Holistic perspective to knowledge integration for performance of renewable and sustainable energy business

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Abstract. Power generation and consumption globally has always been on the top agenda for any country since it contributes to the basic needs of human beings. In the race of bridging the supply and demand gap, human beings created side effects in the name of environmental pollution. The alternate source of energy is renewable energy, and many nations are committed to adopting these new forms of energy generation; these still contribute lesser than one-fourth of global energy consumption and power generation. This study aims to focus on knowledge integration for the performance of the renewable business segment. It creates a more practical alternative against other forms of energy generations like Thermal, natural gas-based. There are areas like a waste of energy as an example where it is still a lesser-known world. Many measurement techniques are still explored, which suggests Knowledge plays a vital role in the Business Performance of Renewable and Sustainable energy and in implementing Global Climate Control Strategies. The study results indicate the energy sector's transformation into the renewable energy sector, highlighting innovations, knowledge integration, effect on performance, and role of management & government.

1. Introduction

Energy has many usages like power generation for electricity purposes, heat exchange requirements in process industries, and other services. The most generated energy was coal (thermal), water (hydro), natural gas, nuclear, oil. As every nation needed energy for primary usage like electricity, they have invested a lot of money and decades on these forms of energy. As the gap between supply and demand, the investment expanded from the government to private in most countries. However, this also has invited climate issues like environmental pollution, which is the biggest survival challenge of the earth and a threat to the future generation.

Here comes the importance of the new form of energies or earlier lesser prioritized form of energy sources like solar, wind, biofuel, geothermal, hydro, wave, tidal. The volume of energy (MW or GW) generated by earlier forms like thermal was not easy or even sometimes impossible in the new form of energy like solar and wind. Depend on the geography and other resources each nation has. However, the technologies and investments in research have explored out-of-the-box thinking ideas, and many nations already started investing in renewable and sustainable energy. It has created opportunities for more considerable change on a global level, but due to a gap of resources, including knowledge, the target time to achieve the transformation committed by most nations is challenging. Hence knowledge
integration among organizations, nations, individuals is necessary to find out the solutions. Knowledge sharing is inevitable across organizations in such situations.

2. Methodology
There are many studies done on knowledge management, specifically within an organization. However, it is interesting to check whether knowledge integration is possible inter-organization. Here we are taking an example of an industry sector called renewable energy, on which many studies are still required because so far, nations were focusing on conventional ways of energy generation like using thermal power plants. When these conventional sources are generating much pollution, the importance of renewable energy has emerged.

2.1. Importance of knowledge integration in renewable and sustainable energy business areas
New initiatives, innovations, successful implementation goes hand in hand in any form of business. Conceptualization of ideas for such sustainable business areas is essential, like renewable and sustainable energy. Governments must make policies to give a guideline to new business forms to go in the right direction. There are researches conducted that provide inputs for policymaking in such areas. Since this takes longer than present forms of energy generation, present efforts in new sites must be analyzed, and new technologies to be suggested based on innovations and experience from different parts of the globe to get better results. In their study on this matter, the need for Consistent efforts, investments, and research were acknowledged by Foxon et al [1].

The knowledge-sharing activities shall give direction for minimization of risks, giving the motivation to attain rewards. Technologies can improve commercial aspects too when are optimized with better knowledge and information sharing. There shall be optimizations in terms of money, time, planning, and maintenance activities. The learning gets its importance in such aspects.

2.2. Secluded view on renewable and sustainable energy and the challenges in knowledge sharing between its stakeholders
Energy is the basic need for human beings irrespective of their geographical location as it helps for the development of socio-economic needs. Hence it is essential to ensure comfort level in the development of the new form of energy like renewable energy by bringing awareness of its sustainability, risks involved, benefits and remove the perception of job security for another form of energy generation company employees which are presently adopted, and which may fade away over the period. Mohammed et al [2] demonstrated from their study how the awareness of new forms of energy like renewable should bring closeness to the success among developed and developing nations.

Economically weaker countries have much more significant challenges in adapting to changes and forming renewable energy plants. Return on investment with higher tangible benefits must be elaborated with better collaboration from developed nations or companies from these countries to bring eco-balance across the globe.

Mainly renewable energy plants like fossil fuel-based are considered economically not viable compared to the present form of energy generation and conservation. The primary target to achieve the tangible benefit of pollution control or climate control is seen as a lower priority by business players or governments to balance their budget. However, the force globally brought under climate summit, time and again, brings much pressure on such players. Pietrosemoli and Monroy [3] reported three benefits from the renewable sector based on their study;

* Life quality in society
* Bringing up citizens from poverty
* Long term development assurances

They concluded that countries taking recent initiation on a larger scale for the renewable sector would need strength from developed countries. These may include knowledge sharing based on innovations made, which can come for a long time. They believe knowledge is precious in this regard. Knowledge includes angles from finance, legal, technological developments and angles from society, generally...
considered complex in such countries. The resources for renewable energy need to be identified, used optimum and distributed in a planned manner to address the maximum need with minimum cost.

3. Result and discussion

Since there is much scope for research in the modern era and many companies are competing globally, innovation is inevitable for long and sustainable performances. It is crucial to identify success factors in innovations so that they are easily adapted on a larger scale and benefit the transformation of the energy sector to the renewable energy sector.

3.1. Bio economy innovations and managing

Innovations, their usage, and optimum time implementation are always affected by other factors, as adaptability (change) is difficult for any organization or individual. In their study, Lancker et al [4] stated different factors that influenced innovation in the bio-economy sector. The innovations address how not to depend on conventional resources like fossil fuel and transition to renewable resources like bio-based. Technology and innovation are basically to help for the green revolution in the economy thru the study of best practices and their lesser or no effects on the environment. Knowledge becomes base for managing bio-economy innovations.

3.2. Metrics of knowledge integration in renewable energy sectors

- We shall now take another type of renewable energy viz’ solar to find knowledge alignment in renewable energy sector. This study also tells us barriers for knowledge integration. The learning is basically from other sectors as this sector is new to many countries.
- Jaegersberg and Ure [5] in their study on knowledge sharing focused on regional benefits while adapting to renewable energies. The study focused on job creation and developmental growth brought by solar energy.
- Understanding of alignment of experience, knowledge and people inclination is very important when we take lessons from other sectors and other regions for successful solar energy business.
- The knowledge sharing among and for the clusters is with the interest to share previous experiences, ground issues and how to deal with them and handhold smaller companies to help to implement strategies and to adhere to climate change policies. The result also expected to gauge by return on investment.

3.3. Role of knowledge-based performance measurement in renewable and sustainable energy sector

Since the renewable and sustainable energy sector is a solution to environmental problems, performance measurement is crucial. Since this is also linked to awareness of newer technologies adapted for the newer sector and its impact on the environment is successfully gauged, the optimum result is achieved only when we measure knowledge-based performance. Lerro A [6] developed a framework with the understanding that the solutions developed are for long-term sustainability, the solutions are practical and efficient. These are termed future energy sources and have an impact on the environment. The performance is measured based on present and future requirements. This performance measurement is expected to help policymakers, ecologists with newer plans, strategies, and designs for technologists.

Value creation is one of the main tasks for any organization specifically involved in new sectors and innovations. Value additions are measurable factors and provide a good insight into the renewable energy sector too. Knowledge is acquired and managed from the energy sector clusters to improve value addition, performance. Lerro A [6] in his study emphasized the necessity of understanding the value addition and its impact on the renewable energy sector. Structured value analysis is envisaged, which is felt missing in this sector, and researchers find gaps to provide solutions. It includes analysis based on the quality of knowledge and its implementation. Being the business sector, mainly the economic angle emerges more than the environmental angle, which needs to be addressed, and hence knowledge-based performance measurement becomes very important for the renewable and sustainable energy sector.
3.4. Role of governments in knowledge management and renewable sector performance

- Governments across globe have planned almost a decade ago or more for developments of low carbon society.
- Generally long-term sustainable plans made for about 15 years and more. These may be called as Renewable energy development plan.
- Governments fund for research and development activities to gain knowledge on renewable energy implementation and sustainable performance.
- Governments encourage private sector also for investment and technological developments.
- There are targets in terms of MW or GW depend on size and need of country for each sector including wind, solar, biofuel, hydro (small & big) and bio energy.
- Governments also announce schemes, subsidies, soft loans, tax holidays and tariffs. To avail the same, performance of renewable sector players should be with need to achieve desired targets.
- For instruments used in renewable energies, import duties are also exempted at many countries.
- Certain nations have formed groups to promote knowledge management and encouragements in the field of renewable and sustainable energy.
- There are energy awards given to encourage performance, one among them is ASEAN energy awards.
- Experiences are being shared thru networking of few governments for renewable energy promotion
- Goals based on region also set in the field of renewable energy.
- Governments formed partners for knowledge management viz;
  1. Japan on training every year,
  2. Korea training on safety for nuclear energy,
  3. Study visits also encouraged by Korean Govt.,
  4. Russia supporting on renewable technological cooperation etc.

Sinsukprasert P [7] presented in International Energy Efficiency Forum about many of the above details and also explained on performance standards and sustainability in energy working groups.

4. Conclusion

Studies have shown that SMEs have lesser exposure in management of environmental aspects. This concept is newly introduced in many countries and involvement of SMEs is also new.

4.1. Environmental initiatives

Renewable and sustainable energy business growth needs many initiatives, basically from a Knowledge integration point of view. These initiatives encourage management teams from SMEs to participate in conferences promoting renewable energy initiatives as explained that these initiations required from behaviors aspects too since this is related to change in SMEs that were sticking to different resources established as energy sources over a few decades. When knowledge is to integrate from experiences, SMEs need to look for inter-organizational knowledge sharing. It does not limit to technological innovations or commercial aspects. It also needs much importance for aspects like the attitude of managers in SMEs to open up for new learnings and implementation [8].

Above mentioned research also identified 5 drivers for the success of renewable energy sector growth.

a) Economical advantages: In SMEs, managers get motivated when competition is envisaged and economical angles is brought so that managers implement, perform and show numbers.

b) Financial benefits: The performance in environmental management attracts financial benefits like subsidies etc.

c) Demands of stakeholders: Stakeholders play important role in knowledge sharing, performance improvement and management of environment. Hence demand of both internal and external stakeholders inevitable in renewable energy sector

d) Legislation: All the actions for environmental management are mainly driven by legislation action as these decide strategy and policies.
Resources, Motivation and Knowledge: Profit is important for any SME. Knowledge & resources drive and motivate managers for environmental management who can look beyond profit.

4.2. Knowledge assessment

Like every business sector, the renewable and sustainable sectors as well depend on knowledgeable services. Knowledge assessment considering services in renewable energy is based on economic factors and research of commercial aspects. Knowledge also helps in creating the best performances and provide the best services.

The renewable business sector, including all players, from the government to companies, needs to increase the knowledge base in-depth, which is necessary for technological transformations and service. The tangible benefits listed under this study are: Experience from the previous job helps future jobs, understanding of customers, site details for better understanding, efficient services, higher quality, customer satisfaction, and predictive maintenance activities [9].

4.3. Environmental implications

Encouraging innovations in energy solutions: Small scale companies working for this objective need much encouragement as it has more environmental implications than making more money out of business. Innovating in this sector is slow compared to major sectors or other energy sectors. It helps to attain experience from small projects and take to a broader group of companies and innovators. These innovators are classified as; enthusiasts, utilizing, green developers [10].

Mostly renewable and sustainable energy sectors need much encouragement to grow further in existing large capacity and profit-based energy sectors. It pushes governments, organizations, and companies to adapt to changes in the business sector and style, the environment, and profit-making. Much knowledge is needed to share with those who have experience in this new sector. Resources and later implications on the environment also need to be studied. These may include measurements of environmental and analytical parameters. Accuracy of the same, manipulation if any do, and how remotely govt. Monitor and address concern areas. Hence knowledge integration across companies, organizations, and nations is required. Many initiatives are happening in this sector, but against training within the organization, if knowledge integration among organizations happens, it benefits all parties involved, the nation and our environment.

References
[1] Foxon T J, Gross R, Chase A, Howes J, Arnall A and Anderson D 2005 Energy Policy 33(16) 2123-2137
[2] Mohammed Y S, Musafa M W and Bashir N 2013 Renew Sust Rev 27 453-463
[3] Pietrosemoli L and Monroy C R 2013 Renew Sust Rev 27 683-691
[4] Lancker J V, Wauters E and Huylenbroeck G V 2016 Biomass and Bioenergy 90 60-69
[5] Jaegersberg G and Ure J 2011 J Strateg Inf Syst 20(4) 343-354
[6] Lerro A 2011 Measuring Business Excellence 15(3)
[7] Sinsukprasert P 2010 Financing Energy Efficiency and Renewable Energy: Thailand’s ENCON Fund (Astana: International Energy Efficiency Forum) p 27-30
[8] Krishna M M, Peter, Kumar M and Arokiasamy L 2012 Int J Acad Res Bus Soc Sci 2(9) 74-86
[9] Lerro A, Schiuma G, Huggins R, Prokop D and Weir M 2012 Small and Medium Enterprises: Concepts, Methodologies, Tools and Applications (IGI Global) p 441-450
[10] Nygrén N, Kontio P, Lyytimäki J, Varho V and Tapioa P 2015 Renew Sust Rev 46 79-87