How Far and How Deep Can Innovation be Introduced and Absorbed in the (Present) Market? (Energiaproject Case Study: Methodologies and System Analysis in Innovation)

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Abstract This paper was acquired while facing real situations of innovation project developments, difficulties to embody all these technologies to the current market, convince buyers, train users, guide technicians to maintain the products, and deal with the systemic stakeholders that could jeopardize the whole undertaking during the R&D of energiaproject. Although the main concept remains the same in most innovations that have originated and have been developed for the sales industry, the way the actual outcome is deal with and handled might differ upon to the resources each manager might have.

Keywords Innovation Risks, Sales Industry, Stakeholders’ Jeopardy, Systemic Approach

1. Introduction

The scope of energiaproject is to observe, check over, study, analyze, develop, test and experiment with innovation techniques in the wider field of energy matters. Most of the times we use what science already knows efficiently but through the ‘journey’ of research unexpected outcomes might surprise us by enriching and embracing what science has already tough us. It is intriguing how in this way things that can’t be seen but are lying right before our eyes turn out the be the best and most successful innovations.

The initial triggers for the project were all the discussions surrounding promotions and commercials focusing on fuel efficiency or saving devices in everyday life and whether those inventions are indeed functional or just scams. While using and testing the above devices it was very soon realized that data collection and computation was not objective and reaching a concrete conclusion was very difficult. Therefore the only way to reach a plausible result and a realistic outcome would be to use quantitative and qualitative methodologies that are undeniable (tested and approved).

As the research was unfolding and some good outcomes were reached and developed it was confirmed that there are indeed ways we can improve combustion efficiency with add on systems. At the same time it became obvious that this would result in us having to deal with two types of stakeholders: those that would benefit from this and would be pleased by the outcome and those that would be exposed and at a loss, that would become your ‘enemy’ and ‘fight’ against this by all means. At this point a more careful examination was needed to analyze the project risk and find the best to deal with any discrepancies.

During the research, more data and statistics were obtained offering the project a better picture. In addition, with more information at hand a better trigger was given on how to improve these technologies and the final products.

The introduction and implementation of the newly developed (growth) products to the public was faced with difficulties as people have a skeptical and critical approach towards new ideas and unknown products. Resistance to change was also felt by those people (stakeholders) that actually could benefit from these products; even those people do need proof to be convinced. At this point in the research you start to realize how important it is to have a good strategy and knowledge on how to infiltrate common sense and shape a new perception to those who already think they have the know-how and expertise.

In other words, any innovation that needs to go beyond research and development and become profitable has to deal
with all those tricky concepts and find a way out to success. Only in this way can balance be achieved for both R&D that needs funding to carry on and the companies that need to profit from those ideas and/or products.

2. Objectives

The main purpose of this study is to reveal our point of view in innovation creation, meaning how far and deep can innovation infiltrate the present market and more specifically to focus on the marketing of the sensitive field of energy. We could consider that the most important powers of humanity in life are: religion, energy and reproduction and all of these are crucial for people to survive and evolve. Maslow's hierarchy of needs (Figure 1) describes peoples core needs. However, today’s society is totally energy dependent and therefore we feel like we do not need to explain and rationalize how certain needs such as reproduction and love can still influence our everyday life. If someone combines all of the above together (society and needs), one can realize how important both are when dealing with everyday situations and thus how serious not having the right balance between those important concepts can be.

![Maslow's hierarchy of needs](image)

Figure 1. Maslow’s hierarchy of needs, represented as a pyramid with the more basic needs at the bottom

Not knowing the risks that you might face commencing a project might turn against you; it might ruin a good personal reputation or even a company’s branding that is already successful in society’s eyes. A negative turnout could lead to a domino effect that could ‘demolish’ any positive accomplishments that have been achieved so far.

Feeling that knowledge is the leading power that can drive you almost anywhere was the main drive to initiate this study so we can share some insights that were obtained through this ‘journey’.

To conclude, the objective for this paper is to give some guidance to whoever is facing similar questions while ‘traveling’ through the unknown path of innovation and change.

3. Methods

You can take many different paths to reach the peak of a mountain. Sometimes there are right ways and wrong ways, and sometimes nobody can say what is wrong or what is right. We need a way out each time and especially when we sail ‘blind’ in uncharted seas. Science is one good approach to use the methodologies provided together with a researcher’s instinct in reaching something. Although I do not believe that scientific methodologies are equally interpreted by everyone, it is a good starting point. Every being has its own perspective of the surrounding world. To establish a good connection and gain a good communication without obscurities or misunderstandings enough time is needed for the way of thinking and talking to be aligned and most of it needs to be done in good will.

As soon as a team realizes that they have a common point of view it is then possible to ‘travel’ further on this journey. Scientific methodologies are a good way to establish a common point of view and a high level of understanding and awakening.

Most inventions happen because someone visualized something known to everyone from a different perspective for the very first time. In rare situations inventions happen by accident or mere luck. The truth is that the way we see things, affects the way we deal with them and what we do about it thereafter moving forward. Do we continue on the same familiar path that everyone else follows or do we want to experiment, take risks and discover new paths?

As many factors influence the way people think so do different types of sciences involved also have an impact and thus make a research kind of a complicated concept. The need to use all knowledge available with the aim to explain or improve an experiment can lead us to select systemic science as the way forward in studying complicated concepts that exist in a dynamic world.

Systemic science or systemology is a word that derives from the Greek word systema (σύστημα). Systemic theory is a scientific field that studies the nature of any system (simple or complex) within nature, society, cognition and science itself. Application of this science can also be found in engineering. Simply, by analyzing a study using a systemic methodology which is a tool that gives you the ability to use all sciences involved in the study being examined. It also provides a more realistic approach to that specific study as it overlooks the entire dynamic system that is examined, how it is connected and also how it is affected by the surrounding environment.

While the main methodology for this project is using systemic science tools, an effort was made to set up an expert team of people from some major scientific fields and get them involved in this kind of project.

This can be very tricky, as time is needed to find the right people whose field of knowledge is adequate for the project in question.
Last but not least for every research a vital factor is financing. This is a very important concept and possibly a separate study itself; how to work out the best deals and agreements and/or all other possible means necessary to set up a research project. Due to the extended subject matter that the concept of financing involves we are not going to examine it in this study, at least in this phase. We assume, for our purposes, that financing is limited. This is the approach and perspective we want to adopt in order to conduct our study. We would like to clarify the above in advance as we do not want to include any discussions about costs that are inevitably a major factor to a research project. Depending on the funding available a relevant strategy is always build and that always affects the direction of a study.

4. Study Analysis Overview

It is very important to have a plan for a research to flow. Methods are a very important part of that plan too. Many times we are not exactly sure how to handle the unknown, so one good approach is to always use scientific methodology to avoid mistakes, errors or wrong conclusions that could damage the research or even cause accidents to a researcher.

The observer effect is a well-known method in physics during which a phenomenon that is being observed can eventually change by the simple act of observation. According to Prof. Mordehai Heiblum [1] and his team, researchers at the Weizmann Institute of Science, in Quantum Theory an experiment was demonstrated: How Observation Affects Reality, which revealed that the greater the amount of "watching," the greater the observer's influence on what actually takes place. That experiment uncovers a significant parameter of a research study that needs to be examined carefully: how data can be acquired without interference to the systems that are been studied.

A draft guide of how our research has been developed is shown in figure 2. The critical steps followed here are:
1. A systemic approach
2. Risk analysis
3. Problem solving techniques
4. Development methods
5. Cause and effect
6. Project Management

4.1. Systemic Approach

First of all, the most important part of an entire project is to be clear about what we are really looking for. This includes the object of the research and what the connections are with the surroundings. In other words, we have to seek out all stakeholders or parameters that can influence or interfere with our project. This is what will help the project to either go successfully far or fail, at which point we have to think of the consequences of a failure. In our case, energy is a very delicate subject. Conflicts or even wars, metaphorically and literally speaking, will usually break out over energy control, as well as the huge financial interests and power associated with them. Finding the most viable approach in initiating this study can be vital for the whole project. Finding a strategy at the start is also vital in tracing the maximum number of stakeholders that need to be involved and who will either have a positive or negative influence.

From a cognitive perspective, people work better when the studied field is visually reproduced. Abstract concepts are more difficult to reproduce and for this reason a special tool is used called Design and Control Systemic Methodology (DCSYM). DCSYM provides a visual reproduction of the entire area to be examined and all of the connections formed are presented. DCSYM is a systemic methodology developed by Prof. Nikitas A. Assimakopoulos [2] (Department of Informatics at the University of Piraeus, Greece) that can visually describe the entire system studied.

In our research the findings of the main stakeholders are shown listed below:
1. Large petroleum companies
2. Governments
3. Other companies that sell products that will be affected by our results
4. Other sciences involved

A graphical representation in free form is listed in figure (3). The representation of DCSYM is a little more complex and therefore it is not shown or presented here as it does not align with the purpose of this paper. We are seeking to be coherent even for those participants that are not familiar with the concept of systemic methodology.
DCSYM describe both internal as well as external factors present. However, a project failure can also be caused by the internal factors involved. Therefore a Viable System Model (VSM) must be exhaustively setup and studied to give us a direction on how we are going to successfully deal with our project.

VSM was described by British cybernetician Stafford Beer in his books Brain of the Firm (1972), The Heart of Enterprise (1979), and Diagnosing the System for Organizations (1985).

VSM is a model of organizational structure based on the structure of the human nervous system following Beer’s observation of information processing and decision-making of that system.

VSM representation of the elements and interactions are considered essential for any system to be viable or autonomous. A viable system is one that is organized and operates in a such manner that it is be able survive in its changing environment.

A schematic representation of a VSM model is in figure (4).

Table 1. Logical sequence in R&D Simulation process

| Trigger                        | Development                  | Experiment                                      | Result                                                                 |
|--------------------------------|------------------------------|-------------------------------------------------|------------------------------------------------------------------------|
| Hypothesis                     | Use theory and previous data to form a new model | Test the model and discover new parameterst to be included | Final result with quantitative qualitative data                       |
| Results that do not fit with the existing theory | Try to figure out the cause of the event | Try to duplicate using all available info & data | If a solution is found, it will be recorded to be utilized. If nothing is resolved it will be recorded as “waiting” until more info is collected in order to reach a solution. |
System five manages the interaction between systems three and four and embodies the corporate ethos. Hence, system five decides the identity of the firm and its governing principles and norms. This includes decisions about the kinds of businesses that need to be developed by system four and be put into operation by systems three, two and one.

People in any organization need information to process and make decisions. The better the information is processed the better the result. On the other hand too much information may result in distractions and misleading results, so the key feature of the VSM model is to have a variety of information that is under control, attenuation or amplification as required each time. This means that, for example, there are cases were a plethora of information is needed when trying to explain a new phenomenon and in other cases we do not need any repetitive information that might confuse and distract us from the project that we need to focus on.

Beyond the incorporation of many other scientific fields involved in our project, other specific tools are also needed to evaluate and simulate situations and results.

Simulation can only be achieved by one of two ways: either by using familiar and known theories that are also related to known behaviors or by experimenting on new behaviors and recording the results which have to be analyzed to extract the logic needed to be used during the simulation process. This process can end up being infinite, since many different parameters appear all the time which have to be measured so that the stress and dynamism of their influence can be measured. Table 1 lists the simulation guidance process. Simulation is accomplished by using special software; either a special ready designed and programmed software that embraces the exact process or a customized programmable simulation software like VENSIM or AnyLogic.

Simulation can be done at a systemic level or lab level. The first will either evaluate a hypothetical approach or consummate an existing model. Systemic simulation can be done with appropriate software such as VENSIM and AnyLogic. The latter will have to find the “numerics”; meaning the quantitative approach to verify the best model.

This is a very simplified view, since there are cases where a strange phenomenon cannot be explained but rather uncovered “accidental” or by use of “unlogical” testing.

4.2. Risk Analysis and Risk Management

In any project in order to have high probability of viability, it is necessary to consider evaluation of any risk. It's likely that you’ll need to make a decision that involves some risk at some point. In that case two things might happen: the probability of something going wrong and the negative consequences when it does. The truth is that there is no single tool that can spot any potential risk, but there are methodologies that can assist a project manager to identify some risks. That, combined with experience and knowledge will certainly reduce the probability of risk.

Risk analysis [4] is the process of prioritizing risks and numerically analyzing the effect of the identified risks combining the probability of occurrence and impact to the project. Risk Management is the process of conducting the above through a plan that must be acquired before execution of the project. The risk can be managed in one of the following ways:

- Avoid the Risk
- Share the Risk
- Accept the Risk
- Control the Risk

Special software such as Oracle’s Primavera Risk Analysis integrates directly within project schedules and estimates costs to provide quick and easy techniques to model risks and analyze those cost and schedule impacts of mitigating them.

Monte Carlo simulation (also known as the Monte Carlo Method) lets you see all the possible outcomes of your decisions and assesses the impact of risk, allowing for better decision making under uncertainty. Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making.

Excel’s “what if analysis” is a good scenario tool that uses existing data, along with estimated data points, to calculate a range of probable outcomes. While a “What If” analysis doesn’t predict a specific outcome, it does provide a precise range of probable outcomes. By varying the input data, decision makers can see how those changes impact the probability of desired outcomes.

Another simple guide to start with, is the SWOT analysis (figure 5), or SWOT Matrix. SWOT is a structured planning method used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project or in a business venture.

It involves specifying the objective of the project and identifying the internal and external factors that are favorable and unfavorable in achieving our objective.

Thus, setting the objective should be done after the SWOT analysis has been performed. This would allow achievable goals or objectives to be set for our project:

- **Strengths**: characteristics of the project that give it an advantage over others.
- **Weaknesses**: characteristics that place the project at a disadvantage relative to others.
- **Opportunities**: elements that the project could be exploited to its advantage.
- **Threats**: elements in the environment that could cause discrepancies to the project.
4.3. Problem Solving

Problems are at the center of what most of people face every day in their jobs. Some problems are small and can be resolved quickly others can be more complex and require more experience for them to be dealt with. However, to be on the safe side and correctly deal with any possible problems, a methodology to work with every critical parts of the problem is required to be found and addressed accordingly.

The seven step methodology described below will help us stay in focus of what needs to be done to solve a problem:
1. Finding what the real problem to solve is
2. Defining the problem
3. Analyzing the problem
4. Developing possibilities
5. Selecting the best solution
6. Implementing
7. Evaluating and learning

4.3.1. Finding what the Real Problem to Solve is

Most of the time people believe they have already figured out what the problem is and start working out a solution. It turns out that many times this is not what actually happens. Intensive research to really understand what we are dealing with and what the real problem is, is necessary. Failure to go through this step will, sooner or later, come back to delay the process after which point much time and valuable resources have been wasted.

In addition, creating hierarchy in case of multiple problems will save us valuable time and much disappointment as this is another issue that relates to the researcher’s point of view. Setting a right order will save a lot of time as most of the times the initial problem in raw form that will be solved might solve subsequent issues that will appear later in the sequence and may be connected somehow. Experience and extensive studying can guide us in the right direction.

Another piece of advice refers to the fact that a thorough research had to be done and as much information as possible needed to be collected so that we can get the whole picture of the incident we are studying.

4.3.2. Defining the Problem

The most important part of solving the problem is to define the problem correctly. The way you look at the problem will determine how you comprehend it, and thus result in the outcomes you get. The solution with will differ based on the way you define the problem.

The key to a good definition of the problem is to ensure that you deal with the real/actual problem and not with its symptoms.

Peter Ferdinand Drucker (management consultant, educator, and author) suggests that we should move from a problem focus approach to an opportunity focus approach. Problems often destroy opportunities, so this can be a crucial attitude which can help define the problem in a way that focuses on the potential and opportunities in the situation.

4.3.3. Analyzing the Problem

By analyzing the problem you discover the facts and what you know about the situation. We need to identify the nature of the problem and form a clear picture of what we are looking at and what we are not.

At this point the stakeholders are the main focus of the problem, which means, we need to know:
- Who knows?
- Who cares?
- Who can?

These simple questions can help us identify the people that are more likely to get involved in the problem. Getting to know them better will give us an advantage on how to deal with them and they how can be part of the solution.

A detailed examination of the issue will let us get a better view of the bigger picture and all connections with the system and the environment. At this point we are able to see what is causing the problem. The obstacles in our way become the cause of the problem and thus prevent us to reach the target.

A good management tip to address a methodology that will keep us in track can be described in the following four steps:
- Defining the current situation
- Challenging all aspects
- Developing confrontational options
- Optimal solution seeking

As soon as we realize what the actual problem is and what has created it, we are in the position to describe our
current situation. Knowing where we are is a good starting point as what remains is to discover where we need to go from here, and this is how the following steps will assist us in that.

When we get to the point that we have to conceptualize what is going on, a process of verification is a good starting point because it will allow us to examine all aspects and possibilities to verify that what we think we know is correct. Everything has to be examined and give us a positive answer otherwise we will have to retreat to that standstill in the process soon or later. In light of that, it is important to mention that this is a critical point in reaching a resolution. In a systemic approach this would be characterized as an attractor point. Attractor points in systemic analysis are the familiar places in a chaotic or complex environment where everything is unsure. Since we don’t know how the system works or reacts we need, from time to time, to lay out a non-questionable step that is familiar to us too.

The next step we need to go through is to find techniques on how to deal with problem. We are going to address this in the next paragraph and look at those techniques as developing possibilities. To conclude, we will also try to find the best solution possible, which will also be examined below.

4.3.4. Developing Possibilities

At this point we should be able to confirm our current situation with a good description of the system that we are examining, as well as the stakeholders involved. This is a critical point as our systems and the stakeholders are interconnected and need to also interact with each other. We are therefore ready to use DCSYM so we can now visualize all the information and have them in hand for the steps to follow.

During that process so far, plenty of possibilities should have been revealed and many opportunities should have also unfolded. What we need is a “tool” to combine all the information already collected and if possible to try and gather some more in order to try and solve the puzzle of the correct location, each part and any missing parts too. We need to find creative solutions and everything has to be put across the table for the team to work together and brainstorm. There is no such thing as silly ideas or illogical hypotheses’. Everything that is put across the table has to be examined so everyone is welcome to throw ideas at this point. The way the team works together will affect how everything gets filtered and how a result is reached. In the systemic approach this process is reported as amplification of complexity: we need an overflow of information to be able select the ideas that we consider valuable and necessary and the team will be the one to go through the complexity and attenuation by separating selected information that matches the desired needs of our research.

In the analysis of the decision many procedures, methods, and tools for identifying, clearly representing, and formally assessing important aspects of that decision are involved. This happens because a recommended course of action needs to be prescribed by applying the maximum expected utility action axiom to a well-formed representation of the decision, and as a result to translate the formal representation of the decision and its corresponding recommendation into insight for us - the decision maker - and the stakeholders involved. Decision analysis (DA) is the discipline comprising the philosophy, theory, methodology, and professional practice necessary to address important decisions in a formal manner.

Creativity techniques are methods that encourage creative actions not only in the arts but also science. Those techniques focus on a variety of aspects of creativity, including techniques for idea generation and divergent thinking, methods of re-framing problems, changes in the affected environment and so on. They can be used as part of problem solving.

Some techniques require groups of two or more people to get involved while others can be accomplished by a single person. These methods include word games, written exercises and different types of improvisation, or algorithms for approaching problems.

All we need to remember at this point is that we need all the information available at hand. This is the most critical point in our project as this is a step that cannot be taught but it is rather a matter of experience, accumulative knowledge and access the largest available network possible. This is why large companies and government organizations are acquiring knowledge to control everything. Everything comes back to this: knowledge is power and the key to everything.

4.3.5. Selecting the Best Solution

When all situation aspects have been acquired and studied we need to figure out what is the best solution. A careful approach needs to be adopted at this time as many factors can influence and confuse judgment. If we have done our due diligence during our initial steps this should not be a problem. We already know the system we are studying, its boundaries and what its purpose is. We know that what is best for our system is the familiar environment that surrounds it and all stakeholders that have been affected. We know where the starting point is and also where we need to go.

Having all the information necessary leads us to examine all possible options we have and all resources available to us. All we need to look at now is what influences are affecting our environment and what results we are going to have if we reach a specific solution. At this point we may use simulation as explained before to survey the results and the effects of the possible actions. Using diagnosis will identify the nature and cause of a certain phenomenon. Diagnosis is used in many different disciplines with variations in the use of logics, analytics, and experience to determine "cause and effect".

A good methodology will be to use a tradeoff analysis, which is a tool for determining the effect of decreasing one or more key factors and simultaneously increasing one or
more other key factors in a decision, design, or project.

To perform the trade-off analysis, we need to define the critical criteria affecting the problem that can then be used to evaluate how each solution compares to each other. The evaluation can be done using a simple matrix. The highest ranking solution will be our best solution for this problem.

MinMax (linear programming) could also be a problem. MaxMin is a decision rule used for minimizing the possible loss for the worst case (maximum loss) scenario. This is a good alternative for complex projects and general decision-making in the presence of uncertainty.

4.3.6. Implementing

Once we have determined which solution we will implement we are ready to take action. This is the point where we are creating the actual, real project so we need to create a plan for managing the project.

In fact it is also at this point that we are faced with multiple projects to handle, as usually innovation resides in the spectrum of complexity. Management in projects ensures reaching an effective solution in a shorter time for different complex problems, which are strategic and strongly innovative projects. This is used because change and performance orientation are major coordinates for our preoccupations.

It also leads to an acceleration of dynamics from the procedural and structural point of view, with favorable consequences towards the human involvement in meeting objectives.

4.3.7. Evaluating and Learning

When completing a project or projects we need to know how we performed. We need to know if we could better or improve our performance and minimize mistakes. Although this monitoring has to be continuous during the entire project, sometimes we are not in the position to predict or we do not have the knowledge at the time to make the right decisions.

While systemic control is needed and is always considered when planning the DCSYM it sometimes happens that even that is not enough to prevent mistakes. However, it seems that it definitely prevents major catastrophes and makes damage control easier to handle. Feedback in management must always be continuous and it is a major aspect in business management, as well as, project management.

Experience gathering through a delivered project may enrich knowledge for statisticians too, and we will subsequently also help the simulation process when we need to address a similar project.

And by ‘similar project’, we are not only referring to a single project but also multiple projects (programs), evaluations or technique reviewing commonly abbreviated as PERT. PERT is a statistical tool used in project management, which was designed to analyze and represent the tasks involved in completing a given project. PERT is also a method for analyzing the tasks involved in completing a given project, especially the time needed to complete each task, and to identify the minimum time needed to complete the total project.

5. Results

Research for this project started in 2009 and gradually evolved including more details and more technical data. At the same time there was a need for breaks in between from the initial project to focus on more specific area orientated research. The reason for that was to focus on some specifics that have eventually enhanced the main area of this research. As this research is carried on, all information is evaluated and projects are adjusted accordingly. On the other hand each and every independent project is closely connected to the others as all of them together have many common characteristics.

6. Conclusions

Any comments and suggestions are welcome so that we can constantly improve this research and identify more aspects for generating new knowledge in this filed.

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