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Building Innovative Ecosystem in an Exploratory Projects for better value creation in project-based organizations – A case study

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Abstract. This paper is about the management of exploratory projects. These are the projects where the goals and the means to accomplish them are not defined at the beginning of the project. The only thing that can be certain is the required ecosystem innovation management at the start. This report also examines the current experiences in the field of solar power projects. The paper analyzes the practiced project management approach on solar energy projects in order to show the proper ecosystem for these projects.
The Solar Park Project is one of UAE's local utility authority and used as the case for this study. The following research discusses and analyzes the active strategies and models used for the solar park project. The results display the best solutions related to exploratory projects, more specifically the ones used in creation of an ecosystem innovation for better value creation.
Keywords: exploratory projects, ecosystem innovation, solar energy project.

Introduction

These days, learning, investigation, simulation, regeneration, and technological change play a major role for businesses when it comes to strengthening competitive advantage and improving organizational performance (March, 1991).

Since the 1960s, project management approach has extended into all types of industries and businesses. However, project management approach cannot solve requirements for building innovative systems and new projects. It is also lacking when facing unexpected issues.

When a firm is developing radically new technology or a breakthrough project, old-style management approach does not work. This is because the traditional way of conducting business forced management to get back to the plan instead of changing direction and learning new things in order to resolve the unforeseen difficulties (Dodgson et al., 2013).

Project management experts know that projects and desire for innovation affect one another in businesses. Special purpose projects help an organization grow and sustain its accomplishments, yet they also play a fundamental role in the course of innovation (Dodgson et al., 2013). Still we see a big gap between the fields of project management and innovation management with a lack of communication between the two fields (Lenfle, 2008; Lenfle, 2016).

Interestingly we saw a new wave of studies that examined the variance techniques in which businesses use projects to manage the uncertainties linked with innovation practices and results (Dodgson et al., 2013; Lenfle, 2008).

To be more precise, the rational understanding of project management is not suitable with the concept of innovation. Projects involve building defined, clear goals within a planned duration of time, within a specified amount of cost and quality requirements. Innovation on the other hand

involves discovery where we do not necessarily know the final product or how long it would take to develop it (Van de Ven, et al., 1999; Lenfle, 2012).

The desire to merge the two ideas in one field gives rise to the prospect of studying the management of exploration projects (Brady & Davies, 2004; Lenfle, 2008; Lenfle, 2012). Research can also focus on finding an effective ecosystem for exploratory projects.

However, we find that there is a limitation of the dominant model or the optimal scheme of project management for managing such innovative-exploratory projects (Lenfle, 2016). The gap in the field of study gives us the opportunity to elaborate more about the role of exploratory projects in innovation-based competitive environment. We can also research on how they constitute an ecosystem innovation for value creation to project-based organizations.

The aim of this paper is to dig through the existing literature that links innovation and exploratory projects in a single ecosystem. The paper will particularly focus on a case study about a solar energy project. To support the proposition of this article about exploratory projects and innovation it is essential to determine the value creation for the firm in the end.

This paper consists of the following: Section 2 shows the literature review about ecosystem and exploratory projects. Section 3 presents the methodology of the study as well as the case study of solar park project. Section 4 consists of the case study discussion. The conclusion and final discussion comes in section 5.

Literature Review

This section examines and critically evaluates the previous studies on the management of exploratory projects and ecosystem innovation formation. We also focus on how the exploratory projects can establish an innovative ecosystem while emphasizing on gaps in the literature.

Exploratory projects features

Exploration is the process of gathering information or new ideas through adaptation, experimentation, variation, search, learning, risk taking, discovery, development or innovation (March, 1991).

In business settings, companies are always exploring new products and services to improve their offering to customers. For businesses, the trickiest situations are those in which neither the customer desires a new product nor the technology is recognized. This can happen particularly at the commencement of a new product launch.

In such circumstances, “Exploration” can help to understand the situation better. When a business chooses to try out new things, the project enters an exploration process where it is led by uncertainty and experimentation (Lenfle, 2008).

Differences between Exploratory and Traditional Projects

It is very important to differentiate between the exploratory projects and the traditional ones (Lenfle, 2016, 2012, 2008; Dodgson et al., 2013; McGrath, 2001; Van de Ven et al.,1999; Maniak et al., 2014; March, 1991). Hence, as per number of research studies related to exploratory project prototypes, researchers have declared the key features or characteristics of projects as the following:

Unclear Strategies:

As suggested by March in 1991, a degree of exploration is critical in organizations. In exploratory projects, there is no clear definition for the goals and procedures at commencement. Goals and ideas are developed during later stages in exploratory projects. This is what makes them dynamic. Thus, no predefined goal is required in early stage. Since a project without vision can be less effective, a control-oriented method is used during innovation, usually in the form of exploitation-oriented assignments.

A Range Of Time Limits And Urgency:

In exploratory projects, managers need to prioritize on short-term project phases in order to deliver the first edition of the products or services in development. They should pay attention to other phases that need to be explored later as the project progresses through various stages.

No Specific Results of the Projects:

Another difference between traditional projects and exploratory projects is the details of the "results" achieved. Exploratory projects do not necessarily end with physical objectives achievement.

Exploration of New Knowledge:

Experimentation plays a central role in exploratory projects according to numerous literature pieces that have endorsed on innovation management. Hence, adaptation in exploratory projects depends on trial-and-error learning, flexibility, and management's judgment to cope with unpredictable conditions facing a project and the failure to forecast the future. Exploratory projects provide support for original opinions, support an unfamiliar setting or help businesses build new capabilities.

A Practical Approach:

When there is no clear demand from the customers' side, a business cannot undertake production for goods and services. This raises problems like feasibility and justification of the project in the organization. Exploration projects normally suffer from their failure to guarantee the required return because of their uncertain nature and the governing logic of the firm. Uncertainty about customer identification and their requirements are also hurdles for such projects.

A New Type of Project

In terms of logic, method and results, we have a new type of project that has emerged during the past two decades. It deals with the emergent and strategic role of innovation-based competition. There is a major need of developing specific principles for these types of projects as identified by a number of researches (Lenfle, 2008; Lenfle, 2016; Dodgson et al., 2013).

In addition, as exploratory projects are "experimental learning processes", it is important to develop methods that will support managers assess the "progress" of such projects. Project leaders must evaluate the "products" they deliver, as well as the knowledge they create (Iansiti & Clark, 1994) after exploration. However, for this study we will focus on the role of exploratory projects in ecosystem innovation creation (Lenfle, 2016).

To be specific, the challenge is how to manage these types of projects (Gillier et al., 2014) where goals are identified throughout the project and subject to changes. For these projects, time is complex, phases are intersected, new knowledge has to be built, and results are varied. This creates a need for main enquiry for the researchers, especially the ones that link with innovation management (Lenfle, 2016).

Framing ecosystem innovation management

Before diving into the "ecosystem innovation management" concept, we need to know the definition of each part.

Ecosystem

The definition of ecosystems as per Dictionary.com is "any system or network of interconnecting and interacting parts, as in a business: Example, the success of Apple's ecosystem depends on hardware/software integration. Manufacturers, retailers, and customers are all part of the automotive industry's ecosystem."
Another comprehensive definition of an ecosystem proposed as per related publications on ecosystem is: "A community supported by a foundation of interacting organizations and individuals that produces goods and services to customers, who are themselves members of that ecosystem. The members of the community also include suppliers, producers, competitors, and other stakeholders. Over time, they co-evolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. The companies holding leadership roles may change over time, but the community values the function of ecosystem leader because it enables members to move towards shared vision to align their investments, and to find mutually supportive roles" (Attias et al., 2016; Moore, 1996; p26).
In a simple sentence, it is a joint experimental system that plays a major role in introducing an ecosystem and nurturing customer demand (Adner, 2013).

Innovation

As per Van de Venin 1986, innovation can be defined as "People, who over time, involve in dealings with others within a constructed direction for the purpose of improvement and deployment of new ideas and notions".

This simple definition is far encompassing and has major inferences for managing innovation. We can conclude four fundamental aspects here namely, People, New ideas, Transactions, and Institutional context. These aspects solve four main challenges related to innovation:

A. A strategic problem,
B. A structural problem of handling the links,
C. A human problem of attention management, and
D. A process problem of implementing new ideas.

Understanding these problems with their significances offers us a first practical theory on the innovation management process (Van de Ven, 1986).

In the past, researchers considered innovation management an internal matter for businesses. Recent research has showed that a business organization should be aware of external environment that exists outside of the organization (Henderson and Clark, 1990). It has become clearer that in order to get the bigger picture, we also have to check the external environment for an organization (von Pechmann et al., 2015).

It is obvious today that there is a need of innovation for modern businesses to govern the challenges that come from a changing environment. Business growth can be captured, enhanced and sustained by following a strategy based on innovative management. All around the world, relationships of human, firms and assets are the ecosystem for innovation (Adner, 2006).

Innovative ecosystems can also be applied to the inter-organizational, political, economic, environmental, and technological systems (Adner, 2006; Jackson, 2011).

Innovation Management

Managers that follow the old traditional model fear innovation when it comes to managing smart people, creativity, R&D and the influences of marketing and science. However the innovative style is necessary in the modern environment as it covers social networks, design, innovation in business models, open and social innovation, ecosystems, platforms and services (Dodgson et al., 2013).

Although many researchers have explored innovation ecosystems, very little is recognized about how companies can pro-actively establish, manage, direct and control innovation ecosystem for better performance and value creation. In addition, one of the most important barriers to innovation is how it directly conflicts with Strategic Business Management (Dodgson et al., 2013). Innovation is characterized by change while Strategic Management is all about laying out long-term plans and sticking to them.

Researchers have looked at important challenges on how ecosystems are created, what actions are needed for changing ecosystems and under which conditions ecosystem innovators gain an accurate view of realizing success (Thomas & Autio, 2013). These questions are examined in detail in coming parts of the paper.

Exploratory projects and the constitution of an ecosystem innovation

In the previous section we elaborated the fundamental requirements of the exploratory project management model and the features of ecosystem innovation management separately. Now we are going to bridge the two concepts in order to understand the ecosystem in exploratory innovative-project management.

In businesses, projects are carried out as an active method to consolidate the innovation process. Research has shown that there are plenty of limitations to the rational, dominant approach to project management. Thus, we have to stop thinking in the old-fashioned way of viewing a business firm as a rational, machine-like entity. One way to do that is by mapping the social and creative characteristics that most businesses have (Hobday et al., 2012; Lenfle, 2016; Dodgson et al., 2013)

We must also dig deeper to understand the problems faced by stakeholders in charge of different types of projects. Project managers generally work with a normal approach in the case of exploratory projects. In practice, the implementation requires an adjustment in design thinking (Lenfle, 2016).

Challenges to Implementation

There are a number of complex challenges faced by exploratory projects as per Lenfle, 2016. These include the following circumstances.

1. Risks that come from exploratory projects,
2. Complication in building a work plan,
3. Undefined budget,
4. Inflexibility of target,
5. Developing wrong products,
6. Bypassing the process,
7. Leading the project into a dead end and
8. People outside the project team having problems in understanding what it is about,

All these challenges are normally experienced in exploratory project management.

A Solution Framework

In 2008, Lenfle proposed five principles that outline a framework for project management model that would be suitable for the most complex innovation circumstances.

The first principle is the need to form a definite unit to manage the exploration. Without a team with well defined roles, an exploratory project would never even get off the ground.

The second principle emphasizes the central role of tests (testing, prototypes, pilot projects, customer trials, etc.) in the management process. This is mandatory and needed to deal with cases of unanticipated events and uncertainties. Tests will allow problems and solutions become exposed easily.

The third principle notes that there is a need for synchronized exploration that must concern knowledge and concepts. As new discoveries are made during the exploratory process, they must form the basis of further exploratory work.

The fourth principle is that the management process must consider the two perspectives of performance (the added knowledge and value creation of the products/services). The knowledge gained must be evaluated to determine the usefulness of the project.

The fifth principle states that the management tools and techniques used during the project delivery stage must allow a reformulation of the objectives and goals. Since exploratory projects have no fixed goals, the management team should be able to redefine the resource commitment at any time.

In 2016, Lenfle came up with three additional solutions for forming a successful exploration project approach:

A. Try to use practical goals as standard measures for normal projects (cost, quality, and time)

B. The stepping time of exploration, as these types of projects are temporary and must have an end like defined projects. However, the ending for these type of projects is difficult to identify
C. Formation of a community

In today's business world, project management has taken a huge jump towards business ecosystem innovation. This is achieved through active partnership, linking competing companies and cooperative (Attias et al., 2016). Moreover, the success criterion for organizations is based on their strategic communities that are commonly referred to as a business ecosystems or innovation ecosystems (Moore, 1993).

One danger that comes from exploratory projects is a continuous spread out of the project into different parts of the organization with poor flexible coordination. In the short term, this is a well identified problem in innovation management.

According to literature review, interviews with projects managers indicated that the power of projects to deliver results come from the people. Forming positive relations among distributed people helps build energy. This creates the links that strengthen the success of the project. This specific feature of exploratory projects makes them useful especially in uncertain environments (Lenfle, 2016).

Exploratory projects are equally useful for managers working in start-ups as well as big multinational organizations. They have been used successfully in public and private sectors. If the manager is contributing to a collaborative work, then his success depends not only on his own efforts but also on his or her team's willingness and ability to succeed.

Different stakeholders are responsible for their own effort and time during various stages of the process. Moreover, some stakeholders are also responsible for distributing the project resources for achieving better outcomes. By using the wide lens principles, organizations will be able to tap into the unseen resources that lurk under the surface and become well prepared to manage projects (Adner, 2013).

Therefore, as emphasized from the exploratory project management researchers, the need of a big umbrella to contain all the challenges and concerns related to the exploratory projects is required. This can be achieved by developing an ecosystem for project innovation management. Creation of an ecosystem where all participants are on one page is a necessary step in the case of exploratory projects.

Studies have shown that in order to improve the ecosystem of developed companies there must be links in the main areas for any project innovation. These include;

1. Availability of the resources for new goods
2. A collaborative arrangement and provision of processes; in order to solve challenges in an innovative way and linking the innovations with current productions
3. Integration of the organization's strategy with the innovation gears

These categories are not perfect, but they can emphasize the importance of organization problem parts. An active innovation ecosystem can be categorized by a repetitive rearrangement of relationships of resources, knowledge, and people. This helps endorse systematic growth of the organization in a reaction to different external and internal powers (Adner, 2006).

Alternative Innovation Models

Other researchers take a slightly different approach (Thomas & Autio, 2013) and suggested that there are four activities that lead to the development of ecosystems;

1. Technological Activities
2. Resource Activities
3. Contextual Activities
4. Institutional Activities

Exploratory projects should be carried out in three phases of ecosystem emergence. These are Initiation, Momentum, and Optimization phases. Moore1993, suggested something similar and noted that there is a fourth phase, that of Evolution.

Ecosystem creation for exploratory projects requires a multi-theoretic approach, as well as a consideration of three related architectures (Dodgson et al., 2013). These are

Technological design:

This details the design criteria of common technical assets and platforms. It defines the people and systems that will be linked and the manner in which each component connects to the innovation ecosystem.

Activity design:

This design explains the alignment and arrangement of the innovation ecosystem that may develop about the core platform.

Value design:

This outlines the resulting dynamic value as defined by the interaction between activity design and technological design.

Adner introduced new ideas in 2013 and proposed a wide lens tools to take advantages through the following methods.

A. Strategies assessment
B. Lead actions and commitments
C. Support to view the entire ecosystem on which the business success depends
D. Uncover the issues before they turn to problems
E. Allow better decisions making
F. Provide effective investments

The lens tools can be summarized as, "*a value blueprint, co-innovation risks, adoption chain risks, the leadership prism, first mover matrix, the five levers of ecosystem reconfiguration, the minimum viable ecosystem, staged expansion, and ecosystem carryover".*

All the tools outlined above are intended to be used as solutions to help organization teams when starting innovation initiative. The tools are effective in different phases and help meet the best strategy organizations can create.

Conceptual framework

The main aim of this paper is to examine the statement: In case of exploratory project type, firms need to create an ecosystem innovation to overcome challenges that may face the project managers in these type of projects for better and new value creation, as shown in figure (1) the framework proposed by Overholm, in 2015.

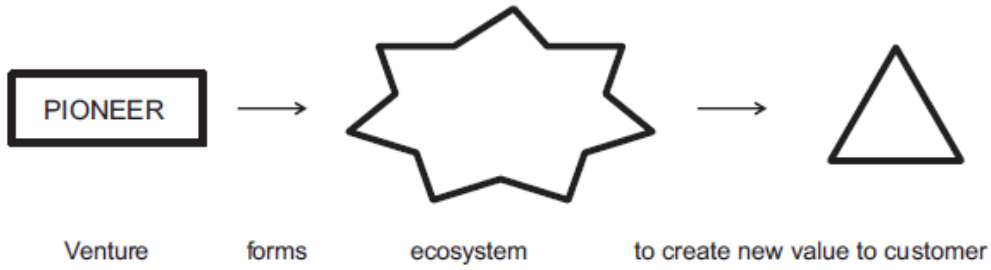

Fig.1. Conceptual framework (Overholm, 2015).

From previous studies we can conclude that the typical description of the ecosystem phenomenon is a logical foundation of founding actors, core schemes of the entity, and value creation concepts over time (Overholm, 2015). Based on that assumption the framework "exploratory project ecosystem" can be proposed according to the figure below.

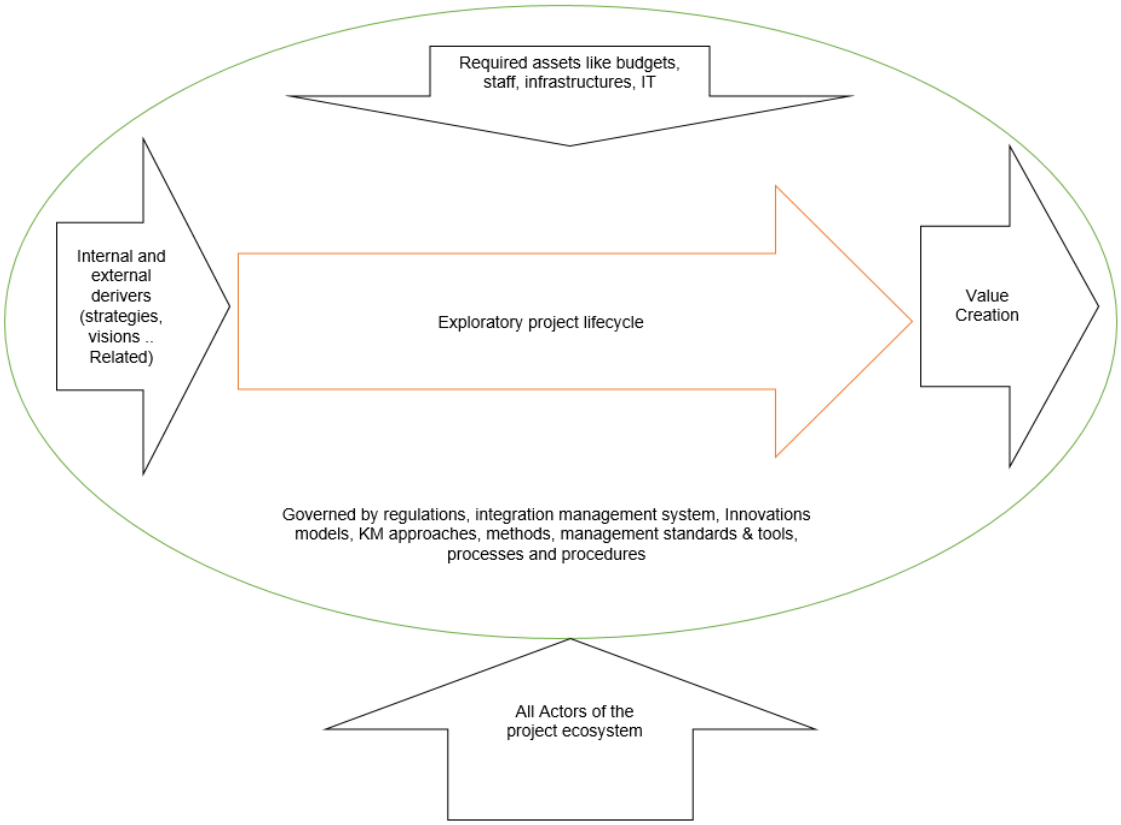

Fig.2. An ecosystem of exploratory project.

Research design and methodology

The following paper is based on a study of a strategic Solar Park project in UAE. It follows the case study methodology grounded by Yin in 2009.

Case Selection

The case selection criterion considers the significance of the case, its theoretical relevance, and data availability. We believe the solar energy sector, due to its innovative market, is perfect for examining exploratory projects.

The solar market was largely recognized in the US in about 2005. Since then, solar projects have become significant due to their investment in development of clean energy and emphasis on protecting the environment for the next generation.

The solar energy is particularly important for counties located within the Sunbelt like UAE. This case is theoretically relevant as we examine the solar project processes, procedures, practices and their links to project ecosystem.

Data Sources

Plenty of data is easily accessible in this domain. The case was researched thoroughly and findings were made based on available information from a great number of resources that were used. Sources included data taken from authority website Archive, a wide collection of independent press coverage, strategy documents and academic literature published in journals, books, and studies over the years.

Moreover, data was validated through interviews with industry insiders. Hence, the empirical research conducted for this report consists of semi-structured interviews with different solar energy project experts, development teams, innovation centre and R&D department in the local utility authority. A total of 5 semi-structured interviews were conducted in the local authority. (See Table 1 for more details).

Table 1. Overview of the Interviewees and Their Affiliations

Departments and number of interviews	Titles of interviewees
Transmission Project Dept.(1)	Mgr.-Projects 400kV
Solar Project Dept.(2)	Solar Specialist, Head of Solar Department -Clean Energy & Diversification- BD&E Senior Engineer in Solar energy Department
Research and Development Dept.(1)	Director Research and Development
Innovation & The Future (1)	Advisor - Innovation & Creativity

Data Collection Methodology

The case study research method is defined partly by its ability to incorporate multiple types of empirical evidence. This allows the researcher to examine whether data sources converge to a conclusion (Yin, 2009). This study mainly uses interviews and archival data. Both types of evidence can be integrated and used together as data sources in a case study (Overholm, 2015).

My main method of research was detailed studies of the local utility authority through semi-structured interviews with the Solar Park Project team, the R&D team and the Innovation team.

The study was carried out over 2 weeks, during which I conducted over 5 interviews with key solar project ecosystem actors.

All interviews were based on an interview protocol and included questions based on the initial conceptual framework. We provided information on the research project to the interviewees with matching material or contacts to ask them for feedback. The interviews were conducted in sequence as per research methodology (Yin, 2009).

In addition to the ecosystem innovation theme, the interviews also dealt with questions regarding exploratory projects. The questions of the interview were reviewed and modified by expert in the authority. Throughout the interviews all answers were kept confidential to encourage honest answers.

Data Analysis

We started data analysis by saving all the collected data for the case study and organizing it into categories. When a worthy degree of understanding had been achieved, and promising theoretical implications were saturated, the final theoretical prototype was formulated. Comparison tools and interpretations were used to analyze the collected data for this case (Yin, 2009).

Based on the literature review, ecosystems were considered networks of all the stakeholders, contributing to joint value creation. Such stakeholders could be businesses or non-business actors that typically had undertaken some degree of co-innovation or adaptation in order to contribute to the collective creation of value (Overholm, 2015).

Normally, solar power is delivered as a service. The Solar PV provider firms are called solar service firms. They take the role as an intermediary between solar panel manufacturers and consumers. The supply chain consists of manufacturer, solar service venture, installers, end customer, consultants, financial institutions, other utilities, regulators, and government as per figure (3) (Overholm, 2015).

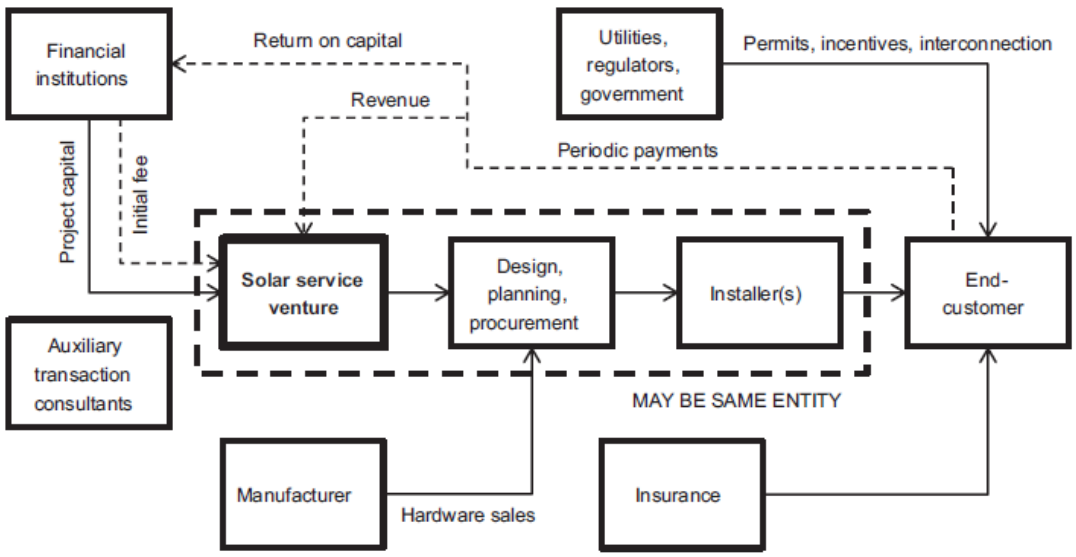

Fig.3. The ecosystem actors required to make a solar facility installation (Overholm, 2015)

Shum & Watanabe, 2009, identified the innovation value-chain as innovators, suppliers of PV modules, inverter, and other BOS components. Complementary innovators such as utility owners, system installers, integrators and end users can also be considered innovators and early adopters.

The Innovation value-chain framework suggests that customers, suppliers, and complementary innovators all play serious roles in the implementation of a novel technology like solar energy.

Case study

As indicated in the UAE national innovation strategy report for year 2015, the government of UAE established a strong platform for solar power companies in order to help them play a leading role in global innovation fields. This is especially true in the field of clean energy and renewable energy projects like The Emirates Nuclear Energy Corporation, Masdar, and Mohamed bin Rashid Al Maktoum Solar Park.

Our case study is about one of these pioneer projects in the region.

The Local Utility Authority in Lines

As per the authority sustainability report year 2016, it is a government responsibility to deliver water and electricity to the residents of the Emirate in UAE. The government holds the departments and maintains desalination and power generation plants, aquifers, power and water transmission lines and power and water distribution networks in the emirate.

Although the authority's main organizational undertakings are in the making and supply of electricity and water, it also has a sum of other associated business interests. One of these is the development and provision of solar energy for the future.

In line with the organization's vision to become a sustainable innovative world-class utility, the authority has made numerous accomplishments since its establishment. It became one of the top utility providers worldwide, by providing world-class services to more than 880,000 customers.

The utility corporation's continued successes have added to UAE's global attractiveness. The authority, as UAE representative, has been ranked first in the world for Getting Electricity, as per the World Bank's Doing Business Report 2018.

In line with the Dubai Clean Energy Strategy 2050, the local utility authority improved its main renewable and clean energy projects to build UAE as an international centre for green economy and clean energy.

In addition, with the sustainable Long-term finance, the utility corporation will be able to play a key role in accomplishing the objectives of the UAE Vision 2021. This vision aims to diversify the UAE economy away from fossil fuel related GDP growth and encourage green economy. There is a plan to invest in innovation and knowledge and significantly raise the amount of Emiratis workforce. Refer to table (2) for the local utility authority key facts.

Table 2. Selected case firm key facts

Case Study	Local Utility Authority in UAE
Date of Firm founding	1992
Industry	Electricity and Water
Role in ecosystem expansion	Pioneer
Customers	Commercial/Residential
Type of Business	Utilities (Government –owned)
Employees	11,485
Water customers	666,006
Electricity customers	752,505
Generation capacity	10,000MW
Production capacity	470 MIGD

Capital expenditure	10,955 AED Million
Return on Equity ROE	8.94%
Total revenue	21,193 AED Million
Debt: Equity	15.6%
Location of early value creation	UAE

Results and discussion

Although there is room for more information to be included in the database, the dataset that was collected provides enough information to enable reasonable analysis of selected case organization.

In order to align with the conceptual framework, the empirical section for this paper is divided into two major parts:

Part 1: The practical role of project management approach used in solar park project that supported in creation of their own ecosystem.

Part 2: About solar park project ecosystem-innovation system, and how the local utility authority structured their own ecosystem.

The local utility authority Solar Park project management approach

The exploratory project management model proposed by a number of researchers (Lenfle, 2016, 2012, 2010, 2008; Dodgson et al., 2013; McGrath, 2001; Van de Ven et al., 1999; Maniak et al., 2014) was compared with the solar park project management. We determined the points listed below:

- **The Transition Challenge:** The solar project faced the difficulty of defining exploratory project strategy, goals, and objectives. In order to solve this problem, the solar project gradually defined the Solar Park project strategy during the project's lifecycle and aligned it with the authority strategy. The internal process objective of "Sustainable and diversified energy mix" under the perspective of "Strategic innovation" was implemented in phases. They also defined KPI for "Solar Generation Capacity" which related to solar park project.
- **A Pace of Time Issue:** With reference to Solar Project goals and objectives, they were connected to the city strategy. For several years the local utility authority will be taken from solar energy source. Moreover, this project is being implemented in phases. They have planned four phases to complete the project. From the table below it can be seen that the goals and objectives for all these phases had been settled gradually with time, and can be changed whenever required.

Table 3. Solar park project phases

Phases	Outputs of the phase	Partnerships	Cost	Progress
First phase	13 MW PV		AED 50 billion	Phase Delivered on 22 Oct 2013
Second phase	200 MW PV	-ACWA Power from Saudi Arabia TSK from Spain		Phase Delivered on 20 March 2017

Third phase: will be implemented in stages	800 MW PV	Masdar		Under progress, to be delivered by 2020
Fourth phase: will be implemented in stages	700 MW CSP	-ACWA Power from Saudi Arabia -The Silk Road Fund -China's Shanghai Electric.		Within Q4 2020-Q4 2022
Future phases	5,000 MW			By 2030
Innovation Center	Latest renewable and clean energy technologies	International & local Schools, universities and companies		Phase Delivered on 2017
R&D Center	Internal labs, 3D printing lab, PV testing facility, CSP testing facility, & PVRO water desalination plant.	-National institutions, entities, and firms -Global specialist manufacturers -The UAE Water Aid Foundation (Suqia)		Under progress

- **No Specific Results of the Projects:** The local utility authority faced this issue as they were unable to determine clarified results. The local authority focused on identifying the customers' needs with comprehensive studies done in the local area and then set objectives accordantly. Thus, they could produce results like delivering solar energy services and gaining knowledge during the exploration journey of the project.
- **Exploration of New Knowledge:** An investment of AED 500 million in the local utility authority's R&D centre helped equip them with new solar testing facilities and labs in the solar park project. The authority carried out a number of related studies in collaboration with many national universities, companies, and research centres to exchange knowledge. To be specific, the local utility authority's R&D work on projects helped create knowledge for the local utility authority as well as setting up the basis for growth of future research.

In addition, the Innovation Centre was developed which will be used to improve the citys attractiveness, mature renewable energy tools and it will support in enhancing local staff capabilities in energy field.

Applying the knowledge management approach had a perfect fit for the local utility authority. It helped set the authority as a good example for exploration of new and existing knowledge in the field of solar energy. Some of the authority's innovation centre initiatives included:

A. Creativity and innovation conference
B. Innovation summit and exhibition
C. Yearly innovation week
D. UAE innovation awards
E. Fund employee ideas on myideas portal
F. Hosts hype innovation manager's forum
G. Innovation camps
H. Public innovation week

I. Universities to showcase in the innovation hall

Moreover, from the interviews of Solar project managers we discovered how they adapt the concept of trial-and-error learning, flexibility, perception and management judgment in their projects. This helps them create new capabilities, skills, and knowledge for their organizations.

- **A Practical Approach:** The Authority's R&D centre is closely connected to the Innovation Centre that is the source of projects and proposals that need to be adapted for the local utility authority's marketing needs. R&D helps industrialize the processes where a return of investment and competitiveness for the company is required.

In the end, innovation processes use the output from R&D projects and feedback from R&D work to direct the research projects towards the interest of the authority.

Theory in Practice

Compare this project management model with the five principles framework proposed by Lenfle in 2008, which suits the most complex innovation situations:

Principle 1: Defining special units to manage innovative complex projects.

In this regard the local utility authority established and developed units to deal with these situations such as R&D centres, the Innovation Centre and solar project department.

Principle 2: The need of a central role of tests (testing, prototypes, pilot projects, customer trials, etc.) in the management process.

For this part the authority's R&D centre was assigned this role to test out new prototypes and customer trials.

Principle 3: The need for coordinated exploration that must concern knowledge and concepts.

Knowledge management is already being practiced within the local utility authority with collaboration of concerned departments such as R&D centre, innovation centre, solar project and knowledge management department.

Principle 4: The management process must consider the two perspectives of performance (the added knowledge and value creation of the products/services).

In the case of solar park project this was being taken care of by considering the value creation and gaining new knowledge in the outcome of the solar park project.

Principle 5: Reformulation of the objectives and goals.

The solar park project practiced this by applying management tools and techniques that were used during the project stages. This allowed the authority to review and reset the goals, like using Stage – Gate process, to follow up and decide for next step of the projects. Also, the local utility authority established a strong platform in order to play a top role in global innovation fields, especially in the field of clean energy.

In addition, solar park project already covers all the three proposed key solutions for forming a successful exploration project approach that we mentioned previously in the literature review section. They set practical goals as standard measures, had timed endpoints and especially implement point (c) which is "formation of a community", which regards to creating a project ecosystem.

In conclusion all proposed exploratory project management principles related to the local utility authority solar park project have been practiced fully by solar park project case.

Solar Park project ecosystem-innovation approach

Solar service ventures must know what ecosystems they need and how to form such ecosystems. For that process, predecessors' works within their own or other industries were used as a base for motivation (Overholm, 2015).

As indicated by de Paulo & Porto in 2017, in order to take advantage of the development of clean energy, firms will have to invest in research, development, and innovation (R&D&I). That is precisely what the local utility authority counted on during its solar project innovation journey. They established a fully equipped and developed R&D&I Centre, practicing international standard of research and used appropriate frameworks in their processes for the field of solar energy. A number of international collaboration partners from developed solar energy producing countries were explored and used in the local utility authority case like China and Spain.

Future Challenges

For Solar Project, their main goal is to produce 5,000 MW by 2030. The local utility authority faces many challenges to achieve this goal.

As Solar, Energy efficiency, Water and Smart Grid integration areas are rapidly growing, R&D has to make sure that they remain at the front of the technological innovation process. Challenges in the initiation and planning phases of the project include,

A. Obtaining Non objection certification from other authorities
B. Dealing with cases of violation
C. Arranging competent resources
D. Changes by Stakeholders
E. Project delays
F. Shortage of resources
G. Site challenges
H. Challenges in getting results on time
I. Obtaining the necessary talent
J. Challenges in developing plans for our employees' growth

Thus, the solar park project ecosystem formation processes that matched with international frameworks were as following; refer to figure (4) for solar project ecosystem.

The authority used international, UAE, and city strategies in relation to innovation, R&D, solar energy as some key derivers for solar park project. We identified all the internal and external actors for solar part project as:

A. Core the local utility authority's divisions like Generation, Transmission, distribution, Planning, Civil
B. Innovation divisions
C. The local utility authority finance department
D. Other government utilities like road and transportation authorities
E. Civil Defence
F. telecommunications service utilities like (Etisalat, Du, and DuSup)
G. Manufacturer
H. Suppliers
I. Contractors
J. Developers
K. Consultants
L. Private companies
M. Establishment and developing the Strategy and implementation plan for the authority Innovation Center
N. Establishment and developing the Strategy and implementation plan for the local utility authority Solar Department - Clean Energy & Diversification.

The authority used related international standards, models, approaches, tools, and processes required for establishing a robust solar energy project system. They established a dynamic project management governance that was ready and willing to adapt to changing requirements. They linked all the parties and stakeholders required with integrated, automated systems.

They ensured that every stakeholder actively participated in the process and remained informed at all stages of the process. This was in line with the theory that an innovative ecosystem needs an active participation from all the involved players.

The authority used communication as a key tool that supported the development of solar project and it was successful in this area. They practiced the local utility authority knowledge management approach.

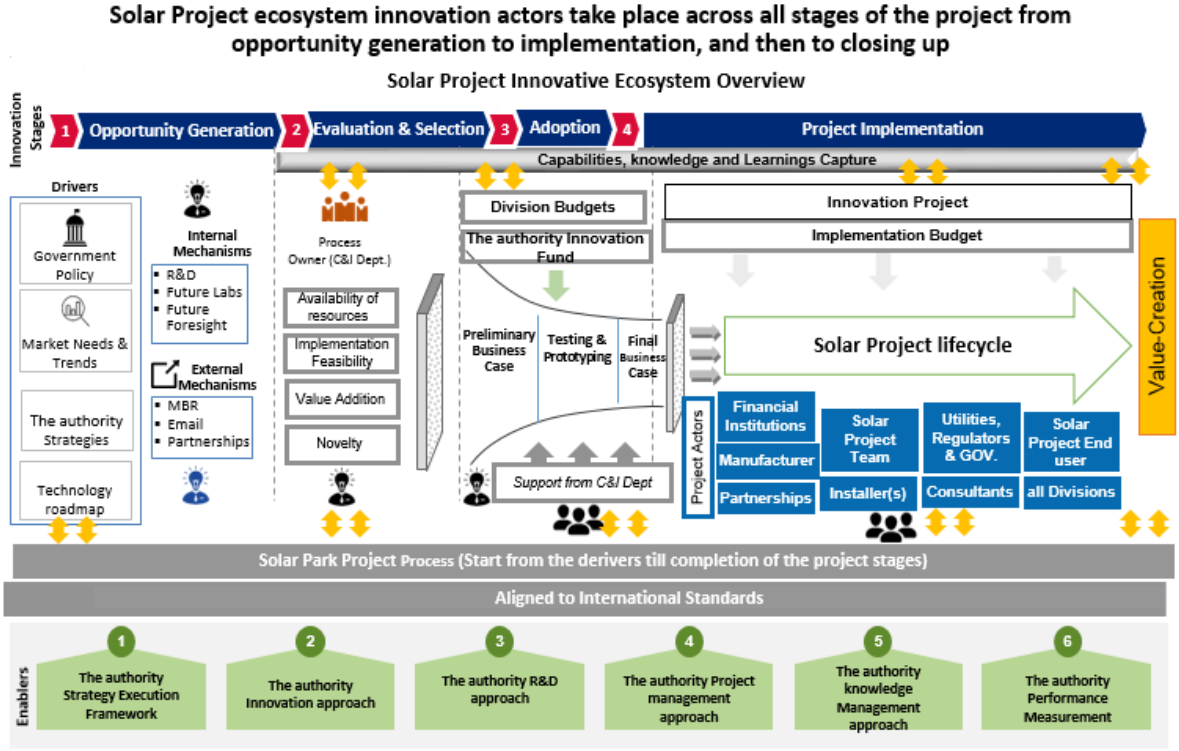

Fig.4. Solar park project ecosystem overview

Moreover, solar project case used other practical solutions to overcome solar park project challenges such as the use of standard project management tools. Research projects are difficult to standardize in most cases. The authority used tools of Risk Management to reduce the uncertainties and actively managed issues to find the best solutions. They successfully managed the change in the local utility authority from EPC to IPP by bringing in new energy supply and integration in the system.

The authority used Apply Stage – Gate process to follow up and decide for next step of the projects. The organization also applied the local utility authority quality procedures internally. They actively sought partnerships with key companies, institutes, research centres and governments as partnering is the best tool to face any problem with confidence. Coordination with both internal and external stakeholders in order to be within budgeted cost, time and quality allowed the organization to implement innovation in their projects.

Knowledge sharing, trainings, and attending workshops helped the authority learn new concepts in solar energy field and allowed them to accumulate knowledge for future use. They attracted

better resources by becoming better involved with sponsors and added daily monitoring and supervision of site progress to their system.

Value gained

As per Overholm, in 2015 specified that the real opportunities for ecosystem to pass, is when new projects or schemes can be included into an existing ecosystem and interact positively with partners in the same tactic as the ecosystem creator want.

In the context of renewable energy strategy, learning investments and gaining new knowledge should be one of the main achievements especially for business development, considering the fruitful journey of shifting from suppliers to system integrators to energy service providers (Overholm, 2015).

Solar park projects will act as an international heart for green economy as they rely on using clean energy. They will decrease 6.5 million tons of carbon emissions on yearly basis. And that will enhance its leading role as a global centre for clean renewable energy research and development. Solar energy will have an important role in protecting the environment for future generation.

Another vital value to the local utility authority is their customers' satisfaction by fulfilling the customer and market demands.

Organizations can gain benefits from innovation depending on how well they are managed. Innovation mainly adds to business competitiveness, financial performance, environmental sustainability, quality of life, and levels of employment. However, organizations must drive towards those benefits while managing innovations complexities and hazards. (Dodgson et al., 2014)

Lenfle 2016, indicated that there is no harm in trying to use practical and useful goals for exploratory projects. For instance, businesses can use standard measure for normal projects based on time, scope, cost, and quality. However, they must be modified in order to be more adaptable for these projects.

One important value to the local utility authority is the local, regional and global recognition of their services. The authority won lots of certificates and awards for its solar park project initiatives.

Conclusions and Future recommendations

Turning from fossil fuel to renewable clean energy projects, requires continuous adaptation and we will need to reinvent new methods for management of these projects (Attias et al., 2016).

When compared to exploratory project characteristics, solar park project case was an exploratory project in many dimensions. Since this is a new industry, it is very much in need of building an ecosystem as per latest effective approaches used globally.

Solar Project UAE wanted to govern all the challenges that came from solar energy innovation project. It was understandable that the need of ecosystem for innovation was important to the local utility authority. Moreover, since the authority needs the growth of its business and operations, they needed to capture, enhance and sustain throughout the relationship with their customers. Fostering relationships of humans, firms and assets are part of the innovative-ecosystem and this is in line with Adner's view, 2006.

In addition, if organizations want to achieve their goals and objectives then they need to use a practical strategy to practice and shape their ecosystem (Overholm, 2015). This is what happened in case of solar park project. In order to achieve their main goal, which is to generate 5,000MW of clean energy source by 2030, and to be the largest single-site solar energy project worldwide, they

had to build their entire ecosystem for the solar project. As we have seen, they used the strategy that consisted of five pillars: infrastructure, financing solutions, legislative structure, environmentally friendly energy mix, and developing capabilities.

In exploratory projects, a level of variances and uncertainty is involved. The best organizations must be capable of adapting to the complexity and uncertainty of projects (Lenfle, 2016).

It is also important to explore the market needs and the technical requirements in relation to the innovation. This helps organization avoid becoming a prey to inaccessible requirements and unusable technology (Lenfle, 2016).

With full integration of PV into the electric grid, it is expected to build a business model within the entity system. It will have its own processes, operations, control and utility key actors, that emerge with differences and uncertainties (Shum & Watanabe, 2009).

Innovation is a significant ingredient through which associations survive and flourish. Thus, innovation must be to be understood first and then to make changes appropriately. Areas that cover innovation might be economic, social, technological, legal, cultural, and historical. However, it really depends on the managers' choice about which innovation to introduce, practice, monitor and gain value from (Dodgson et al., 2014).

Future directions

Ecosystem innovation tells us that we are facing new kinds of relationships between companies who will need to focus on radically changed core businesses. The energy industry is going through massive changes and facing new fields encompassing networking specialists, IT, and new principles. This raises new queries about value creation, as well as the management models of innovative projects (Attias et al., 2016).

This study elaborates about the project management model to be used and how to make an ecosystem for exploratory projects. However, we did not elaborate on opportunity creation and how discoveries can be made for the entire community of business persons in a developing ecosystem. That would be a viable topic for future research direction (Overholm, 2015).

Another fruitful area for empirical investigation is on providing a guideline for how to manage ecosystem entry as a pioneer and as a follower and get the best of it. We should note that pioneers face a hard time in any industry. However, the value that can be created by being an ecosystem pioneer, like in the solar project case, is huge.

Thus, one possible attention to practitioners is to study the ecosystem work of pioneers, and the necessity of making it available to followers to learn from the leaders (Overholm, 2015).

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