Chapter 5
Radical and Systematic Eco-innovation with TRIZ Methodology

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Abstract The main objective of this chapter is to support an implementation of systematic eco-innovation and radical eco-innovation with analytical tools and techniques of the Theory of Inventive Problem Solving (TRIZ) methodology. It also aims to increase opportunities for eco-innovative products and services while simultaneously enhancing the innovation capacity of organizations.

By applying the TRIZ techniques to the eco-innovation approach, competitiveness and innovation of a firm can be increased. Thereby, the development of clean production processes, waste recycling, and thus "environmentally friendly" products and services is supported, allowing enterprises to "green" their business, product, and management methods.

A survey was conducted regarding application opportunities for the most important pillars of the TRIZ methodology in an eco-innovation environment.

Some opportunities for TRIZ were analyzed in the domain of systematic eco-innovation, since TRIZ is seen as a scientific basis of systematic innovation.

It is difficult to find analytical tools that can truly provide support to radical innovation. TRIZ has successfully supported these activities; therefore, it was also proposed to extend this support to the activities of radical eco-innovation.

The study included the analysis of opportunities to use the most important TRIZ elements and techniques, namely, the levels of innovation, the contradictions, the analysis of resources and ideality, the scientific effects and databases, the inventive principles, and the contradiction matrix in environments of systematic and radical eco-innovation.

Keywords Eco-innovation • Systematic eco-innovation • Radical eco-innovation • Problem solving • TRIZ

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5.1 Introduction

The growing internationalization of enterprises requires the introduction of new technological innovation management practices with strong socio-environmental responsibility. All industrial programs must combine technological innovation with good practices, always based on environmental vision. The environmental impacts can have a strong influence on management practices in general and on innovation issues as well.

Eco-innovation implies innovation in products, processes, or business models that enables the company to achieve higher levels of environmental sustainability. Eco-innovation does not only demand the identification, implementation, and monitoring of new ideas aimed at improving the environmental performance of the organization but must also have an impact on the overall level of competitiveness.

Enterprises need to invest in systematic eco-innovation if they plan to win or at least survive. Innovation can no longer be seen as the product of occasional inspiration. It has to be transformed into a capacity, not a gift. Eco-innovation has to be learned and managed. Unexpected occurrences, inconsistencies, process requirements, changes in the market and industry, demographic change, and changes in perception or new knowledge can give rise to eco-innovation opportunities.

Systematic eco-innovation can be understood as a concept that includes the instruments necessary to develop the right inventions needed at that point in time and incorporate them into new products and processes.

Incremental eco-innovation is not always sufficient to prevent environmental impact of economic activities; thus, more radical eco-innovation initiatives are needed. Radical eco-innovation presupposes a profound shift in the use of resources. More radical forms of eco-innovation can cause a sustainable transition to be difficult to deploy (Hellström 2007).

Radical solutions are very important, especially considering the long-term gains. Traditional engineering and management practices can become insufficient and inefficient for the implementation of new scientific principles or for vast improvements of existing systems.

Organizations need innovation in the right dose and at the right moment. They need methodologies and analytical tools that can help implement radical changes and completely new techniques. The Theory of Inventive Problem Solving (TRIZ), brainstorming, collateral thinking, mind maps, and other methodologies can stimulate individual and collective creativity.

Also needed in order to become more competitive are new management paradigms. The environmental sustainability is a very pertinent issue in industrial management. Eco-initiatives allied to innovation and innovative technologies can improve the sustainability of organizations through low emissions to the nature and recycling strategies for products.

Some authors dedicate their studies to the evaluation of compatibility between TRIZ techniques and eco-innovation with, for example, the use of a TRIZ contradiction matrix with the eco-compass principle (Jones 2003), a collection of eco-innovation examples for all 40 TRIZ inventive principles (Chen 2003), or the elaboration of an eco-design guideline using the TRIZ Law of Evolution (Russo and Regazzoni 2008).

This chapter focuses on the integration of the major TRIZ analytical tools with a radical and systematic eco-innovation. It is a different approach from previous literature, which focuses on specificities of systematic and radical eco-innovation.

5.2 Theory of Inventive Problem Solving (TRIZ)

The Theory of Inventive Problem Solving, better known by its acronym (TRIZ), was developed by Genrich Altshuller in 1946 (Altshuller 1995). TRIZ is a theory that can assist any engineer in the inventing process.

The TRIZ methodology can be seen and used on several levels. At the highest level, the TRIZ can be seen as a science, as a philosophy, or as a way to be in life (a creative mode and a permanent search of continuous improvement). In more terms, the TRIZ can be seen as a set of analytical tools that assist both in the detection of contradictions on systems and in formulating and solving design problems through the elimination or mitigation of contradictions (Savransky 2000).

The TRIZ methodology is based on the following grounds:

- Technical systems
- Levels of innovation
- Law of ideality
- Contradictions

Every system that performs a technical function is a technical system. Any technical system can contain one or more subsystems. The hierarchy of technical systems can be complex with many interactions. When a technical system produces harmful or inadequate effects, the system needs to be improved. Technical systems emerge, ripen to maturity, and die (they are replaced with new technical systems). TRIZ systematizes solutions that can be used for different technical fields and activities.

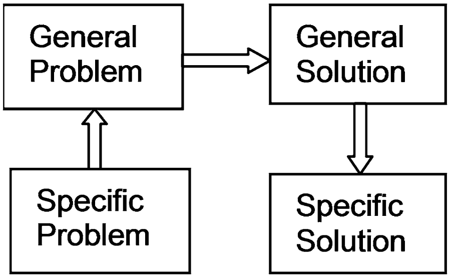
In TRIZ, the problems are divided into local and global problems (Altshuller 1995). The problem is considered to be local when it can be mitigated or eliminated by modifying a subsystem, keeping the remaining unchanged. The problem is classified as global when it can be solved only by the development of a new system based on a different principle of operation.

Over the past decades, TRIZ has developed into a set of different practical tools that can be used collectively or individually for technical problem solving and failure analysis.

Generally, the TRIZ process is to define a specific problem, formalize it, identify the contradictions, find examples of how others have solved the contradiction or utilized the principles, and, finally, apply those general solutions to the particular problem.

Figure 5.1 shows the steps of the TRIZ process.

Fig. 5.1 Steps of the TRIZ's algorithm for problem solving (Fey and Rivin 1997)



It is important to identify and to understand the contradiction that is causing the problem as soon as possible. TRIZ can help to identify contradictions and to formalize problems to be solved. The identification and the formalizing of problems is one of the most important and difficult tasks, with numerous impediments. The situation is often obscured.

The problem can be generalized by selecting one of the TRIZ tools. The generic solutions available within TRIZ can be of great benefit when choosing corrective actions.

The integral development of TRIZ consists of a set of concepts (Radeka 2007):

- Problem formulation system
- Physical and technical contradictions solving
- Concept of the ideal state of a design
- Analysis "substance field"
- Algorithm of Inventive Problem Solving (ARIZ)

Altshuller built a contradiction matrix, classifying the contradictions as follows (Altshuller 1995):

- Physical contradiction, which occurs when two mutually incompatible requirements refer to the same element of the system
- Technical contradiction, which occurs when the improvement of a particular attribute or characteristic of the system causes the deterioration of another attribute

The first step in the conflict solving process is drawing up a statement of the problem in order to reveal the contradictions contained in the system. Then, the parameters that affect and improve system performance are identified.

5.3 TRIZ Levels of Innovation for the Evaluation of Systematic and Radical Eco-innovation Initiatives

There are different methods to assess the levels of eco-innovation. Different methods take into account different aspects of eco-innovation initiatives. However, eco-innovation requires analysis on different levels; therefore, the evaluation systems must be organized accordingly. There is a need for approaches to capture complexities of a multilevel eco-innovation analysis.

The measurement of innovation is necessary; it contributes to the establishment of longer-term policies for eco-innovation.

Altshuller's analysis of a large number of patents reveals that the inventive value of different inventions is not equal. Altshuller systematized the solutions described in patent applications by dividing them into five levels (Altshuller 2001):

- Level 1: routine solutions using methods well known in their area of specialty. Level 1 is not highly innovative. This category constitutes about 30 % of the total.
- Level 2: small corrections in existing systems using methods known in the industry. This level makes up approximately 45 % of the total.
- Level 3: major improvements that solve contradictions in typical systems of a particular branch of industry. About 20 % of the total are on this level, which is where creative design solutions appear.
- Level 4: solutions based on the application of new scientific principles. They solve the problem by replacing the original technology with new technology. Nearly 4 % of the total are classified to be on this level.
- Level 5: innovative solutions based on scientific discoveries not previously explored. This level consists of less than 1 % of the total.

The five-level TRIZ classification can be used for analysis of eco-innovation initiatives. The same problem can be solved by solutions with different levels of innovation. The five-level classification can be applied for the evaluation of innovation level of different eco-innovation solutions, and it can be used during the development process of new proposals.

The development of a new solution can follow different procedures:

- Conventional improvement of existing system (levels 1 and 2)
- New forms but with existing principles of operation (levels 2 and 3)
- Creation of new system generation with new principles of operation (levels 4 and 5)

The creative solutions classified in levels 4 and 5 (and especially the solutions at level 5) can be considered radical.

For example, the need to reduce fuel consumption in automobiles has led manufacturers of engines and vehicles to introduce several new features and modifications. They do not possess the same level of innovation. The level of creativity can be determined according to the following scale that is adapting the TRIZ five levels of innovation:

Level 1 (compromising design) – travel with the windows rolled up because the aerodynamic performance improves and fuel consumption is lower.

Level 2 (resolving the technical contradiction) – install a speed limitation device, since the increase in speed increases the fuel consumption.

Level 3 (resolving the physical contradiction) – reconsider the design of the gearbox, as a good steady speed can help spend less fuel.

Level 4 (new technology) – change from traditional gasoline to LPG.
Level 5 (new phenomena) – rather than traditional internal combustion engines, switch to using electric or hybrid vehicles.

The five levels of innovation also can be useful for the prognosis of evolution of a specific system (Kraev 2006).

One could observe, for example, the evolution of diapers for babies. Earlier diapers were made of cloth and later evolved to disposable diapers. The evolution of disposable diapers is related to several criteria such as being healthier, more comfortable, cleaner, and more economical. In the future, the diapers must continue to evolve in order to be made of breathable, chemical-free, and biodegradable materials as well as being soft for skin contact and super absorbent.

5.4 Technical and Physical Contradictions and Eco-innovation

Technical and physical contradictions constitute one of the most important terms of the TRIZ vocabulary.

The TRIZ Axiom of Evolution reveals that, during the evolution of a technical system, improvement of any part of that system can lead to conflict with another part.

A system conflict or contradiction occurs when the improvement of certain attributes results in the deterioration of others. The typical conflicts are reliability/complexity, productivity/precision, strength/ductility, etc. A technical problem is defined by contradictions.

The traditional way of contradiction solving is through the search of possible compromise between contradicting factors, whereas TRIZ aims to remove contradictions and compromises. The inconsistencies are eliminated by modification of the entire system or by modification of one or more subsystems.

A traditional approach is based on trade-offs through preferable combinations of characteristics in conflict. TRIZ aspires to solve the contradictions by modification of systems to avoid deterioration of any characteristic in case of improvement of other characteristics.

Altshuller distinguished three types of contradictions (Altshuller 1986):

1. Administrative contradiction – contradiction between the needs and abilities
2. Technical contradiction – the classical engineering “trade-off,” an inverse dependence between parameters/characteristics of a machine or technology
3. Physical or inherent contradiction – opposite/contradictory physical requirements of an object

An identification and analysis of contradictions should be included in any process of TRIZ inventive solving of problems. When a contradiction is identified, it becomes easier to find creative and effective solutions for the problem. A contradiction does not solve a problem, but it gives direction for a solution.

We can now use two ways of problem solution. One way is to resolve all contradictions by applying one of the appropriate TRIZ analytical tools for solving technical contradictions (e.g., 40 inventive principles, contradiction matrix, or others). The other way is to transform the technical contradictions into physical contradictions resolving all contradictions at the physical level (e.g., with databases of physical phenomena and effects).

All technical contradictions can be transformed into a corresponding physical contradiction.

Any physical contradiction can be resolved using one of the four principles (principles of physical contradiction solving):

- Separation of contradictory characteristics in time
- Separation of contradictory properties in space
- System transformation
- Phase transformation (physical and/or chemical transformation of substances)

Eco-innovative initiatives can contain some technical contradictions, such as the following:

- The goal of building vehicles that use less fuel conflicts with the engine power (lower horsepower).
- The goal of building vehicles that use less fuel conflicts with acceleration.
- The usage of electric vehicles as an alternative to internal combustion engines, but the distances between recharging are much smaller in electric vehicles.
- Heavier batteries needed as the distance range of the electric vehicle increases.

5.5 TRIZ Resource Analysis in an Eco-innovation Environment

The identification of available resources around a problem and the maximization of their use are important for finding cost-effective and environmentally friendly solutions. TRIZ demands that the analysis of resources take into account the negative as well as the positive resources in a system (Mann 2000).

The improvements must continue until the resources are fully utilized.

Resources can be grouped according to the following (Savransky 2000):

1. Natural or environmental resources
2. System resources
3. Functional resources
4. Substance resources
5. Energy and field resources
6. Time resources
7. Space resources
8. Information resources

Altshuller also grouped resources in the following categories:

1. Based on accessibility
    (a) Internal (limited to the main elements of the system)
    (b) External, including resources from the general environment and those which are specific for the given system
    (c) Resources from the supersystem or other accessible, inexpensive resources (including waste)
2. Based on readiness for utilization
    (a) Readily available resources
    (b) Derived (modified readily available resources)

The key for sustainability is resources productivity.

TRIZ analysis of resources can be useful in eco-innovation initiatives related to more efficient and responsible usage of resources, including energy use.

The gains in resource efficiency generally result from process improvements. Thus, sporadic initiatives of eco-innovation must evolve to the continuously planned and scheduled activities; the eco-innovation must become systematic.

The traditional incremental improvement of existing technologies is no longer sufficient. All economic activities need to radically increase the efficiency of resource utilization.

The application of the TRIZ analytical tools and techniques can be especially useful for the radical eco-innovation both in the generation of innovative and revolutionary solutions as well as in the resource analysis and forecast.

The resources can be used to solve problems according to the following workflow:

1. Formulate the problem.
2. Build the list of resources in the following order: internal, external, by-products, and complex resources.
3. Define what kind of resources is needed to solve the problem.
4. Estimate each of the existing resources and the effects of its use.
5. Propose how to use the resource.

For example, consider the following problem: it is necessary to increase the efficiency of a fireplace without any interior reconstruction (Kraev 2007). The list of resources is as follows: firewall brick, fire, hot-air conductivity system, fuel, convection air flow, ambient chilly air, atmospheric pressure, gravitational field, and geomagnetic field. It is necessary to increase the heat transport capacity.

The convection air current linked to the system and convection heat transfer are both useful, free resources that we can try to use.

Solution: It is known that the fireplace heats the air in the room by convection heat transfer. In fact, the air in the room will be heated considerably by placing a metal sheet with small air gaps on the front edges of the fireplace. In this way the air will heat much more quickly in the narrow space between the fireplace and the metal sheet. Hot air will come out of the top, while cold air will come out from the bottom of the metal sheet (Kraev 2007).

5.6 System Ideality for Radical and Systematic Eco-innovation

The law of ideality states that any technical system tends to reduce costs, energy wastes, and space and dimensional requirements as well as become more effective, more reliable, and simpler. Any technical system, during its lifetime, tends to become more ideal.

We can evaluate an inventive level of a technical system by its degree of ideality.

The ideality can be calculated as the ratio of a system's useful functions to its harmful functions with the formula:

$$\text{Ideality} = \text{useful functions} / \left(\text{harmful functions} + \text{cost}\right) \tag{5.1}$$

Useful functions include the following:

- Primary useful functions – the purpose for which the system was designed
- Secondary functions – other useful outputs
- Auxiliary functions – functions that support the primary useful functions, such as corrective functions, control functions, housing functions, transport functions, etc.

Harmful functions include all harmful factors associated to the system (e.g., costs, area that it occupies, emission of noises, expended energy, resources needed for system maintenance, etc.).

The level of ideality increases with the increase of useful functions and reduces with the increase of harmful functions.

There are three ways to increase an ideality of a technical system:

- Increasing the useful functions
- Reducing any harmful or expensive function
- A combination of the first two paths

According to the TRIZ methodology, an ideal system does not exist. An absolute ideality is impossible to achieve, but other relative levels of ideality are achievable. A real system can approximate to the ideal system by increasing the useful functions and eliminating the harmful functions through contradiction solving, more efficient use of resources, and the reduction of system complexity and number of components.

The ideality can be used both to improve existing systems and also for the creation of new technologies or new systems to fulfill specific functions.

The concept of increasing the degree of ideality is crucial for predicting the evolution of the system.

There are several concepts derived from the same concept of ideality, such as ideal final result, ideal final goal, ideal solution, ideal product, ideal process, etc.

Ideal final result (IFR) is the ultimate idealistic solution of a problem when the desired result is achieved by itself.

Systematic eco-innovation can be supported by TRIZ ideality, whereas the planned and continuous improvement can be made in terms of increasing the level of ideality of a given system.

Table 5.1 Ideality matrix for the camping stove (Navas 2013)

Parameter	1.	2.	3.	4.	5.	6.	7.	8.
1. Volume		+			–	–	–	
2. Weight	+				–	–	–	
3. Firing time					+			
4. Noise level								
5. Time required to boil water	–	–	+				–	+
6. Tank capacity	–	–	+		+		+	+
7. Burning time at maximum flame	–	–			–	–		–
8. Boiled water per unit of gas	–	–			+	+	–	

– Harmful iteration

+ Useful iteration

The initiatives of a radical eco-innovation can be seen as actions aimed at dramatically increasing the level of ideality. The ideal final result can be very useful, especially for a radical eco-innovation.

For example, consider the case study focused on increasing the energy efficiency of a camping stove.

The customer requirements were collected, pooled, and prepared by an affinity diagram, yielding the following list:

- Volume
- Weight
- Firing time
- Noise level
- Time required to boil water
- Tank capacity
- Burning time at maximum flame
- Boiled water per unit of gas

Table 5.1 contains the matrix of ideality built for the camping stove.

The ideality matrix helps identify the interactions between the technical requirements and distinguish the positive and negative effects of iterations. For example, weight reduction can lead to reduction in volume but may lead to reduction of the tank capacity.

The ideality matrix (Table 5.1) contains 11 positive (useful) and 19 negative (harmful) interactions. In this case, the level of ideality is

$$I = 11/19 \approx 0.579$$

Based on this analysis, measures can then be established to increase the level of ideality by increasing the useful functions, reducing any harmful or expensive function, or by combination of the first two paths.

5.7 Scientific Effects and the Application of Databases for Eco-innovation Problem Solving

TRIZ includes a database of scientific effects structured according to technological functions. According to TRIZ, the scientific effects are one of the principles for contradiction solving by transformation of an action or field to another with the application of physical, chemical, biological, geometric, or another phenomena.

Currently, there are over 8,000 known effects and different phenomena, and 400–500 of them are most applicable in the practice of engineering activity.

Special tables and descriptions of scientific phenomena exist, which give us the opportunity to define the required effect of an output action or function that should be performed according to the identified problem. Also, there are special software with databases of scientific and engineering phenomena. These programs allow effective selection based on the desired function. Some software provides access to more than 4,500 engineering and scientific effects, theorems, laws, and phenomena.

The use of scientific effects and phenomena helps to develop solutions at the highest level of innovation. Scientific effects can be used to solve problems outside the field where the original problem was found.

The databases of scientific effects can help all initiatives of eco-innovation, especially radical eco-innovation dispelling the fear of using new techniques but also avoiding repetition of wrong solutions.

For example, consider a study conducted in a plant that traditionally used toxic organic solvents. The main objective of the study was the elimination or drastic reduction of use of toxic solvents. The query databases helped tremendously in terms of both filtering solutions deemed to be inappropriate or potentially dangerous and also providing many ideas and suggestions for possible solutions. Solutions with lower levels of innovation (the toxic solvents replaced by less toxic solvents) were considered, and ideas for a radical change in the whole technological process of the company (total removing of the toxic solvents from the technological process) were analyzed.

5.8 Application of the Inventive Principles and Matrix of Contradictions

Altshuller (2001) found that, despite the great technological diversity, there are only 1,250 typical system conflicts. He also identified 39 engineering parameters or product attributes that engineers usually try to improve.

Table 5.2 presents the list of these parameters.

All 1,250 conflicts can be solved through the application of only 40 principles of invention (Altshuller 2001), often called Techniques for Overcoming System Conflicts, which are shown in Table 5.3.

Table 5.2 Engineering parameters according to TRIZ (Altshuller 2001)

No	Engineering parameter
1	Weight of moving object
2	Weight of nonmoving object
3	Length of moving object
4	Length of nonmoving object
5	Area of moving object
6	Area of nonmoving object
7	Volume of moving object
8	Volume of nonmoving object
9	Speed
10	Force
11	Tension, pressure
12	Shape
13	Stability of object
14	Strength
15	Durability of moving object
16	Durability of nonmoving object
17	Temperature
18	Brightness
19	Energy spent by moving object
20	Energy spent by nonmoving object
21	Power
22	Waste of energy
23	Waste of substance
24	Loss of information
25	Waste of time
26	Amount of substance
27	Reliability
28	Accuracy of measurement
29	Accuracy of manufacturing
30	Harmful factors acting on object
31	Harmful side effects
32	Manufacturability
33	Convenience of use
34	Repairability
35	Adaptability
36	Complexity of device
37	Complexity of control
38	Level of automation
39	Productivity

However, most of the principles of invention in Table 5.3 have a specific technical meaning introduced by Altshuller. For example, the principle of local quality involves (Terninko et al. 1998):

- Transitioning from a homogeneous structure of an object or outside environment/action to a heterogeneous structure

Table 5.3 Inventive principles of TRIZ

No	Inventive principle
1	Segmentation
2	Extraction
3	Local quality
4	Asymmetry
5	Combining
6	Universality
7	Nesting
8	Counterweight
9	Prior counteraction
10	Prior action
11	Cushion in advance
12	Equipotentiality
13	Inversion
14	Spheroidality
15	Dynamicity
16	Partial or overdone action
17	Moving to a new dimension
18	Mechanical vibration
19	Periodic action
20	Continuity of a useful action
21	Rushing through
22	Convert harm into benefit
23	Feedback
24	Mediator
25	Self-service
26	Copying
27	Exchange of expensive durable object by inexpensive short-lived object
28	Replacement of a mechanical system
29	Pneumatic or hydraulic construction
30	Flexible membranes or thin film
31	Use of porous material
32	Changing the color
33	Homogeneity
34	Rejecting and regenerating parts
35	Transformation of the physical and chemical states of an object
36	Phase transformation
37	Thermal expansion
38	Use of strong oxidizers
39	Inert environment
40	Composite materials

- Having different parts of the object carry out different functions
- Placing each part of the object under conditions most favorable for its operation

The inventive principles are simple analytical tools to solve technical contradictions and finally resolve the problem.

Table 5.4 Fragment of Altshuller's matrix of contradictions

		Worsening characteristic	
Characteristic		9 speed	21 power
Characteristic to be improved	19 energy spent by a moving object	8, 35	6, 19 37, 18

In practical activities, various methods are used to apply the 40 principles in the process of problem solving. The simplest method is to examine each contradiction and try to apply the principles of each of them or their combinations to solve the contradiction technique on the specific problem. Another method is the development of a technical contradiction and use of the contradiction matrix in order to determine the set of recommended principles to solve the problem (usually between two and four principles).

Altshuller built a contradiction matrix. The rows of the table of contradictions are populated with parameters whose adjustment improves the behavior of the system, and these intersect with the columns with parameters whose adjustment produces unwanted results. At the intersection are the numbers of invention principles that are suggested as being capable of solving the contradiction.

In the contradiction matrix, the rows and columns refer to Table 5.2. The numbers in the cells refer to Table 5.3.

For example, if the goal of a study is the reduction of fuel consumption of a vehicle, the modification can have a negative effect on the acceleration, speed, and power.

Table 5.4 contains the extract of the matrix of contradictions built into the case.

The conflict between the characteristics 19 and 9 can be solved by applying the principles of the invention 8 (counterweight) and 35 (transformation of the physical and chemical states of an object). The conflict between the characteristics 19 and 21 can be solved using the principles 6 (universality), 19 (periodic action), 37 (thermal expansion), and 18 (mechanical vibration).

5.9 Conclusions

The constant need for change is a current issue in industrial activities. Although organizations place priority on meeting their own objectives, ecological aspects must also be considered. Organizations need powerful and highly efficient analytical tools related to innovation and creativity. One of the most important factors for the success of industrial activities is the generation of ideas and innovation. The lack of creativity can lead to the failure of objectives. Creativity is crucial for competitiveness.

Some authors have tried to find common ground among some of the TRIZ techniques and eco-innovation. The novelty of this study is to survey the applicability of the key pillars of TRIZ to eco-innovation, especially systematic eco-innovation and radical eco-innovation.

The TRIZ methodology, with its strong theme of radical and systematic innovation, can contribute to accelerating the resolution of problems in the eco-innovation activities. The TRIZ analytical tools would be very useful for schematization of eco-innovation tasks, system analysis, identification, and formalization of contradictions and problematical situations and their solving processes.

TRIZ is a methodology especially suited for supporting the development of radical solutions where traditional techniques usually do not yield positive results.

Moreover, TRIZ is considered the scientific basis of systematic innovation. Thus, the extension of TRIZ for systematic eco-innovation and radical eco-innovation seems to be a logical step of evolution.

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