FUZZY-BASED EVALUATION OF INTELLECTUAL PROPERTY VALUE FOR THE ENERGY SECTOR

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Overview

Forecasts by the International Energy Agency suggest the world's energy consumption could increase by up to 30% by 2040. To satisfy these rising energy demands, traditional methods of supplying energy are unsustainable especially considering climate change challenges. Accordingly, the World Intellectual Property Organization argues that higher levels of technological and non-technological innovations are necessary for the supply side of the energy equation, which includes cleaner energy sources, smart cities, energy-efficient industries, transportation, and future mobility, as well as enabling technologies for the optimization of energy systems, such as smart grids and new advanced energy storage technologies. Intellectual property (IP) is the cornerstone of these innovations and initiatives that are essential to technology life cycles and serve as catalysts for technical advancement in energy sector. However, for energy companies to develop and accrue IP portfolios, there needs to be an awareness of how IP value is created, captured and appropriated – a process that begins by defining and evaluating IP value.

Methods

To evaluate different forms of IP value, we developed a preliminary model comprising dimensions of IP value and prepared a questionnaire containing IP value forms for evaluation by 12 IP experts working in the energy sector. These experts are IP managers, scientists and specialists with 12 to 30 years working experience. The experts compared the dimensions and forms of IP value within the scope of investigation. We then analyse the dimensions and forms using the Fuzzy Analytical Hierarchical Process (Fuzzy-AHP) approach which involves pair-wise comparison of criteria and the use of Fuzzy triangular numbers with Fuzzy evaluation matrices and local weights.

Results

For the preliminary model, we identified six dimensions involving: (i) **market value** which centres on the market conditions, demand, and prospects for IP, (ii) **collaboration** (or enterprise) **value** which is benefits from the alignment of IP with the overall enterprise strategy and the involvement of multiple organisations for the co-creation and co-ownership of IP along value chains, (iii) **utilisation value** which is how the utilisation of IP (specifically knowledge) significantly affects economic growth and wealth generation, (iv) **motivational value** which reflects fulfilment of motives for invention with beyond monetary rewards, and in relation to aspects such as career advancement or benefits, personal satisfaction, prestige, and reputation, (v) **positional value** which is the significant role of IP in deliberately enhancing firm reputation or for blocking/ preventing competing firms from protecting or imitating similar technologies, and (vi) **technical value** for meeting operational objectives using the technical creations from IPs.

Based on these dimensions, we determined 22 forms of IP value for technological and non-technological innovations of energy companies. Preliminary assessments of these value forms using seven-point Likert scale evaluations of the different value forms, show that motivational value from “solving technical problems” (6.5 out of 7) rated top among the different forms of IP value. Market value from “higher the market share of technology based on IP” (6.2 out of 7) and “profit of technology based on IP” (6.1 out of 7), occupied the second and third place among the IP value forms. The F-AHP evaluations will take place during April 2023.

Conclusions

The foundation of modern economies relies on high-tech industries, which depend on the usage of certain forms of intellectual property. Technology development in the renewable energy sector demands a significant upfront investment from businesses and takes a lot of time (Kim et al., 2018). Hence, retaining a company's value in this sector has become increasingly dependent on patent protection . IP is a crucial economic tool for the successful commercialization and return on investment driving energy sector towards the creation of new technologies. However, the energy sector is a cross-technological industry with a constrained market coverage and extremely mature patent portfolios presenting a much lower percentage of revenues than the percentage of generated patents. According to the patent portfolio value index PPVI developed by the patent portfolio of the "Energy" sector is only partially optimized and shows many critical characteristics from a strategic standpoint (Grimaldi et al., 2018).

For the accrual of IP portfolios, it seems the defining and solving of technical problems by will spur scientists and engineers while energy market dominance and profitability will prompt energy firms. Therefore, we recommend that corporate strategies for energy firms reflect these imperatives for motivational and market value in energy transition initiatives and incentives.

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