aim to foster an environmentally sustainable society by advocating for intelligent, secure, and networked communities. Thus, the PEA emphasizes the importance of digital energy operations for enterprises (PEA Annual Report., 2022).

4.3 SEP

The ideals of the Sustainable Energy Practice (SEP) were introduced by King Bhumibol Adulyadej. They focus on cyclical sustainability principles and emphasize moderation, reasonableness, and virtues like Knowledge, honesty, and perseverance. Sustainable living involves financial control, strategic planning, and risk management. Self- immunity and resilience are key components, while reasonableness emphasizes morality and ethical standards. The SEP is rooted in Thai culture and will be implemented at individual, community, and national levels.

4.4 SI Numerous

SI programs have focused on SI programs focus on improving technological processes, promoting eco-efficiency, and reducing production costs. Companies incorporate sustainability into their innovation strategies to mitigate harmful environmental effects. SI is defined as developing innovative products, processes, services, and technologies that fulfill human needs while respecting natural resources. The SI model emphasizes processes, attributes, results, and unique inventions.

4.5 Design of a workshop training course based on the sufficiency economy philosophy

Research for thorough research design, data collection, and analysis. A study on sustainable electricity uses in a provincial electricity authority used a workshop training course, pretest, and teacher satisfaction survey. Statistical methods included percentage, mean, standard deviation, and t-test for dependent samples. Evaluation of the Training Workshop on Sustainable Energy Practices (SEP) using ANOVA.

Phase 1: The training of sustainable electricity consumption for Provincial Electricity Authority personnel using the Sufficiency Economy Philosophy.

The Sufficiency Economy Philosophy (SEP) is being utilized by Thailand's Provincial Electricity Authority (PEA) to enhance economic resilience and sustainable electricity consumption. The program aims to improve energy efficiency among PEA personnel, focusing on sustainable electricity utilization, government initiatives, and international energy-saving trends. The program will be evaluated through pre- and post-training evaluations, participant feedback surveys, and energy consumption metrics. The data collection process for training in sustainable power usage involves a blend of qualitative and quantitative methodologies. Data acquisition includes surveys, questionnaires, interviews, focus group discussions, observational studies, and document analysis. The aim is to evaluate the efficacy of training programs, identify deficiencies in Knowledge, and assess changes in electricity usage behaviors. The data analysis aims to enhance training programs and promote responsible energy consumption among staff, aligning with the Sufficiency Economy Philosophy.

Phase 2 The training promotes sustainable electricity and the Sufficiency Economy Philosophy.

The workshop training course educates PEA personnel on sustainable electricity management, integrating SEP concepts, promoting energy efficiency, environmental stewardship, and sustainable economic stability. It focuses on assessing energy utilization goals, enhancing efficiency through energy auditing techniques, and integrating renewable energy sources. The course also promotes CSR initiatives, developing action plans, and incorporating sustainability into daily operations. The objective is to ensure sustainable success through training sessions, energy savings data analysis, and technical expertise.

Phase 3: Data Collection on Perceptions and Utilization

The Provincial Electricity Authority is implementing training to enhance Knowledge of sustainable electricity consumption (SEP). The training aims to promote energy-efficient habits, improve organizational efficiency, and connect theoretical Knowledge with practical implementation, enhancing the overall SEP program. *Phase1;* The Provincial Electricity Authority (PEA) is implementing a Sufficiency Economy Philosophy (SEP) workshop training program to promote sustainable electricity use. The training aims to enhance staff knowledge, attitudes, and behaviors in energy conservation and sustainability. Data was collected through surveys, interviews, focus groups, and observation of workplace energy consumption patterns —the SEP workshop aimed to enhance PEA's understanding of sustainable electricity use and promote sustainable practices. The IOC scale assessed internal and external factors affecting PEA DEI, identifying six factors: Disruptive Leadership, Thailand 4.0, Industry 4.0, PEA Digital Utility, ICT/digital innovation, and SEP. The study involved 17,170 PEA employees, with a sample size of 390. The reliability of each factor was excellent, with Cronbach's Alpha at $\alpha = 0.975$. To determine the PEA DEI that the Employees Knew Best. Change and Internal and External Factors that Influence PEA DEI. The Perceptions of PEA DEI ($n = 419$). The Highest and Lowest Mean of Internal and External Factors Influencing PEA DEI. The PEA DEI in Thailand is influenced by several predictor variables, including disruptive leadership, Thailand 4.0, Industry 4.0, PEA Digital Utility, ICT/digital innovation, and SEP. The PEA DEI is influenced by these predictor variables, with a VIF value of ≤ 4 indicating no multicollinearity and a Tolerance value of less than 10. Multivariate Normality-Multiple Regression assumes a normal distribution of residuals and no multicollinearity, and the Durbin-Watson statistic tests for autocorrelation in the regression model's output. The study utilized Pearson's Product Moment Correlation Coefficient and Multiple Regression Analysis to analyze data from a semi-structured questionnaire containing demographic information, PEA global innovation knowledge, and PEA DEI. The questionnaire was divided into three parts: the respondents' Knowledge of PEA global innovation, the six categories of social, technological, economic, environmental,

political, and PEA change, and internal and external factors affecting PEA global digital innovation. The third part focused on PEA's DEI, including processes, attributes, results, and unique inventions. The data analysis included frequency, percentage, mean, standard deviation, and comparison by percentage.

Table 1: The findings provide insights into the PEA's DEI and its impact on the industry.

Phases	n	Part	Topic	Statistics
Phase I				
Round I	17	1 (37)	Cmaps	IOC
		2 (40)	DEI	Frequency and Percentage
Round 2	17	1 (129)	Rating Scales	*M* and QD
		2 (24)	Rating Scales	*M* and QD
Phase II	419	1	Demographic	Frequency and Percentage
		2	PEA DEI that the employees know best.	Frequency and Percentage
		3	Change and internal and external factors that influence PEA DEI	Frequency and Percentage
		4	PEA DEI	Frequency and Percentage
		5	The highest and lowest mean	*M*, *SD*
		P1 (54) P2 (24)	The internal and external factors that influence PEA DEI	ANOVA, Model Summary, Correlations, Coefficients
		P1 (9) P2 (24)	SEP that influence PEA DEI	ANOVA, Model Summary, Correlations, Coefficients
Phase III	30 Employees and 20 Stakeholders	1	Demographic (30 Employees)	Frequency and Percentage
		2	PEA DEI that the employees/stakeholders know best.	Frequency and Percentage
		P1 (6)	Change and internal and external factors that influence PEA DEI	Frequency and Percentage
		P2 (4)	PEA DEI	Frequency and Percentage
	419 Employees	1	Develop the quality of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel.	E1/E2
Phase IV		2	Compare the pretest and posttest of provincial electricity authority personnel's learning achievement in a workshop training course based on the SEP for sustainable electricity use.	t-test
		3	The provincial electricity authority personnel were satisfied with a workshop training course based on the SEP for sustainable electricity use.	Frequency and Percentage

Data were examined using thematic and quantitative analysis to analyze the relationship between SEP awareness and sustainable electricity use behaviors. Thematic analysis identified knowledge deficiencies, motivational factors, and obstacles to sustainable power utilization, while quantitative analysis focused on employee demographics and experience levels.

5. Results

The article evaluates the effectiveness of three different training formats, interactive, lecture-based, and hybrid, in promoting sustainable energy practices (SEP) among provincial electrical authorities. The results show that interactive methods involving hands-on learning are more effective in strengthening participants' Knowledge of SEP ideas. The study also suggests that a hybrid model, combining online learning with face-to-face contact, can be just as effective as

interactive lectures. The study reveals that the Lecture-Based Group training format significantly affects participants' SEP understanding and application, with significant differences between the three groups, rejecting the null hypothesis of equal impact.

Table 2: In order to provide a visual representation of the statistical data, the following ANOVA table summarizes the results:

Source of Variation	The sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	p-Value
Between Groups	125.4	1	125.4	10.2	0.002
Within Groups	356.2	29	12.3		
Total	419	30			

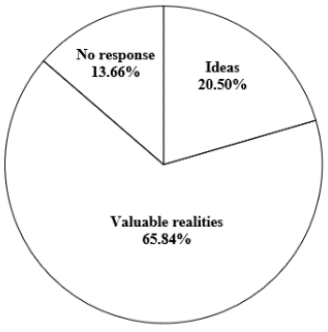
***P<0.01*

From Table 2, The study reveals that a hybrid model, combining online learning with in-person engagement, can significantly improve information retention and application skills for PEA DEI employees. The hybrid model offers greater benefits than the lecture-based method, suggesting that future training programs incorporate interactive elements or adopt a hybrid model. The study also reveals that PEA Smart Plus is the most popular PEA DEI among males aged 25-30. Technological changes, particularly in PEA Digital Utility, have impacted PEA DEI, particularly in the electric vehicle service adopted by 40-50-year-olds.

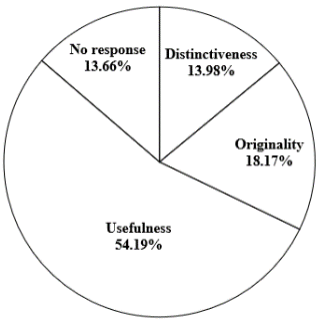
Table 3: The seventeen experts' opinions on the concepts or maps of Thailand 4.0, Industry 4.0, PEA Digital Utility, ICT/digital innovation, and SEP through a semi-structured interview, round 1 (n = 17).

Concepts	**Opinions expressed by Experts**				**Total**
	Agree	**Not sure**	**Disagree**	**No response**	
1. Disruptive Leadership	137(27.29%)	15(22.06%)	5(29.41%)	3(50.00%)	160(100.00%)
2. Thailand 4.0	53(10.56%)	10(14.71%)	1(5.88%)	0(0.00%)	64(100.00%)
3. Industry 4.0	58(11.55%)	6(8.82%)	0(0.00%)	1(16.67%)	65(100.00%)
4. PEA Digital Utility	105(20.92%)	15(22.06%)	8(47.06%)	0(0.00%)	128(100.00%)
5. ICT/digital innovation	69(13.75%)	8(11.76%)	2(11.76%)	1(16.67%)	80(100.00%)
6. SEP (Sufficiency Economy Philosophy)	80(15.94%)	14(20.59%)	1(5.88%)	1(16.67%)	96(100.00%)
Total	502(84.65)	68(11.47%)	17(2.87%)	6(1.01%)	593(100.00%)

From Table 3: In the semi-structured interview, round 1, most experts (84.65%) agreed on the concepts of Thailand 4.0, Industry 4.0, ICT/digital innovation, and SEP. Only 11.47% of experts were not sure, 2.87% disagreed, and 1.01% made no response. A semi-structured interview of 17 experts in round 1 found that the PEA DEI consisted of processes, attributes, and results, including unique invention, as shown in Figure 1.

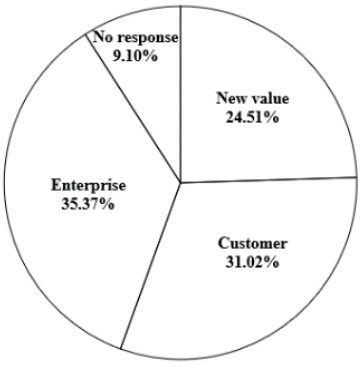


(a) Process



(b) Attribute

(c) Result



(d) Unique Invention

Figure 1: PEA DEI consisting of 1 (a), 1 (b), 1(c), 1(d)

According to Figure 1, The PEA DEI, as discussed in a semi-structured interview, focuses on valuable realities, usefulness, new strategies, working methods, and unique inventions. The experts' congruency of internal and external factors influencing PEA DEI was validated in round 2.

Table 4: Level of consensus and importance on the role of internal and external that influence PEA DEI

No	Internal and External Factors	Round 2				
		Median	Level Importance	*M*	QD	Level Consensus
1.	Disruptive leadership	4.63	High	4.36	0.05	High
2	Thailand 4.0	4.13	High	4.30	0.10	High
3.	Industry 4.0	4.88	High	4.48	0.02	High
4.	PEA Digital Utility	5.00	High	4.63	0.05	High
5.	ICT/digital innovation	4.00	High	4.23	0.10	High
6.	Sufficiency Economy Philosophy (SEP)	4.00	High	4.36	0.09	High

From Table 4, the PEA DEI (Process, Attributes, Results, and Unique Invention) study analyzed PEA employees' perceptions of internal and external factors influencing their performance. The study found that PEA employees had a high level of consensus, with most respondents aged between 25 and 30. Most respondents had position rankings of levels 4-7 within the organization. The frequency and percentage of PEA DEI that employees knew best were also found to be high.

Table 5: Frequency and percentage of PEA DEI that PEA employees knew best (n=419)

No.	PEA DEI	n	%
1.	PEA Smart Grid	51	12.17
2.	PEA Smart Plus	216	51.55
3.	PEA Innovation Hub	26	6.21
4.	PEA Care & Service	9	2.15
5.	PEA Smart Home	13	3.10
6.	PEA Smart Electronic Meter	9	2.15
7.	PUPAPLUG	14	3.34
8.	EV & Charging Station	32	7.64
9.	Others*	49	11.69
	Total	419	100.00

* PEA DEI was identified for more than one type.

From Table 5 The study reveals that 51.555% of PEA employees are familiar with the 'One Touch Service' application, which was recommended during the COVID-19 pandemic. 12.17% know the PEA Smart Grid Network, which deals with electrical systems, services, and the environment. 36.28% know innovations like EV & Charging Station and the PEA Innovation Hub, which are considered environmentally friendly shown in Table 5-6.

Table 6: Change and internal and external factors that influence PEA DEI, as perceived by 419 PEA employees.

No	Change	Internal and External Factors	n	%
1.	Technological Change	PEA Digital Utility	7188	16.86
2.	Technological Change	Industry 4.0	7143	16.75
3.	Technological Change	ICT/digital innovation	7142	16.75
4.	Social Change	Disruptive Leadership	7110	16.67
5.	Politics and Economic Change	Thailand 4.0	7050	16.53
6.	Social and Environmental Change	SEP	7011	16.44

From Table 6, the study reveals that technological change significantly impacts PEA Digital Utility (16.86%), Industry 4.0 (16.75%), and ICT/digital innovation (16.75%), while social change affects disruptive leadership (16.67%), politics and economics impact Thailand 4.0 (16.53%), and social and environmental change impact SEP (16.44%), as shown in Table 7.

Table 7: Frequencies and percentage of responses on PEA DEI relating to process, attributes, results, and unique invention divided into three groups, as perceived by 419 PEA employees.

No.	The 5-Point Likert Type Scale			No.	The 5-Point Likert Type Scale		
	5 & 4	3	1 & 2		5 & 4	3	1 & 2
1.	377 (89.98%)	39 (9.31%)	3 (0.71%)	13.	369 (88.07%)	46 (10.98%)	4 (0.95%)
2.	373 (89.02%)	44 (10.50%)	2 (0.48%)	14.	372 (88.78%)	42 (10.03%)	5 (1.19%)
3.	364 (86.87%)	53 (12.65%)	2 (0.48%)	15.	370 (88.31%)	42 (10.02%)	7 (1.67%)
4.	358 (85.44%)	57 (13.61%)	4 (0.95%)	16.	360 (85.92%)	57 (13.60%)	2 (0.48%)
5.	353 (84.25%)	60 (14.32%)	6 (1.43%)	17.	375 (89.50%)	39 (9.31%)	5 (1.19%)
6.	354 (84.49%)	60 (14.32%)	5 (1.19%)	18.	374 (89.26%)	42 (10.02%)	3 (0.72%)
7.	363 (86.63%)	53 (12.65%)	3 (0.72%)	19.	368 (87.83%)	48 (11.46%)	3 (0.71%)
8.	351 (83.77%)	62 (14.80%)	6 (1.43%)	20.	357 (85.20%)	59 (14.08%)	3 (0.72%)
9.	371 (88.54%)	44 (10.50%)	4 (0.96%)	21.	358 (85.44%)	50 (11.93%)	11 (2.63%)
10.	371 (88.54%)	45 (10.74%)	3 (0.72%)	22.	346 (82.58%)	64 (15.27%)	9 (2.15%)
11.	369 (88.07%)	47 (11.22%)	3 (0.71%)	23.	350 (83.53%)	62 (14.80%)	7 (1.67%)
12.	364 (86.87%)	53 (12.65%)	2 (0.48%)	24.	343 (81.86%)	64 (15.28%)	12 (2.86%)

From Table 7, 81-100% indicates strongly agree while 0-20% indicates strongly disagree. Most 419 respondents strongly agree (81.86%-89.98%) on developing PEA DEI relating to processes, attributes, results, and unique inventions. However, when customer-centric business was considered, it was found that there were only two items one (86.87%) was higher than 85%, and the other (81.86%) was the lowest. The Highest and Lowest Mean of Internal and External Factors influencing PEA DEI.

Table 8: Highest and lowest mean of internal and external factors influencing PEA DEI.

Variables	Highest-Lowest Variables	*M*	Variables	Lowest-Highest Variables	*M*
DLP1	In sharing purposes and aspirations, leadership brings forward new ways of being, knowing, and doing.	4.38	DLP6	'Inclusiveness' is the practice or policy of including those who might be excluded or marginalized, those with physical or mental disabilities, and members of minority groups.	4.02
PEA4	Social media and the Internet to be used to communicate with customers as a one-stop service through the PEA Smart Plus application so that they will be impressed by the service.	4.35	THA5	Designing a value-based economy driven by innovation based on the Sufficiency Economy Philosophy (SEP).	4.02
PEA1	Aimed at providing electricity with high-quality service and developing the organization (which is continuously	4.34	SEP2	Traditional Knowledge and wisdom accumulated in the past but may have been forgotten can be employed to solve problems.	4.06

Variables	Highest-Lowest Variables	*M*	Variables	Lowest-Highest Variables	*M*
	responsible for society and the environment).				
DLP4	Technological literacy.	4.31	THA3	Its over-arching aim is to transform Thailand into a high-income country with an entirely digitalized economy led by fully digitalized organizations.	4.12
DLP5	Recognizing the importance of people in the organization will lead to a sustainable future, or the thought that the customer is a valuable creation will lead to success.	4.31	SEP3	Its goal refers to achieving harmony and stability in financial matters and life.	4.13

The abbreviation name of internal and external factors; for example, PEA = PEA Digital Utility, DLP = Disruptive Leadership, THA = Thailand 4.0, IND = Industry 4.0, ICT = ICT/digital innovation, SEP = Sufficiency Economy Philosophy, the number after each factor would be the number of its subcategories.

Table 8 shows that the PEA DEI is influenced by disruptive leadership, social media, and the PEA Digital Utility. Less important variables include inclusive leadership, Thailand 4.0, and SEP (Supreme Economic Policy). PEA Digital Utility provides a one-stop service, while SEP recognizes traditional Knowledge for problem-solving. The Highest and Lowest Means of PEA DEI are identified.

Table 9: Highest and lowest means of PEA DEI.

Variables	Highest-Lowest Variables	*M*	Variables	Lowest-Highest Variables	*M*
PEA14	Attributes-usefulness.	4.32	SEP24	Unique inventions concerning the Sufficiency Economy Philosophy focus on customers.	4.14
DLP2	Attributes-usefulness.	4.32	THA8	Unique inventions concerning Thailand 4.0 focus on enterprise.	4.18
ICT18	Attributes-usefulness.	4.32	SEP23	Results-new strategies.	4.18
PEA15	Results-focus on new ways of working.	4.29	THA5	Process-value.	4.19
IND10	Attributes-usefulness.	4.29	SEP21	Process-value.	4.20

From Table 9, PEA's disruptive leadership and focus on ICT/digital innovation are among the highest variables. At the same time, SEP's unique inventions primarily target customers and Thailand 4.0's enterprises, highlighting the importance of these factors.

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	40171.132	6	6695.189	125.521	.000[b]
Residual	21975.780	412	53.339		
Total	62146.912	418			

***P<0.01*

a. Dependent Variable: PEA_DEI

b. Predictors: (Constant), SEP, Disruptive Leadership, ICT/digital innovation, Thailand 4.0, Industry4.0, PEA Digital Utility

The model summary reveals that the multiple regression model significantly predicts the change in PEA DEI, explaining it 125.521 times more than the unexplained proportion.

Model Summary

Model	R	R Square	Adjusted R Square	*SD* of the Estimate	Change Statistics			Durbin-Watson
					R Square Change	F Change	Sig. F Change	
1	.804[a]	.646	.641	7.303	.646	125.521	.000	1.895

The PEA, a leading digital utility in Thailand, is implementing Disruptive Leadership strategies to drive Industry 4.0 and ICT innovation, thereby enhancing its digital utility.

Correlations

Pearson Correlation	PEA DEI	Disruptive Leadership	Thailand 4.0	Industry 4.0	PEA Digital Utility	ICT/ Digital Innovation	Sufficiency Economy Philosophy
PEA DEI	1.000	.660	.680	.713	.715	.704	.662
Disruptive Leadership		1.000	.772	.765	.744	.685	.551
Thailand 4.0			1.000	.767	.765	.721	.600
Industry 4.0				1.000	.843	.763	.596
Pea Digital Utility					1.000	.794	.577
ICT/digital innovation						1.000	.568
Sufficiency Economy Philosophy							1.000

The correlations indicate a strong relationship between Industry 4.0 and PEA Digital Utility, ICT/digital innovation, disruptive leadership, Thailand 4.0, and Industry 4.0, with coefficients ranging from 0.843 to 0.767.

Coefficients[a, b]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	*SD*	Beta			Tolerance	VIF
(Constant)	16.773	3.288		5.101	.000		
Disruptive Leadership	.261	.143	.094	1.823	.069	.321	3.113
Thailand 4.0	.180	.139	.070	1.294	.196	.290	3.445
Industry 4.0	.328	.156	.130	2.106	.036	.225	4.453
PEA Digital Utility	.402	.163	.154	2.461	.014	.218	4.582
ICT/digital innovation	.483	.122	.205	3.949	.000	.318	3.142
Sufficiency Economy Philosophy	.596	.080	.285	7.418	.000	.581	1.720

Regression is used to determine the strength and character of the relationship between one dependent variable (usually denoted by Y) and a series of other variables (known as independent variables). A coefficient refers to a number or quantity placed with a variable. The unstandardized beta (B) represents the slope of the line between the predictor variables and the dependent variable. The constant value is 3.288. The coefficients of ICT/digital innovation (0.483) and SEP (0.596) is statistically significant at the 0.01 level, while Industry 4.0 (0.328) and PEA Digital Utility (0.402) are statistically significant at the 0.05 level. Beta values represent constant and regression coefficients of the independent variables which are used to describe the changes in the PEA DEI. The constant value is 16.773. The coefficient of ICT/digital innovation (0.205), and SEP (0.285) is statistically significant at the 0.01 level, while Industry 4.0 (0.130) and PEA Digital Utility (0.154) are statistically significant at the 0.05 level. The t-value indicates the causal relationship between the constants and groups of the source variables and the dependent variables. It was found that the t-value of the constant was 5.101 (p value < 0.01), Industry 4.0 was 2.106; PEA Digital Utility was 2.461; ICT/digital innovation was 3.949; and SEP was 7.418, respectively. The regression equation can be written as follows:

The raw score formula:

$$\hat{y} = 16.773 + 0.328 \text{ (Industry 4.0)} + 0.402 \text{ (PEA Digital Utility)} + 0.483 \text{ (ICT/digital innovation)} + 0.596 \text{ (SEP)}$$

The standard formula:

$$Z = 0.130 \text{ (Industry 4.0)} + 0.154 \text{ (PEA Digital Utility)} + 0.205 \text{ (ICT/digital innovation)} + 0.285 \text{ (SEP)}$$

SEP that influences PEA DEI: To find out SEP that influences PEA DEI, statistics were utilized for data analysis as follows:

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29076.393	9	3230.710	39.956	.000[b]
	Residual	33070.519	409	80.857		
	Total	62146.912	418			

***P<0.01*

a. Dependent Variable: Y1

b. Predictors: (Constant), X6.9, X6.2, X6.4, X6.7, X6.1, X6.5, X6.8, X6.3, X6.6

The model was able to predict statistically significant dependent variables, where, from the ANOVA table, the F value of 39.956 indicates that the multiple regression has a proportion explaining the change in the PEA DEI 39.956 times more than the unexplained proportion.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			Durbin-Watson
					R Square Change	F Change	Sig. F Change	
1	.684[a]	.468	.456	8.992	.468	39.956	.000	1.803

a. Predictors: (Constant), X6.9, X6.2, X6.4, X6.7, X6.1, X6.5, X6.8, X6.3, X6.6 (X6.9 (Virtue), X6.2 (Traditional Knowledge and Wisdom), X6.4 (Positive Impact), X6.7 (Risk Management), X6.1 (Negative Impact), X6.5 (Moderation), X6.8 (Knowledge), X6.3 (Goal), X6.6 (Reasonableness)

b. Dependent Variable: Y1

From the Durbin-Watson statistic of 1.803, which is between 1.50-2.50 and indicates that the error values are independent, it can be concluded that the group of variables used in the test had no relationship. The value of R is equal to 0.684, which is close to 1. This indicates that the group of independent variables are correlated with the dependent variable which has a correlation size of 0.684. The R^2 value indicates that the group of variables can explain the dependent variables 46.80% or 47%. The Multiple R for the relationship between the set of independent variables and the dependent variable is 0.684 or 46.80% or 47% which would be characterized as a weak or low effect size (Jim, 2018). Dependent Variable: PEA DEI, b. $R^2 = 64.60$. The PEA and SEP are independent factors in the industry, with PEA Digital Utility showing significant correlations with Industry 4.0 and ICT/digital innovation. The regression equation reveals a causal relationship between these variables, with Industry 4.0, PEA Digital Utility, ICT/digital innovation, and SEP having coefficients of 0.05 and 0.01, respectively.

$$\hat{y} = 16.773 + 0.328 \text{ (Industry 4.0)} + 0.402 \text{ (PEA Digital Utility)} + 0.483$$

$$\text{(ICT/digital innovation)} + 0.596 \text{ (SEP)}$$

The standard formula:

$$Z = 0.130 \text{ (Industry 4.0)} + 0.154 \text{ (PEA Digital Utility)} + 0.205 \text{ (ICT/digital innovation)} + 0.285 \text{ (SEP)}$$

SEP that influences PEA DEI: Statistics were utilized for data analysis, as follows: ANOVA.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29076.393	9	3230.710	39.956	.000[b]
	Residual	33070.519	409	80.857		
	Total	62146.912	418			

***P<0.01*

The ANOVA table revealed that the multiple regression model effectively predicted the dependent variable, Y1, with a proportion explaining the change in PEA DEI 39.956 times more than the unexplained proportion.

Model Summary

Model	R	R Square	Adjusted R Square	SD of the Estimate	Change Statistics			Durbin-Watson
					R Square Change	F Change	Sig. F Change	
1	.684[a]	.468	.456	8.992	.468	39.956	.000	1.803

The dependent variable, Y1, is influenced by the group of independent variables correlated with the dependent variable. The positive impact of these variables is attributed to the influence of traditional Knowledge and wisdom. The correlation size is 0.684, indicating a weak or low effect size, with the group of variables explaining 46.80% or 47% of the dependent variables.

Correlations

Pearson Correlation	PEA DEI	X6.1	X6.2	X6.3	X6.4	X6.5	X6.6	X6.7	X6.8	X6.9
PEA DEI	1.000	.510	.454	.494	.548	.505	.530	.542	.554	.590
X6.1		1.000	.656	.643	.502	.578	.607	.548	.494	.505
X6.2			1.000	.642	.485	.567	.595	.504	.511	.441
X6.3				1.000	.593	.619	.682	.611	.569	.539
X6.4					1.000	.588	.584	.514	.562	.586
X6.5						1.000	.694	.606	.574	.557
X6.6							1.000	.634	.586	.593
X6.7								1.000	.663	.638
X6.8									1.000	.643
X6.9										1.000

A moderate relationship exists between Moderation and Reasonableness, Risk Management and Knowledge, Traditional Knowledge and Wisdom, Goal and Traditional Knowledge and Wisdom, and Reasonableness and Risk Management. Positive Impact, Virtue, Philosophy, and Knowledge are statistically significant.

Table 10: shows the t-value reflecting the causal relationship between source variable constants, groups, and dependent variables. The constant had a t-value of 16.611 ($p < 0.01$), Knowledge was 2.390, Negative Impact 2.599, Positive Impact 3.531, and Virtue 4.155. R2 indicated that the regression model explained 45.60% of fitted data regression findings of 419 employees' SEP views that affect PEA DEI.

Coefficients[a, b]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	*SD*	Beta			Tolerance	VIF
(Constant)	48.261	2.905		16.611	.000		
Negative Impact	2.016	.776	.140	2.599	.010	.446	2.243
Traditional Knowledge and wisdom	.525	.798	.035	.658	.511	.458	2.184
Goal	-.447	.865	-.030	-.516	.606	.377	2.649
Positive Impact	2.750	.779	.180	3.531	.000	.498	2.007

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	*SD*	Beta			Tolerance	VIF
Moderation	.299	.814	.021	.367	.714	.414	2.414
Reasonableness	.774	.868	.053	.892	.373	.363	2.757
Risk management	1.482	.860	.097	1.723	.086	.409	2.448
Knowledge	2.071	.866	.131	2.390	.017	.433	2.309
Virtue	3.359	.808	.224	4.155	.000	.446	2.242

The study examines the relationship between a dependent variable (Y1) and a sequence of independent variables, focusing on the Positive and Negative impacts. Traditional Knowledge and wisdom are considered significant predictors, while moderation of Knowledge has a negative impact. The regression coefficients reveal a significant causal link between the variables, with positive impact and negative impact being significant.

$$\hat{y} = 48.261 + 2.750 \text{ (Positive Impact)} + 3.359 \text{ (Virtue)} + 2.016 \text{ (Negative Impact)} + 2.071 \text{ (Knowledge)}$$

The standard formula:

$$Z = 0.180 \text{ (Positive Impact)} + 0.224 \text{ (Virtue)} + 0.140 \text{ (Negative Impact)} + 0.131 \text{ (Knowledge)}$$

30 PEA employees and 20 stakeholders assessed the PEA DEI's internal and external aspects. Most respondents were aged 40-50, with 22 having organizational position ranks of 4-7. The PEA DEI respondents knew best, with the majority aged between 25-30 and 30-35.

Table 10: Frequency and percentage of PEA DEI that the 30 PEA employees knew best.

No.	PEA DEI	n	%
1.	PEA Smart Grid	4	13.33
2.	PEA Smart Plus	14	46.67
3.	PEA Innovation Hub	1	3.33
4.	PEA Care & Service	1	3.33
5.	PEA Smart Home	3	10.00
6.	PEA Smart Electronic Meter	1	3.33
7.	PUPAPLUG	0	0.00
8.	EV & Charging Station	6	20.00
	Total	30	100.00

From table 10 shows that most respondents (14 or 46.67%) knew PEA Smart Plus best, which is the application in the form of 'One Touch Service'. Six (20%) of respondents knew the EV and charging Station. Three (10%) of respondents knew the PEA Smart Home. Other respondents (1 or 3.33%) knew the best innovations, such as the PEA Innovation Hub, the PEA Innovation Hub, and the PEA Smart Electronic Meter.

Table 11: Frequency and percentage of PEA DEI that the 20 stakeholders knew best.

No.	PEA DEI	n	%
1.	PEA Smart Grid	4	20.00
2.	PEA Smart Plus	4	20.00
3.	PEA Innovation Hub	0	0.00
4.	PEA Care & Service	1	5.00
5.	PEA Smart Home	0	0.00
6.	PEA Smart Electronic Meter	1	5.00
7.	PUPAPLUG	0	0.00
8.	EV & Charging Station	10	50.00
	Total	20	100.00

Table 11 The Provincial Electricity Authority (PEA) has identified various internal and external factors that influence its DEI, including the PEA Care, the Standard Stand, the PEA Smart Grid, the PEA Care & Service, and the PEA Smart Electronic Meter.Are shown in Table 12-13.

Table 12: Frequency and percentage of change and internal and external factors that influence PEA DEI, as perceived by 30 PEA employees.

No	Change	n	%	Internal and External Factors	n	%
1.	Technological Change	25	83.33	PEA Digital Utility	12	40.00
2.	Technological Change	2	6.67	ICT/digital innovation	12	40.00
3.	Technological Change	2	6.67	Industry 4.0	3	10.00
4.	Social Change	1	3.33	Disruptive Leadership	2	6.67
				Thailand 4.0	1	3.33
	Total	30	100.00	**Total**	30	100.00

Table 12 shows that technological change had an impact on PEA Digital Utility (40%), ICT/digital innovation (40%), and Industry 4.0 (10%) while social change had an impact on disruptive leadership (6.67%).

Table 13: Frequency and percentage of change and internal and external factors that influence PEA DEI, as perceived by 20 stakeholders.

No	Change	n	%	Internal and External Factors	n	%
1.	Technological Change	16	80.00	PEA Digital Utility	4	20.00
2.	Technological Change	1	5.00	ICT/digital innovation	7	35.00
3.	Technological Change	1	5.00	Industry 4.0	6	30.00
4.	Social Change	2	10.00	Thailand 4.	3	15.00
	Total	20	100.00	Total	20	100.00

From table 13 shows that technological change had an impact on ICT/digital innovation (35%), Industry 4.0 (30%), and PEA Digital Utility (20%) on the Development of PEA DEI while social change had an impact on Thailand 4.0 (15%). The responses of 30 PEA employees on 24 items in the third part of the semi-structured questionnaire dealing with PEA DEI relating to process, attributes, result, and unique invention (shown in Fig. II). Here, 5 strongly agrees, and 1 strongly disagrees, as shown in Table 14-15.

Table 14: Frequencies and percentage of responses on PEA DEI relating to process, attributes, result, and unique inventions divided into four groups, as perceived by 30 PEA employees.

PEA DEI				
Process		**Attributes**		
Ideas (%)	Valuable realities (%)	Distinctiveness (%)	Originality (%)	Usefulness (%)
16 (53.33%)	14 (46.67%)	1 (3.33%)	2 (6.67%)	27 (90%)

PEA DEI			
Result			
New products (%)	New ways of working (%)	New strategies (%)	New business models or new ventures (%)
6 (20%)	9 (30%)	4 (13.33%)	11 (36.67%)

PEA DEI		
Unique Invention		
New values (%)	Customers (%)	Enterprises (%)
4 (13.33%)	17 (56.67%)	9 (30%)

From table 14 shows that the 30 PEA employees preferred ideas (53.33%) in process, usefulness (90%) in attributes, new business models or new ventures (36.67%) in result, and customers (56.67%) in unique inventions.

Table 15: Frequencies and percentage of responses on PEA DEI relating to process, attributes, result, and unique invention divided into four groups, as perceived by 20 stakeholders.

PEA DEI				
Process		**Attributes**		
Ideas (%)	Valuable realities (%)	Distinctiveness (%)	Originality (%)	Usefulness (%)
12 (53.33%)	8 (46.67%)	4 (20%)	1 (5%)	15 (75%)

PEA DEI			
Result			
New products (%)	New ways of working (%)	New strategies (%)	New business models or new ventures (%)
5 (25%)	2 (10%)	3 (15%)	10 (50%)

PEA DEI		
Unique Invention		
New values (%)	Customers (%)	Enterprises (%)
4 (20%)	11 (55%)	5 (25%)

From table 15 shows that the 20 stakeholders preferred ideas (53.33%) in process, usefulness (75%) in attributes, new business models or new ventures (50%) in result, and customers (55%) in unique inventions.

To develop the quality of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel.

Table 16: shows the quality of a workshop training course based on the SEP for sustainable electricity use by provincial electricity authority personnel

Items	Full scores	*M*	*SD*	Level of quality
Content	20	4.78	0.58	great
Media	20	4.50	0.58	great

According to table 16 shows that the experts greatly evaluated the content ($\bar{x}$=4.78, SD. = 0.58) and the media ($\bar{x}$= 4.50, SD. = .58) of the design of a workshop training course based on SEP for SI of sustainable electricity use for provincial electricity authority personnel.

Table 17: To determine the efficiency of a workshop training course based on the SEP for sustainable electricity use of provincial electricity authority personnel. shows the efficiency of the design of a workshop training course for provincial electricity authority personnel on sustainable electricity use based on the SEP. n = 30

Variables	Full scores	*M*	Percentage	Criteria	E_1/ E_2
The scores between training	80	65.00	81. 25	80	81. 25
Posttest training Scores	20	17.11	80.56	80	80.56

Table 17 *shows that the design of a workshop training course based on the SEP for sustainable electricity use for provincial electricity authority personnel, or E_1/E_2, was 81.25/80.56 in accordance with the specified hypothesis 80/80.*

Table 18: The Provincial Electricity Authority demonstrated significant differences in personnel learning achievement on a workshop training course based on the Sustainable Energy Plan (SEP) for sustainable electricity use.

Items	Full scores	*M*	*SD*	t	Sig.(2-tailed)
Pretest	20	14.44	0.88	4.08	0.0035**
Posttest	20	16.11	1.05		

***P<0.01*

According to table 18 shows that the significant difference between the pretest *(M = 14,44, SD = 0.88)* and posttest *(M = 16.11, SD = 1.05)* scores *of a workshop training course based on SEP for SI of sustainable electricity use for provincial electricity authority personnel* was *at the 0.01 level.*

Table 19: shows that the SEP is being implemented in a workshop training program to promote sustainable electricity use and enhance electricity production efficiency.

	Items	*M*	*SD*	Meanings
1	The design of a workshop training course based on the sufficiency economy philosophy for sustainable electricity.	5.00	0.00	Most
2	The learning content was appropriate.	5.00	0.00	Most
3	The learning time was appropriate	5.00	0.33	Most
4	The content edu, cation media, and equipment were appropriate.	4.89	0.00	Most
5	The training course provided Knowledge and experience.	5.00	0.00	Most
6	PEA personnel who attended the workshop training course on sustainable power utilization can use the activities.	5.00	0.00	Most
7	Understanding of the application of SEP concepts to energy conservation.	4.89	0.33	Most
8	Practical, hands-on training sessions were more effective than theoretical lectures.	4.67	0.50	Most
9	Management support and workplace incentives were essential in motivating personnel to adopt sustainable electricity usage.	4.78	0.44	Most
10	The training course was designed to include interactive modules and real-world case studies.	4.67	0.50	Most
11	Practical demonstrations were appropriate.	4.78	0.44	Most
12	The training session was tailored to accommodate employees' knowledge levels, attitudes, and challenges.	4.89	0.44	Most
13	Activities foster a culture of sustainable energy usage in alignment with the SEP	5.00	0.00	Most
14	The personnel could apply their knowledge to practice.	5.00	0.00	Most
15	The SEP for sustainable electricity was appropriate for training courses based on sustainable electricity use for provincial electricity authority personnel.	4.89	0.33	Most
	Total	**4.90**	**0.12**	**Most**

According to table 19 The study reveals that satisfaction among provincial electricity authority (PEA) personnel with a workshop training course based on the Sufficiency Economy Philosophy (SEP) for sustainable electricity use was the highest level. The satisfaction was highest among 30 employees, with an average of 4.90. The training course was designed to provide Knowledge and experience, fostering a culture of sustainable electricity usage that aligns with the sufficiency economy philosophy. The course included interactive modules, real-world case studies, and practical demonstrations to enhance employees' understanding of applying SEP concepts to energy conservation. Management support and workplace incentives were essential in motivating employees to adopt sustainable electricity usage. The training session was tailored to accommodate employees' knowledge levels, attitudes, and challenges, fostering a culture of sustainable electricity usage in alignment with the Sufficiency Economy Philosophy.

6. Discussion

In this analysis, we will examine the workshop training course design that makes use of the sufficiency economy philosophy in order to achieve sustainable electricity use for the personnel of the Provincial Electricity Authority. It was His Majesty King Bhumibol Adulyadej of Thailand who founded the Sufficiency Economy Philosophy (SEP), which provides a framework for sustainable growth that is based on moderation, logic, and self-reliance. The implementation of SEP into the utilisation of power has the potential to enhance the sustainable behaviours of employees working for the Provincial power Authority (PEA). The purpose of this discussion is to investigate the process of developing a workshop training programme that incorporates SEP concepts for the purpose of achieving sustainable electricity usage. Important goals of the workshop are as follows; 1) To educate and equip professionals working for the PEA with a full understanding of SEP ideas and the implications of those concepts for the use of sustainable electricity. Providing employees with concrete ideas for implementing energy conservation programmes

in their workplaces and communities is the second step in the process of cultivating competencies. The third step is to cultivate a sustainable mindset and encourage behavioural changes that are in line with the principles of energy conservation and environmental sustainability. The Sufficiency Economy Philosophy (SEP) is a developmental framework in Thailand that promotes moderation, rationalism, and prudence. King Bhumibol Adulyadej instituted it, emphasizing the middle route for all classes and governments. Empirical evidence from three local Thai administrative organizations (LAO) case studies demonstrates the application of SEP in improving public service delivery and localizing sustainable development through social innovation. The use of SEP aligns with the core principles of sustainability economic, social, and environmental balance.(Prayukvong, et al., 2023). SEP promotes economic advancement by balancing ecological economics principles with ecological integrity. It enhances corporate performance and environmental stewardship, aligning with critical period and social mobility theories. Policies at local, national, and international levels can modify social environments.(Finkel, et al., 2024). The SEP framework is a key tool in promoting sustainable practices in the workplace. It emphasizes principles like moderation, sufficiency, and resilience, which are crucial for ethical decision-making and resource management. By incorporating these principles into training programs, PEA employees can understand their impact on resource utilization and contribute to a more sustainable future. The following are the three key modules that will make up the workshop: Understanding the Sufficiency Economy is the Topic of the First Module Philosophy - In the A brief introduction to the SEP and its three core principles, which are self-reliance, reasonableness, and moderation. Implementation of SEP across multiple sectors, prioritising energy conservation. Case studies on effective SEP application in sustainable projects. Patterns of energy usage and the ecological ramifications of such patterns are covered in Module 2 of the Sustainable Electricity Utilisation course. Optimal solutions for reducing power usage in business and residential contexts. An overview of sources of renewable energy and technology that is efficient with energy. The third module focuses on the strategic action plans and practical implementation. Practical exercises and simulations for energy conservation strategies. Develop policies for the conservation of energy in the workplace that are in accordance with SEP. The community-based energy conservation initiatives will be the focus of collaborative discussions and brainstorming workshops. Methodology of Instructional Methods for the purpose of facilitating efficient learning, the workshop will make use of the following procedures: Expert speakers will provide insights on sustainable energy usage and sustainable energy production during interactive lectures. Participants will examine realistic applications of SEP in energy management through the use of case studies and participant-led group discussions. Employees will be able to use the knowledge they have gained in their working environment through the use of engaging activities such as workshops and practical exercises. Feedback Sessions and Assessments: Evaluations will be carried out in order to determine how effective the training was and to gather information that can be used to improve it. Resulting Expectations.The following are some of the things that PEA staff are expected to do once the session is over; (1) Demonstrate knowledge; comprehend and communicate the SEP principles of electricity conservation, (2)Incorporate environmentally responsible practices and make daily operations more energy-efficient by utilising energy-saving techniques, and (3) Develop action plans; implement energy saving techniques within their organisations and communities; and suggest new strategies for energy conservation. The concluding evaluation. In order to encourage PEA personnel to make more sustainable use of power, this workshop training session has been prepared in accordance with the concepts of SEP. In order to assist long-term energy conservation and environmental sustainability, this programme aims to raise awareness, cultivate skills, and promote practical implementation throughout the world. Through unceasing participation and modification, the workshop has the potential to serve as a model for the incorporation of SEP into broader sustainability initiatives within the energy industry.

7. Conclusions

When it comes to incorporating sustainability into their professional and personal practices, the workshop training course that is centred around the Sufficiency Economy Philosophy (SEP) for sustainable electricity utilisation among employees of the Provincial Electricity Authority (PEA) provides a method that is both systematic and pragmatic. Participants are able to acquire the knowledge and abilities essential to make informed decisions regarding energy that are in line with both economic and environmental sustainability when they put into practice the fundamental principles of the Sustainable Energy Programme(SEP), which include moderation, rationality, and self-immunity. Through the use of interactive learning methods, such as case studies, group discussions, and practical activities, employees are able to acquire a profound understanding of energy efficiency and conservation measures. The fact that the course has an emphasis on ethical responsibility, long-term planning, and community involvement at the local level ensures that it will foster a culture of sustainable electricity usage within the PEA. In the event that this training is successful, the staff will be able to execute SEP-driven sustainability activities in their employment and will have a greater awareness of the energy consumption patterns that they engage in. Through the promotion of responsible electricity usage, the

reduction of operational expenses, and the strengthening of Thailand's sustainable development strategy, this programme ultimately contributes to the advancement of the overarching goal of national energy sustainability. Do you think it would be more beneficial to integrate certain elements or to enhance this further.

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