INTERNATIONAL JOURNAL OF SUSTAINABLE CONSTRUCTION ENGINEERING AND TECHNOLOGY
VOL. 13 NO. 4 (2022) 205-215

IJSCET

http://publisher.uthm.edu.my/ojs/index.php/ijscet

ISSN : 2180-3242 e-ISSN : 2600-7959

International Journal of Sustainable Construction Engineering and Technology

Innovative Initiatives in Influencing the Success of Solar Energy Implementation in UAE

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DOI: https://doi.org/10.30880/ijscet.2022.13.04.018
Received 26 September 2022; Accepted 30 October 2022; Available online 13 November 2022

Abstract: This paper presents a research study that investigated the rank of the influence of innovative initiatives' groups and determined the importance of innovative initiatives to the successful implementation of solar energy adoption in the UAE. The information was gathered via a questionnaire survey and analysed descriptively. The findings of this research work include a ranking analysis of the groups of innovative initiatives, which revealed that administrative innovation ranks first, followed by incremental innovation, technical innovation, radial innovation, process innovation, and finally product innovation in influencing the success of solar implementation in the UAE. For decision on the innovative initiatives on its importance to the successful implementation of solar energy, it was found that technical innovation (RII = .87) appeared as the most important innovation initiative that drive solar energy implementation. This is followed by Incremental innovation (RII =.797), Radical innovation (RII =.773), Process innovation (RII =.764), Administrative innovation (RII =.745), and finally Product innovation (RII =.698). The findings of this study contribute to the body of knowledge on innovative initiatives in successful solar implementation, as well as to the parties involved in solar project implementation.

Keywords: Innovative initiatives, successful solar implementation, UAE

1. Introduction

Globally, energy is inevitably required to power homes, commercial properties, industries, desalination, transportation infrastructures, institutional buildings and day to day running of human lives. The energy comes from the renewable and non-renewable sources. The greatest share of the energy source globally comes for the non-renewable source using fossil fuels such as coals, diesel, natural gas, etc. This energy source emits substantial greenhouse gases that are deleterious to the environment. Several concerns haves been raised on the sustainability of this energy source. There is gradual commitment towards migrating from the non-renewable energy sources to the more sustainable renewable sources. This concern is also applicable within the context of United Arab Emirate (UAE) energy consideration (Poullikkas, Zueter, & Dirar, 2015).

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The UAE is among the top oil and gas producing countries in the world. It has about 98 billion barrels of oil reserve which makes it seventh in the world ranking. It is also ranked seventh in natural gas reserves. The country is among the 10 top oil producing countries in the world. However, despite this oil and natural gas resources of UAE, it is still a net importer natural gas (Poullikkas et al., 2015). This is due to increasing energy demand in the UAE. The UAE has increasing energy consumption over the years. This increasing energy demand has compelled the country to increase the use of the traditional energy generation to non-renewable means. This significantly increased the greenhouse gases emissions (AlFarra & Abu-Hijleh, 2012a; Poullikkas et al., 2015). This led to sustainability concern associated with the conventional energy sources. Thus, the need to explore sustainable means to reduce the emission of the Carbon Dioxide (CO_2).

The sustainability concern has made the UAE to consider alternative energy sources to meet the increasing energy demand as well as reduce the emission rates of CO_2. The UAE energy policy considers diversifying the energy source using both the renewable and non-renewable sources. The UAE plan to have up to 44 per cent of the total energy mix from renewable/clean sources by 2050. The energy from non-renewable sources are planned to be reduced to 38 per cent (Alzaabi & Mezher, 2021). The short-term frame of the policy enacted in 2009 anticipated at least 7 per cent of the energy sources to come from renewable sources (Jamil, Ahmad, & Jeon, 2016a). The alternative sustainable energy sources include the carbon capture and storage technologies, solar energy, wind energy, wave energy and even nuclear energy (AlFarra & Abu-Hijleh, 2012b). These sustainable energy sources significantly reduce the emission of CO_2 and are renewable thereby not adversely affecting the future generations (Mokri, Aal Ali, & Emziane, 2013a). Of the renewable energy sources, the solar energy has the highest potential (Poullikkas et al., 2015; Salim & Alsyouf, 2020). For instance, the average wind speed in UAE was found to be 5.1 m/s which is not optimally viable due to moderate speed. There are also security concerns and the disposal of the waste water associated in nuclear energy. The wave energy also has associated concerns of disruption the ecological balances in the oceans (Mokri, Aal Ali, & Emziane, 2013b). Thus, the solar energy overcomes such concerns. With the abundance of solar radiations in UAE the potential of the solar energy in UAE is considered by the UAE government (Jamil, Ahmad, & Jeon, 2016b). Various solar energy parks have been installed in the UAE and connected to the grid. However, there are limited studies on the effectiveness and success of the solar energy relative to the conventional sources. The role of innovation in enhancing such effectiveness needs to be ascertained.

Countries around the world recognise innovation as a cornerstone of social and economic development. Thus, they are continuously developing national innovation strategies and frameworks. It is defined as what individuals, the private sector and governments want to achieve development by introducing new products, services and businesses that improve quality. It is the key to providing employment opportunities. Economies are increasingly driven by innovations, including but not limited to, technological innovation. They increasingly emerge as solutions to problems on the ground and follow a bottom-up evolution at an increasing pace. Asia is not left behind in this trend. This means that governments and the international community need to create and reinforce favourable conditions to drive innovation including the energy areas. UAE imbibed this call and is in the fore front in innovation in the world.

United Arab Emirates has always been recognized as a symbol of innovation and creativity, enhancing its social and economic status, and at an unprecedented pace, transformed into the first destination of talent and business achieved. UAE leadership thinks that innovation is the future of human investment and emphasizes the importance in all fields through the UAE Vision 2021 (Ahmad, Abu Bakar, & Ahmad, 2019; Almuraqab, 2016; Ameen, Almari, Isaac, & Mohammed, 2019). “Innovation, research, science and technology are the pillars of a knowledge-based, productive and competitive economy by entrepreneurs, a business-friendly environment where public and private sectors form effective partnerships.

UAE National Innovation Strategy (NIS) aims to create culture of innovation embedded among individuals, businesses and governments. It focuses mainly on identified priority areas that will drive future innovation. The NIS framework is organized around the following key pillars as figure 1. The figure shows the priority areas for innovation in UAE which renewable and clean energy is part of. Given the rising demand for energy, many countries around the world need to innovate renewable and clean energy. Thus, the global tendency to diversify energy sources and provide access to sustainable energy to future generations ensures that they have a better lifestyle. The United Arab Emirates has many existing projects related to renewable energy and clean energy, such as Masdar, Mohammed Bin Rashid Al Maktoum Solar Park and Emirates Nuclear Energy Corporation. NIS develop related energy industries within the United Arab Emirates, promote useful investigation on renewable energy and fresh energy technologies, increase the competence of energy networks and storage, and further shift to distributed energy generation through supply, promote the cleaning of renewable energy, with a tariff program. Thus, this research evaluates the innovative initiatives which influencing solar energy implementation success in UAE.

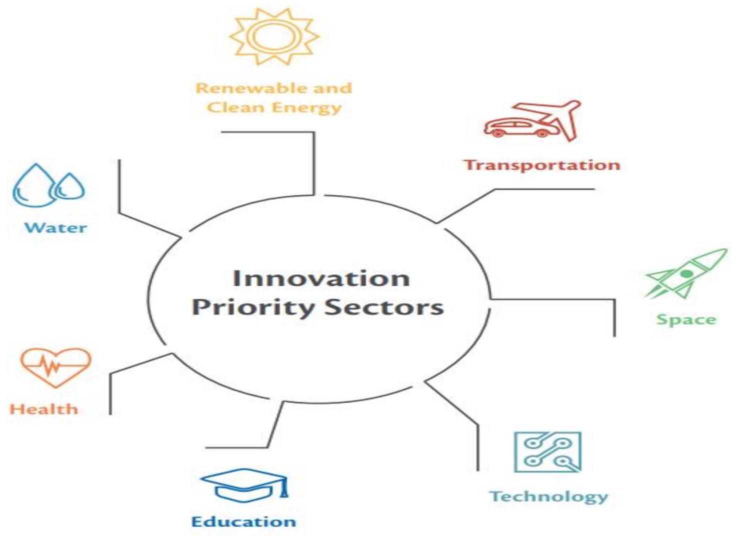

Fig. 1 - Innovation Strategy Sector

2. Innovative Initiatives Influencing Solar Energy Implementation Success

There are many initiatives in influencing the solar energy implementation success. These initiatives are clustered into six groups as elaborated in the following parts.

2.1 Administrative Innovation

Many of the changes required to transform the energy system start with modifying existing configurations of technologies, services, or practices for use at a smaller scale (Ornetzeder, & Rohracher, 2013). Some of these innovations are developed by people and organizations located at the bottom of a system's pyramid, such as users, community groups, voluntary associations, and cooperatives. These bottom-up innovators create grassroots solutions for sustainable development that respond to the local situation and the interests and values of the communities involved (Seyfang, & Smith, 2007), usually as matters of necessity and in response to challenges that are not addressed adequately by actors with more power (Hilmi, 2012).

The administrative innovations involve organizational structure and administrative processes. These innovations are indirectly related to basic activities of the organization and more directly to the management of those activities (Wadin et al., 2017). Administrative innovations are facilitated by low levels of professionalism, high formalization and" high centralization.

This study relies on types of innovation factors to explain the effects of administrative innovations on sustainable energy in UAE. Researcher argues that there is a curvilinear relationship between implementation and sustainable energy infrastructure. Administrative innovations shed new light on the often documented problem of implementation failure (Khanna & Nerkar, 2016). Many studies refer to implementation dichotomously: the organization either has or has not implemented the innovation (Staw and Epstein, 2000).This study measures the degree of implementation, rather than relying on the dichotomous measures upon which most past research depended (Douglas & Judge, 2001). We explain organizational performance with a variety of measures, subjective and objective, at the operating and firm levels, and test our pro-posed model on a large, multi-industry sample. Finally, this study will develop the new model/framework for innovation in developing sustainable energy infrastructure in UAE.

2.2 Technical Innovation

The technical innovations refer to products, services and technologies in the production process. They relate to basic activities of an organization and focus on product or process (Wadin et al., 2017). Besides, the increasingly grim problems of climate change and energy security, many countries have been searching for solutions to not only mitigate greenhouse gas emissions but also guarantee the security of energy supply. Sustainable energy can achieve environmentally sustainable development, reduce dependence on foreign resources and meet the energy demand related to economic growth. Sustainable energy development has become an important part of the national energy strategy in many countries. After the signing of the Kyoto Protocol in 1997, many countries have gradually unveiled a series of energy policies in order to accelerate the development of renewable energy. The average annual growth rate of the global sustainable energy consumption was 1.89% for the period 1990–2009. According to the forecast of the

International Energy Agency (IEA), the average annual growth rate of the global sustainable energy consumption will be 3.13% for the period 2009–2035. As a result, the renewable energy share of the global energy consumption will increase from 13% in 2009 to 18% in 2035, and the renewable energy share of the global electricity generation will increase from 18% in 2009 to 30% in 2035 (IEA, 2011)1. In the foreseeable future, accelerating the development of renewable energy will continue to be important for the national sustainable energy strategy in many countries. However, sustainable energy development is subject to the economic situation, resource abundance and environmental conditions. In order to promote sustainable energy development effectively, it is essential to grasp the long-term trend of sustainable energy development, differentiate the external and internal driving factors that influence sustainable energy development under the international economic situation, low-carbon development and technical revolution environment, and formulate pertinent energy policy and various corresponding economic and environmental policy measures.

The technical and economic aspects of integrating larger shares of sustainable into electricity grids becomes increasingly challenging. There is a major emphasis on innovation in enabling technologies that can help integrate variable sustainable into electricity systems, including storage; smarter electricity systems that include the widespread integration of digital and so-called exponential technologies such as artificial intelligence; and technologies to increase the flexibility of energy demand.

Furthermore, technological innovation to improve the efficiency of energy-using products and systems lead to lower energy consumption and reduced environmental impacts? This debate, ultimately about the impact of technological change upon economic growth, stretches back to the mid-19th century. Then Stanley Jevons in his famous work The Coal Question of 1865 argued that improved efficiency in coal use would lead not to a reduction in national coal consumption, but rather to an increase (Alcott, 2005). As Jevons said: It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth. Every improvement of the engine, when effected, does but accelerate anew the consumption of coal. Similar arguments are heard today: that improved energy efficiency will lead to lower national energy consumption and is thus a way to reduce carbon emissions. So can technical innovation help to reduce energy consumption?

2.3 Process Innovation and Sustainable Energy Effectiveness

Process innovations are new elements introduced in the various processes carried out at the level of the organization. The adoption of product innovations and the process are different in various stages of the organization development (Van Der et al., 2015). Industry is the major sector that consumes resources and emits pollution (De Marchi, 2012). Process innovation helps to solve environmental problems in the manufacturing process. It can increase resource productivity as well as energy usage efficiency and decrease pollution during production (Christmann, 2000). In addition, process innovation is also a necessary condition for green product innovation (Voss & Voss, 2008). Product innovation is often accompanied by process innovation. No matter whether in the R&D stage, the pilot production stage or the large-scale production stage, all need process innovation to provide condition (Mantovani, 2006). As long as firms have first made significant progress in the implementation of process innovation, they will be able to successfully adopt product stewardship (Hart, 1995). Process innovation is the most basic building block of green innovation (De Marchi, 2012). In spite of its important role, the research on process innovation in prior literature has been relatively insufficient (Lee & Kim, 2011). In this study we focus specially on process innovation.

Process innovation is purposefully focused on the production process. Although it is novel to the focal firm, it can be exploited or applied to reduce environmental risk, pollution emission, and other negative impacts (Cainelli, & Grandinetti, 2015). The literature has identified some forms of green process technology such as clean production, pollution control, pollution prevention, eco-efficiency, and recirculation (Sharma, & Henriques, 2005). Although performance, including economic performance and environmental performance, is widely used by most prominent literature to measure the business outcome derived from firms' innovation (Berrone, & Gomez- Mejia, 2013 and (Wagner, 2015) an improved eco environment cannot be appropriated by the green innovators completely considering the externality feature of environmental issues (Berrone, & Gomez- Mejia, 2013). Environmental performance may not bring in economic performance directly (Wagner, 2015). As economic entities, firms' managers and shareholders may pay more attention to its benefit when they devote to green innovation (Mitchell, & Wood, 1997). So we use benefit to measure the outcome of firms' process innovation.

2.4 Product Innovations and Sustainable Energy Effectiveness

Product innovations are "represented by the new products or services introduced to meet the needs of the market. Such innovations are reflected in new products or services on the market to the benefit of customers (Wadin et al., 2017). Some Dutch energy initiatives have also produced innovative technological solutions. Examples include an experimental church heating and ventilation system that increased energy efficiency as well as comfort, and a hydroelectric power station that has been integrated into a sluice gate. These cases show that local energy initiatives tinker with technologies and methods for their implementation, leading to innovative arrangements of localities, actors, and technologies. De Vries et al. conceptualize these outcomes as "configurational user innovations", which they define as "user designed arrangements of loosely related sets of components" (p.51). Innovation can thus be understood as the alignment of technical components, people, organizations, policies, business cases, physical characteristics of the site, skills, and local goals and values in a network.

2.5 Radical Innovations and Sustainable Energy Effectiveness

Radical innovations are represented by the fundamental re-conceptualizing of a business. This type of innovation can be approached on three levels: product (new ideas or technology), process (new methods of product and services delivery to consumers) and the combination of the two levels mentioned above (Van Der et al., 2015).

Technological innovation can be defined as the process by which new or improved products or processes are created and introduced into the market. The origin of the radical- incremental dichotomy in the literature is most commonly traced to the economist Joseph Schumpeter (Freeman 1992; Dahlin & Behrens 2005). Schumpeter (1935; 1942) placed far greater emphasis on the discontinuous nature of technological change than on smaller, more gradual improvements.

Radical innovation has generally been characterized in two distinct ways. First, as rare events (Tushman and Anderson 1990) that result from a stroke of individual genius or luck (Mokyr 1990). These innovations can be unpredictable, incorporating a dimension of "surprise" (Criqui, Martin et al. 2000). The historian Joel Mokyr (1990: 13) referred to macro-inventions as those that require one to step outside accepted practice and design "an act of technological rebellion and heresy.

2.6 Incremental Innovation and Sustainable Energy Effectiveness

The incremental innovation refers to improving products, services and the existing" processes. The "architectural innovation (Cantillo et al., 2016) is the kind of innovation that changes only the architecture of a product without influencing its components. The distinction between the product as a system and the product as a set of components challenges the idea that successful development of a product requires the use of two types of knowledge: about the components of a product and the product architecture, i.e. how those components are integrated and linked to form a coherent" whole. The essence of the architectural innovation is the reconfiguration of the existing system by integrating existing components in "a new way so that to form a coherent whole. Another classification of innovation is given by Thompson (2004): creative innovation adoptive innovation. Creative innovation refers to the ability of the organization to implement and carry out technological innovation through its own system, usually materializing in new products or services.

Adoptive innovation, on the other hand, refers to the ability to use new ideas from outside the organization, adapting those ideas to implement change in the management system of the organization or in the relationship between the system's components. An adoptive approach to innovation is addressed mainly to areas such as strategy or management by processes leading to new" strategies, to a new company image or to new organizational structures.

3. Method and Data

This study is on identifying innovative initiatives in influencing the success of UAE solar energy implementation success. It adopted a quantitative approach where data was collected through questionnaire survey. This study has identified 18 innovation initiatives clustered into six groups namely technical innovation; technical innovation; process innovation; product innovation; radical innovation and incremental innovation. These initiatives were used as the main contents in the questionnaire development. Respondents were requested to rate the degree of influence of these initiatives toward the success of solar project implementation using 5 points Likert scale. The survey adopted simple random sampling technique in respondents' selection.

A total of 500 questionnaires were distributed to the targeted respondents in the study area. Out this number, a total of 291 were successfully retrieved, which represents about 73% response rate. Among the retrieved questionnaires, two were incomplete, thus making them invalid. This implies that only 289 valid questionnaires were used in the analysis. The collected data was analysed descriptively to determine the objectives of this study which are to determine the rank of the innovative initiatives and the decision on the level of influence of the initiatives toward the success of the solar implementation in UAE. Table 1 shows the distribution of the questionnaire statistics.

Table 1 - Questionnaire distribution statistics

Items	Frequency	Percentage
Total questionnaire distributed	500	100
Total returned	291	58.2
Total valid	289	57.80

The demographic characteristics of the 289 valid responses from of a UAE employees of energy sectors. Respondents is as in table 2.

Table 2 - Demographic characteristics

Items	Frequency	Percent
Gender		
Male	206	71.3
Female	83	28.7
Total	289	100.0
Age		
18-30 years	38	13.1
31-40 years	156	54.0
41-50 years	89	30.8
Above 51 years	6	2.1
Total	289	100.0
Education		
Secondary certificate	21	7.3
Diploma	70	24.2
Degree	122	42.2
Master degree	67	23.2
PhD	9	3.1
Total	289	100.0
Years of Experience		
Less than 5 years	34	11.8
5-10 years	81	28.0
11-15 years	157	54.3
above 15 years	17	5.9
Total	289	100.0

The gender distribution shows in table 2 approximately 71% are male while about 29% are female. Analysis of the age of the respondents shows that slightly more than 50% are aged between 31-40 years. About 31% indicated that they are aged between 41-50 years. Exactly 6 respondents are above 50 years while only 13.1% are in the 18-30 years age category. Information about the educational attainment of the respondents shows that majority have Degree (42.2%). About a quarter of the respondents have Diploma and Master each. Exactly 7.3% indicated that they have secondary certificate while only 3.1% possess PhD. The analysis further revealed that more than half of the respondents (54.3%) have 11 to 15 years' experience. Twenty eight percent indicated that they have 5 to 10 years' experience. About 12% of the respondents have less than 5 years' experience while only about 6% indicated that they have more than 15 years' experience.

4. Descriptive Analysis on The Collected Data

4.1 Reliability Test

Constructs that have multiple items are required to be internally consistent to have reliability. This implies that the items under the construct should be highly related. Reliability is the degree to which research measurement is free from random error and the extent to which a scale used produces consistent results if repeated measurements were made on the variable concern (Pallant, 2011; David Sutton, 2012). The most common measure of reliability is Cronbach's alpha. Cronbach's alpha measures the reliability of the measurement scale. For internal consistency to be achieved, Cronbach's alpha is required to be above 0.7 (Joe F Hair, Sarstedt, Ringle, & Mena, 2011; Memon & Rahman, 2014; Pallant, 2011; Wong, 2013b). Accordingly, the reliability of the research initiatives groups is evaluated using Cronbach's alpha as presented in Table 3.

Table 3 - Results of reliability test

Innovative initiatives groups	Code	Number of factors	Cronbach's Alpha
Technical Innovation	AI	3	0.859
Technical Innovation	TI	3	0.809
Process Innovation	PcI	3	0.849
Product Innovation	PtI	3	0.790
Radical Innovation	RI	3	0.842
Incremental Innovation	II	3	0.868

The internal consistency of the research initiatives groups was measured using Cronbach's alpha, which is presented in Table 3. The results indicate that Cronbach's alpha value for all the constructs were above the recommended 0.7 minimum. Hence, all the research initiatives groups were internally consistent and reliable.

4.2 Normality Test

Normality test is one of the important preliminary analyses required whenever a multivariate analysis is conducted. As applicable in the case of outlier diagnostic, normality of data is tested at both univariate and multivariate levels. In order to test for univariate normality, the researcher proposed skewness and kurtosis measures (Pallant, 2011; Hair et al., 2010, Tabachnick & Fidell, 2013). Based on the skewness and kurtosis criterion, a variable is said to be normally distributed if the values of the two lies within ±2 standard errors of the respective measures (Pituch & Steven, 2016). Table 4 shows the skewness and kurtosis measures of the initiatives of the research.

Table 4 - Skewness and kurtosis measures

Code	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Initiatives							
AI1	289	4.29	.695	-.455	.143	-.869	.286
AI2	289	3.90	1.026	-.568	.143	-.808	.286
AI3	289	4.07	.728	-.107	.143	-1.101	.286
TI1	289	4.40	.610	-.481	.143	-.639	.286
TI2	289	3.85	.966	-.723	.143	-.356	.286
TI3	289	3.69	.834	-.113	.143	-.574	.286
PcI1	289	4.01	.589	-.003	.143	-.091	.286
PcI2	289	3.84	.905	-.168	.143	-.971	.286
PcI3	289	3.65	1.160	-.251	.143	-1.392	.286
PtI1	289	3.50	1.310	-.439	.143	-.962	.286
PtI2	289	3.47	.726	.170	.143	-.235	.286
PtI3	289	3.58	.979	-.117	.143	-.981	.286
RI1	289	3.72	.985	-.470	.143	-.487	.286
RI2	289	4.05	.869	-.638	.143	-.279	.286
RI3	289	3.92	.884	-.451	.143	-.398	.286
II1	289	3.78	1.111	-1.214	.143	1.154	.286
II2	289	4.11	.919	-.958	.143	.195	.286
II3	289	4.11	.995	-.806	.143	-.522	.286

The result indicates that all the initiatives are normally distributed because none of the initiatives have values exceeding the recommended threshold of ±2 standard errors.

5. Results

5.1 Ranking of Innovative Initiatives Groups

A 5-point Likert scale was used throughout this research. A mean score generated from the analysis of the collected data was used to rank the initiatives. This research adapted the mean score based on the works of Kasim et al. (2013), Hassanain and Iftikhar (2015) and Abdullahi (2017). However, if more than two innovative initiatives having same mean score than the rank is decided with standard deviation value. Initiative having less standard deviation value is rank higher than the other. The results of this analysis are as in Table 5.

Table 5 - Innovative initiatives

Code	Indicator	Mean	Standard Deviation
AI1	The renewable energy administrative processes were innovative	4.29	.695
AI2	The structure of our organisation is novel towards achieving success	3.90	1.026
AI3	The management of our organisation is innovative	4.07	.728
	Administrative Innovation	**4.09**	**.816**
TI1	Our organisation integrates system and data processes in an innovative manner	4.40	.610
TI2	We use innovative technologies for the achievement of our goals	3.85	.966
TI3	Our renewable energy production processes are innovative.	3.69	.834
	Technical Innovation	**3.98**	**.803**

PcI1	We introduce novel elements in our operations regularly	4.01	.589
PcI2	The processes at our organisation are innovative and flexible	3.84	.905
PcI3	Our organisation adapt to changing needs	3.65	1.160
	Process Innovation	**3.83**	**.885**
PtI1	We render innovative services to our customers	3.50	1.310
PtI2	Our solar energy is innovatively packaged	3.47	.726
PtI3	Our products are based on the needs of solar energy stakeholders	3.58	.979
	Product Innovation	**3.52**	**1.005**
RI1	We always re-conceptualise our services to meet the changing needs	3.72	.985
RI2	We provide additional innovative products to satisfy the needs of our stakeholders	4.05	.869
RI3	We reconfigure our services regularly to meet global best practice	3.92	.884
	Radical Innovation	**3.90**	**.913**
II1	Our organisation strives to improve its services	3.78	1.111
II2	Our organization strives to improve its products	4.11	.919
II3	Our organisation always improves its processes	4.11	.995
	Incremental Innovation	**4.00**	**1.008**

The values of mean scores and standard deviations for each innovative initiatives were averaged and the rank for the initiative groups are as in table 6.

Table 6 - Rank of the innovative initiatives' groups

Innovative initiatives groups	Means	Standard deviation	Rank
Administrative Innovation	4.09	.816	1
Technical Innovation	3.98	.803	3
Process Innovation	3.83	.885	5
Product Innovation	3.52	1.005	6
Radical Innovation	3.90	.913	4
Incremental Innovation	4.00	1.008	2

Table 6 shows the rank of the innovative initiatives' groups that influence the success of solar implementation in UAE. The highest rank is administrative innovation, follows by incremental innovation, technical innovation, radial innovation, process innovation and finally, product innovation.

5.2 Decision of Innovative Initiatives Influence Level

In order to determine the influence level of the innovative initiatives in influencing the success of solar energy implementation in UAE, a descriptive analysis using Relative Importance Index (RII) was conducted on the pooled data obtained from the questionnaire survey. The RII was computed using the formular:

$$RII = \sum \frac{w}{AN} \times 100$$

Where:

W = is the weight of given to each items by the respondents, range from 1 to 5; such that 1 the least implying (Strongly Disagree and 5 the highest implying (Strongly Agree).

A = is the highest weight (5 in 5-point Likert scale)

N = Number of respondents

The decision rule for interpreting RII is as presented in Table 7.

Table 7 - Decision criteria for interpreting RII (adopted from Akadiri, 2011)

RII value	Importance level	
$0.8 \leq RII \leq 1$	High	H
$0.6 \leq RII \leq 0.8$	High Medium	H-M
$0.4 \leq RII \leq 0.6$	Medium	Medium
$0.2 \leq RII \leq 0.4$	Medium-Low	M-L
$0 \leq RII \leq 0.2$	Low	L

Table 7 shows the result of the descriptive statistics on the initiatives that are deemed capable of influencing successful implementation of solar energy. By referring to table 4, the decision for each innovative initiatives are classified either high, high medium, medium, medium-low and low as in table 8.

Table 8 - Decision on the innovative initiatives

Code	Indicator	RII	Decision
AI1	The renewable energy administrative processes were innovative	.612	H-M
AI2	The structure of our organisation is novel towards achieving success	.851	H
AI3	The management of our organisation is innovative	.772	H-M
	Administrative Innovation	**.745**	**H-M**
TI1	Our organisation integrates system and data processes in an innovative manner	.811	H-M
TI2	We use innovative technologies for the achievement of our goals	.876	H-M
TI3	Our renewable energy production processes are innovative.	.733	H-M
	Technical Innovation	**.807**	**H**
PcI1	We introduce novel elements in our operations regularly	.800	H
PcI2	The processes at our organisation are innovative and flexible	.765	H-M
PcI3	Our organisation adapts to changing needs	.728	H-M
	Process Innovation	**.764**	H-M
PtI1	We render innovative services to our customers	.695	H-M
PtI2	Our solar energy is innovatively packaged	.687	H-M
PtI3	Our products are based on the needs of solar energy stakeholders	.712	H-M
	Product Innovation	**.698**	**H-M**
RI1	We always re-conceptualise our services to meet the changing needs	.736	H-M
RI2	We provide additional innovative products to satisfy the needs of our stakeholders	.804	H
RI3	We reconfigure our services regularly to meet global best practice	.779	H-M
	Radical Innovation	**.773**	**H-M**
II1	Our organisation strives to improve its services	.750	H-M
II2	Our organization strives to improve its products	.820	H
II3	Our organisation always improve its processes	.821	H-M
	Incremental Innovation	**.797**	**H-M**

As displayed in the Table 8, the RII result shows that all the analysed innovation initiatives are important to the successful implementation of solar energy. The RII importance level range from High-Medium to High. Specifically, technical innovation (RII = .87) appeared as the most important innovation initiative that drive solar energy implementation. This is subsequently followed by Incremental innovation (RII = .797), Radical innovation (RII = .773), Process innovation (RII = .764), Administrative innovation (RII = .745) and lastly Product innovation (RII = .698).

6. Conclusion

This paper presents a research study in investigating the rank of the influence of innovative initiatives' groups and in deciding the innovative initiatives on its importance to the successful implementation of solar energy initiatives implementation in UAE. The data was collected through a questionnaire survey and analysed descriptively. The findings from this research work are the ranking analysis of the innovative initiatives' groups. It was found that the highest rank is administrative innovation, follows by incremental innovation, technical innovation, radial innovation, process innovation and finally, product innovation in influencing the success of solar implementation in UAE. For decision on the innovative initiatives on its importance to the successful implementation of solar energy, it was found that technical innovation (RII = .87) appeared as the most important innovation initiative that drive solar energy implementation. This is subsequently followed by Incremental innovation (RII = .797), Radical innovation (RII = .773), Process innovation (RII = .764), Administrative innovation (RII = .745) and lastly Product innovation (RII = .698). The findings from this study contribute to the knowledge on the innovative initiatives in the success solar implementation and help the parties involved to the implementation of solar project.

Acknowledgement

The authors would like to thank the Universiti Teknikal Melaka Malaysia (UTeM) for the support and opportunity to conduct this research.

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