

# **AATRIZINVENTOR SOLUTION FOR INNOVATION BASED ON NATURE'S L.I. Working Document to Build a Specific Solution.**

**INNOVATION CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea**

**APPLICATION OF NATURE'S LANGUAGE OF INNOVATION / Nature's L.I.**

Web site: [www.aatrizinventor.com](http://www.aatrizinventor.com)

Reference book: The Nature's Language of Innovation, José Roberto Espinoza, Amazon, Kindle.

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## **FACTORS OF INNOVATION:**

**FUNCTION AFFECTED:** Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

**PHYSICAL VARIABLE OR CHARACTERISTIC:** Less Survivability

**S1 OBJECT:** LARVA Type: Stationary

**S2 OBJECT:** SEAWATER Type: Moving

**DESIRED ACTION VERB:** Improve

## **INNOVATION CHALLENGE:**

**CHALLENGE:** Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

**DESIRED GOAL:** More Survivability

**EVALUATED OBJECT:** LARVA

**NEED TO SATISFY > 34. Ease of change, repair or maintain**

## **SELECTED INNOVATION PARAMETERS TO EVALUATE:**

### **A. UNDESIRABLE EFFECTS CAUSES OF DISSATISFACTION (UDEs)**

There are More difficulty to Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea because:

LARVA Has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

LARVA Has Less Appropriate shape, composition, or configuration interacting with S2

LARVA Has Less Adaptability or versatility to interaction variability of S2

LARVA Has More Difficulty in detection and measurement interacting with S2

There are undesirable effects that cause dissatisfaction because:

There is Less Survivability

### **B. DESIRED EFFECT FOR NEED TO SATISFY**

There is More ease to Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea because:

LARVA Has More Desired ease of change, repair or maintenance to interact with S2

There is desirable effect for need to satisfy because:

There is More Survivability

**Table I. RELATIONSHIP WITH UNIVERSAL TRIZ INNOVATION PARAMETERS ( maximum of 7 undesirable effects)**

**CHALLENGE:** Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

This table presents the selected innovation parameters to evaluate the challenge that must be resolved for the interaction between an Object S1 and an Object S2, and no others. The choice of undesirable effects must be based on a thorough review of the current situation, identifying them based on the objective evidence present within the predefined space and time of evaluation. Fulfilling this requirement is crucial: If you do not connect the dots of the current situation properly, the algorithm will deliver a disconnected solution.

The selection of the need to satisfy should reflect the best estimation of the innovation-evolution state of the object S1 being evaluated.

Recognizing the criticality of this selection process, the Aatrizinventor algorithm provides flexibility to change parameters and conducts a sensitivity analysis in order to offer alternative solutions. These alternatives are based on different combinations of the entered parameters, also including a different need to satisfy from the one originally posed.

<b>Parameters to evaluate(s)</b>	<b>It is understood as LARVA has:</b>
<b>Parámetros of undesirable effects (UDE):</b>	<b>Undesirable effects causes of dissatisfaction:</b>
(+) 2. Heaviness of stationary object	More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
(-) 12. Shape / composition / configuration	Less Appropriate shape, composition, or configuration interacting with S2
(-) 35. Adaptability or versatility	Less Adaptability or versatility to interaction variability of S2
(+) 37. Difficulty of detecting and measuring	More Difficulty in detection and measurement interacting with S2
<b>Desirable parameter (DE):</b>	<b>Desirable Effect for Need to satisfy:</b>
(+) 34. Ease of change, repair or maintain	More Desired ease of change, repair or maintenance to interact with S2
<b>TRIZ undesirables parameters for sensitivity analysis</b>	<b>It is understood as LARVA has:</b>
(+) 24. Loss of Information	More Loss of information or lack of communication interacting with S2
n/a	
n/a	
n/a	
n/a	

## EVALUTION RESULTS TABLES

**TABLE II. SPECIFIC CONTRADICTION MATRIX FOR UNDESIRABLE EFFECTS AND NEED TO SATISFY. FOR EVALUATED OBJECT: LARVA AND NEED TO BE SATISFIED > 34. Ease of change, repair or maintain**

CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

(\*) Preferred parameters: Improve 37. Difficulty of detecting and measuring & Attenuate or preserve 12. Shape / composition / configuration.

Contradictions/ E.C: Essential, Comp.:Complementary, Top 5: Up to the major fifth, noted if outside the preferred parameters.

Parameters in the first row are the same as those in the first column.

Parameter to attenuate or preserve => Parameter to improve	Var.	(+) Par.2	(-) Par.12 PREF.	(-) Par.35	(+) Par.37	(+) Par.34	Sum wt
(+) 2. Heaviness of stationary object	wt		<b>wt.18 Compl.</b>	wt.9	wt.14	wt.15	31%
	IP(s)	0,0,0,0	13,10,29,14	19,15,29,0	25,28,17,15	2,27,28,11	
(-) 12. Shape / composition / configuration	wt	wt.16		wt.6	wt.12	<b>wt.3 Top 5</b>	64%
	IP(s)	15,10,26,3	0,0,0,0	1,15,29,0	15,13,39,0	2,13,1,0	
(-) 35. Adaptability or versatility	wt	wt.7	<b>wt.13 Compl.</b>		wt.8	wt.10	48%
	IP(s)	19,15,29,16	15,37,1,8	0,0,0,0	1,0,0,0	1,16,7,4	
(+) 37. Difficulty of detecting and measuring PREF.	wt	<b>wt.1 E.C.</b>	<b>wt.5 Compl.</b>	<b>wt.4 Compl.</b>		<b>wt.19 Compl.</b>	100%
	IP(s)	6,13,28,1	27,13,1,39	1,15,0,0	0,0,0,0	12,26,0,0	
(+) 34. Ease of change, repair or maintain	wt	wt.17	<b>wt.2 Compl.</b>	wt.10	-		58%
	IP(s)	2,27,35,11	1,13,2,4	7,1,4,16	0,0,0,0	0,0,0,0	
Sum wt		70%	81%	65%	32%	54%	

This table shows the essential contradiction (E.C.) that determines the solution strategy. Additionally, preferred parameters are established where complementary contradictions (Compl.) are found, allowing the definition of the Base Solution shown in Table III.

As a complement to the Base Solution, Table II also provides the following information that could be relevant to obtain an optimal solution:

a) The algorithm identifies the top 5 contradictions from the entire Table II and highlights those that are

outside the preferred parameters for further review.

b) There are inventive principles present in Table II that are not part of the Recommended Solution proposed in Table V. In the latter, the top three most relevant ones are highlighted, and the contradictions they involve are presented to evaluate whether they contribute significant aspects to the desired solution. For further details, Table VIII provides a prioritization of the inventive principles from Table II, and those not included in the Recommended Solution in Table V are marked with \*\*\*.

**TABLE III. BASE SOLUTION FOR THE EVALUATED OBJECT: LARVA**

**NEED TO SATISFY > 34. Ease of change, repair or maintain**

CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

Table II Selection: Essential Contradiction wt.1 y Complementary contradictions with preferred parameters (*) wt.2/wt.4/wt.5/wt.13							
Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	Essential	wt.1	<b>6 Es.</b>	<b>13 Es.</b>	<b>28 Es.</b>	<b>1 Es.</b>
(+) 34. Ease of change, repair or maintain	(-) 12. Shape / composition / configuration	Compl. 1	wt.2	<b>1 Es.</b>	<b>13 Es.</b>	2	4
(+) 37. Difficulty of detecting and measuring	(-) 35. Adaptability or versatility	Compl. 2	wt.4	<b>1 Es.</b>	15	0	0
(+) 37. Difficulty of detecting and measuring	(-) 12. Shape / composition / configuration	Compl. 3	wt.5	27	<b>13 Es.</b>	<b>1 Es.</b>	39
(-) 35. Adaptability or versatility	(-) 12. Shape / composition / configuration	Compl. 4	wt.13	15	37	<b>1 Es.</b>	8

**Inventive Principles (IP) selected for the Base Solution**

IP.6. Universality - tactical type

IP.13. Reverse or Indirect Action - strategic type

IP.28. Mechanics Substitution - strategic type

IP.1. Segmenting/ Integrating - strategic type

IP.2. Taking out/ Adding - strategic type

IP.4. Asymmetry/ Symmetry - **operative type**

IP.15. Dynamics - strategic type

IP.27. Cheap Short-Living Objects - strategic type

IP.39. Inert Atmosphere / Environment - **operative type**

IP.37. Useful Perceptible Change - **operative type**

## IP.8. Anti-Weight/ Compensation - tactical type

Table III shows the essential contradiction, the one with the highest weight, plus the following 4 complementary contradictions in weight, which are located in the row and column of the preferred parameters selected in Table II. These contradictions are considered relevant for the solution and are described as the Base Solution in Table IX.

Keep in mind that all inventive principles selected for a solution must be evaluated according to the specific context of the contradictions in which they participate.

Inventive principles marked with 'Es.' correspond to inventive principles that belong to the essential contradiction.

### TABLE IV. CONTRADICTION MATRIX COVERAGE FOR SOLUTION AMONG NEEDS TO SATISFY FOR EVALUATED OBJECT: LARVA, NEED TO BE SATISFY: 34. Ease of change, repair or maintain

Coverage is defined as the extent to which the inventive principles from Table II encompass the inventive principles from Table IV. If weighted coverage is higher, it has been observed that the obtained solution is more likely to have the lowest cost and the maximum benefit-to-cost ratio.

Parameter to improve	Parameter to preserve	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
34. Ease of change, repair or maintain	38. Extent of automation/ autonomy	<b>34</b> nT2	35	7	13
34. Ease of change, repair or maintain	39. Productivity	1	<b>32</b> nT2	10	0
34. Ease of change, repair or maintain	33. Ease of operation	1	12 nT3	26 nT3	15
34. Ease of change, repair or maintain	34. Ease of change, repair or maintain	0	0	0	0
34. Ease of change, repair or maintain	32. Ease of achieving desired outcome	1	35	11 nT3	10
34. Ease of change, repair or maintain	20. Use of energy by stationary object	0	0	0	0
34. Ease of change, repair or maintain	27. Reliability	11 nT3	10	1	16 nT3
34. Ease of change, repair or maintain	35. Adaptability or versatility	7	1	4	16 nT3
34. Ease of change, repair or maintain	13. Stability	2	35	0	0



(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	Essential	wt.1	<b>6 Es.</b>	<b>13 Es.</b>	<b>28 Es.</b>	<b>1 Es.</b>
(+) 34. Ease of change, repair or maintain	(-) 12. Shape / composition / configuration	Compl. 1	wt.2	<b>1 Es.</b>	<b>13 Es.</b>	2	4
(+) 37. Difficulty of detecting and measuring	(-) 35. Adaptability or versatility	Compl. 2	wt.4	<b>1 Es.</b>	15	0	0
(+) 37. Difficulty of detecting and measuring	(-) 12. Shape / composition / configuration	Compl. 3	wt.5	27	<b>13 Es.</b>	<b>1 Es.</b>	39
(-) 35. Adaptability or versatility	(-) 12. Shape / composition / configuration	Compl. 4	wt.13	15	37	<b>1 Es.</b>	8
34. Ease of change, repair or maintain	38. Extent of automation/ autonomy	NS.1	wns.1	34	35	7	<b>13 Es.</b>
34. Ease of change, repair or maintain	39. Productivity	NS.2	wns.2	<b>1 Es.</b>	32	10	0

### Relevant inventive principles from Table II not included in Recommended Solution

Before deciding on the solution, make sure you have previously reviewed the contradictions with relevant Inventive Principles from Table II, not included in the Recommended Solution. The 3 most relevant are shown below.

IP.19. Time-Varying Action/ Periodic or Pulsating (Pos.5) ***	IP. Str.	[Par.35][Par.2][ IP(s) : 19,15,29,16] - [Par.2] [Par.35][ IP(s) : 19,15,29,0] -
IP.25. Self-service (Pos.8) ***	IP. Oper.	[Par.2][Par.37][ IP(s) : 25,28,17,15] -
IP.12. Equipotentiality (Pos.9) ***	IP. Tac.	[Par.37][Par.34][ IP(s) : 12,26,0,0] -

### Inventive Principles (IP) selected for Recommended Solution:

To develop a Specific Solution based on the contradictions provided in Table V, where S1: LARVA interacts with S2: SEAWATER, the Innovation Team must analyze the recommended innovation concepts for each selected inventive principle listed below. At least one concept from each principle that is applicable to the challenge under evaluation should be chosen.

Once the concepts are selected per inventive principle, it is essential to conduct an 'integrated reading' of the contradictions indicated in Table V. If this 'integrated reading' can demonstrate a coherent logical thread for each selected contradiction and as a whole, then it can be considered that there is a potential

innovation solution.

To complete the definition of the specific solution, it is necessary to review the relevant inventive principles from Table II that were not included in the Recommended Solution in Table V, which are presented above.

For more details on the selected contradictions, you can review the complete descriptions of the inventive principles by contradiction, as shown in Table IX.

In the Starting Manual, Fundamentals of Aatrizinventor, Point 11, an example is provided for developing the Specific Solution based on the Recommended Solution by the Aatrizinventor algorithm, based on the 'Language of Nature Innovation.' The identification of a specific solution is a systematic and iterative process involving multiple concepts, aiming to determine a comprehensive solution with minimal implementation costs and maximum benefit-to-cost ratio.

It's important noting that an asterisk (\*) has been added to the name of the object under evaluation to remind that the descriptions of the inventive principles may consider that LARVA can be in its current physical and functional state, or in a modified state, or even in a new state, as needed to achieve the desired objective. Please, make the most of your relational thinking skills.

**Summary description of the Inventive Principles included in the Recommended Solution shown above, applicable to the challenge under evaluation for the defined space and time:**

**N°1 Improve: (+) 37. Difficulty of detecting and measuring and Attenuate or Preserve: (+) 2. Heaviness of stationary object**

**IP.6. Universality - tactical type (1)**

- a. Make a part or the whole of LARVA\* perform multiple functions.
- b. Eliminate the need of LARVA\* for others parts.

**IP.13. Reverse or Indirect Action - strategic type (2)**

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object S2 It should be identified how LARVA\* currently performs an action with Object S2 and from there evaluate an inverse or indirect action.
- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) 'upside down', 'change the position', 'change the condition'!

**IP.28. Mechanics Substitution - strategic type (3)**

- a. Replace a direct or manual action in, or for, LARVA\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, LARVA\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields gto improve action of LARVA\*.
- d. Change from static fields in, or for, LARVA\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, LARVA\*.

**IP.1. Segmenting/ Integrating - strategic type (4)**

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.
- c. Make LARVA\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**N°2 Improve: (+) 34. Ease of change, repair or maintain and Attenuate or Preserve: (-) 12. Shape / composition / configuration**

**IP.1. Segmenting/ Integrating - strategic type** (5)

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**IP.13. Reverse or Indirect Action - strategic type** (6)

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object S2 It should be identified how LARVA\* currently performs an action with Object S2 and from there evaluate an inverse or indirect action.
- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) 'upside down', 'change the position', 'change the condition'.

**IP.2. Taking out/ Adding - strategic type** (7)

- a. Separate an interfering part or a property from LARVA\*, or single out the only necessary part (or property) of LARVA\*.
- b. Add new parts or properties to LARVA\*.

**IP.4. Asymmetry/ Symmetry - operative type** (8)

- a. Change the shape of LARVA\* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.
- b. If LARVA\* is asymmetrical, increase its degree of asymmetry, or vice versa.

**N°3 Improve: (+) 37. Difficulty of detecting and measuring and Attenuate or Preserve: (-) 35. Adaptability or versatility**

**IP.1. Segmenting/ Integrating - strategic type** (9)

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**IP.15. Dynamics - strategic type** (10)

- a. Allow (or design) the characteristics of LARVA\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.
- b. Divide LARVA\* into parts that are capable of relative movement between each other.
- c. If LARVA\* (or process) is rigid or inflexible, make it flexible or adaptive.
- d. To enhance the dynamics of LARVA\* or the process, use feature(s) or object(s) available in the nearby environment.

**N°4 Improve: (+) 37. Difficulty of detecting and measuring and Attenuate or Preserve: (-) 12. Shape / composition / configuration**

**IP.27. Cheap Short-Living Objects - strategic type** (11)

- a. Replace or divide (either fully or partially) LARVA\* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
- b. Compress certain qualities of LARVA\* (e.g., the degree of participation, complexity, or lifetime), with no

loss of functionality, to achieve the desired objective.

**IP.13. Reverse or Indirect Action - strategic type** (12)

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object S2 It should be identified how LARVA\* currently performs an action with Object S2 and from there evaluate an inverse or indirect action.
- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) 'upside down', 'change the position', 'change the condition'.

**IP.1. Segmenting/ Integrating - strategic type** (13)

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**IP.39. Inert Atmosphere / Environment - operative type** (14)

- a. Replace a currently harmful or undesirable environment for LARVA\* with an inert one, either fully or partially.
- b. Add neutral parts, or inert additives to OBJECT S1 or its environment.
- c. Leave the harmful environment for OBJECT S1 towards another environment or dimension.

**N°5 Improve: (-) 35. Adaptability or versatility and Attenuate or Preserve: (-) 12. Shape / composition / configuration**

**IP.15. Dynamics - strategic type** (15)

- a. Allow (or design) the characteristics of LARVA\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.
- b. Divide LARVA\* into parts that are capable of relative movement between each other.
- c. If LARVA\* (or process) is rigid or inflexible, make it flexible or adaptive.
- d. To enhance the dynamics of LARVA\* or the process, use feature(s) or object(s) available in the nearby environment.

**IP.37. Useful Perceptible Change - operative type** (16)

- a. Use state, dimension or condition changes occurring to LARVA\*, because of a modification or application of an external or self-generated field, which is perceptible by and can influence to object S2 with which it interacts. The change may be permanent or variable in time.

**IP.1. Segmenting/ Integrating - strategic type** (17)

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**IP.8. Anti-Weight/ Compensation - tactical type** (18)

- a. To compensate for the heaviness/lightness or incidence of LARVA\*, merge it with other objects or independent own parts that provide an effect to improve the current situation.
- b. To compensate for the heaviness/lightness or incidence of LARVA\*, make it interact with the environment.

**N°6 Improve: 34. Ease of change, repair or maintain and Preserve: 38. Extent of automation/ autonomy**

**IP.34. Discarding and Recovering - tactical type** (19)

- a. Make portions of LARVA\*, which have fulfilled their functions or are unnecessary, go away (discard by

absorption, dissolving, evaporating, etc.).

b. Conversely, restore consumable parts of LARVA\* directly in operation.

**IP.35. Transformation / Parameter Changes - strategic type (20)**

a. Change LARVA\*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of LARVA\* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of LARVA\*.

**IP.7. Nesting/ Dispersing - tactical type (21)**

a. Place LARVA\* fully or partially inside another object; place each object, in turn, fully or partially inside the other.

b. Make one part of OBJECT S1 pass through a cavity in the other, or vice versa.

c. If LARVA\* is nested with another object, and if necessary, apply a dispersing action.

**IP.13. Reverse or Indirect Action - strategic type (22)**

a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object S2 It should be identified how LARVA\* currently performs an action with Object S2 and from there evaluate an inverse or indirect action.

b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.

c. Turn LARVA\* (or process) 'upside down', 'change the position', 'change the condition'!

**N°7 Improve: 34. Ease of change, repair or maintain and Preserve: 39. Productivity**

**IP.1. Segmenting/ Integrating - strategic type (23)**

a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different existing or new parts, forms, phases, states or conditions of LARVA\* in a single entity.

c. Make LARVA\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

**IP.32. Perception/ Appearance/ Color Changes - strategic type (24)**

a. Change how is perceived, the appearance or shape of LARVA\* in relation to the object S2 with which it interacts.

b. Change the color, or appearance, of LARVA\* or its external environment.

c. Change the transparency of LARVA\* or its external environment.

**IP.10. Preliminary Action - strategic type (25)**

a. Perform the required change in, or for, LARVA\*, before it is needed (either fully or partially).

b. Pre-arrange LARVA\* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

**N°8 Improve: and Preserve:**

**Relevant inventive principles from Table II not included in Recommended Solution**

**IP.19. Time-Varying Action/ Periodic or Pulsating (Pos.(5) - strategic type (26)**

a. Instead of using continuous action in, or for, LARVA\*, use time-varying, periodic, or pulsating actions.

b. If the action of LARVA\* is already periodic, change the periodic magnitude or frequency.

c. Use pauses between impulses to perform a different action of LARVA\*.

d. If the current action of LARVA\* is time-varying, and if necessary, change to an action higher or lesser time-varying.

**IP.25. Self-service (Pos.(8) - operative type (27)**

- a. Make LARVA\* serve itself by performing helpful auxiliary functions.
- b. Use resources, energy or substances that are wasted or unused by LARVA\*.
- c. Incorporate resources and/or functions into LARVA\* for self-service during operation.

**IP.12. Equipotentiality (Pos.(9) - tactical type (28)**

- a. In a potential field, limit position changes or energy variations of LARVA\*.
- b. Change operating conditions to eliminate the need to change the position or energy quality of LARVA\* in a potential field.

**TABLE VI. RESULTS OF SENSITIVITY ANALYSIS FOR THE EVALUATED OBJECT LARVA**

CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

**Coverage obtained for the current evaluation to compare with sensitivity analysis**

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
#	2	12	35	37	34. Ease of change, repair or maintain	89.56	100	92.17

Table VI presents the 10 most favorable parameter combinations recommended by the Aatrizinventor algorithm. It is suggested to evaluate the 2 or 3 most relevant ones. Practice teaches that they often contain the best solution for the evaluated challenge.

(E) Combination of TRIZ innovation parameters evaluated in this Aatrizinventor Solution is prioritized here

(U) Combination of TRIZ innovation parameters shows a match only in the evaluated undesirable effects. 34. Ease of change, repair or maintain. See Table V.

**A. PRIORITISED CONTRADICTIONS BY GLOBAL COVERAGE (Cob.GL)**

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
I.a	2	24	35	37	32. Ease of achieving desired outcome	89.75	100	92.31
II.a	2	12	35	37	34. Ease of change, repair or maintain (E)	89.56	100	92.17
III.a	2	24	35	37	34. Ease of change, repair or maintain	89.56	100	92.17
IV.a	2	12	37	0	16. Duration of action by stationary object	88.64	96.85	90.69

V.a	2	35	37	0	34. Ease of change, repair or maintain	84.66	100	88.5
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## B. PRIORITIZATION OF CONTRADICTIONS BY COVERAGE OF NEEDS TO SATISFY (Cob.NS)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)	Table VI.A
I.b	12	24	35	37	32. Ease of achieving desired outcome	95.16	43.29	82.19	-
II.b	2	12	35	37	13. Stability (U)	92.5	16.41	73.48	-
III.b	2	24	35	37	32. Ease of achieving desired outcome	89.75	100	92.31	I.a
IV.b	2	12	35	37	34. Ease of change, repair or maintain (E)	89.56	100	92.17	II.a
V.b	2	24	35	37	34. Ease of change, repair or maintain	89.56	100	92.17	III.a

## TABLE VII ESSENTIAL CONTRADICTIONS MATRIX FOR NEEDS TO SATISFY (NS) FOR THE SAME UNDESIRABLE EFFECTS EVALUATED OF: LARVA

CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea  
 Evaluated need to satisfy in this report: **34. Ease of change, repair or maintain**

UDEs: (+) 2. Heaviness of stationary object// (-) 12. Shape / composition / configuration// (-) 35. Adaptability or versatility// (+) 37. Difficulty of detecting and measuring

This table allows the Innovation Team to compare the coverages obtained for the evaluated need to satisfy with those of the other defined needs, for the same undesirable effects. This way, they can decide whether to choose any of the suggested innovation parameter combinations here that offer better coverage.

Need to Satisfy	Parameter to improve	Parameter to attenuate or preserve	Contradict. Essential	Cob. NS (%)	Cob. between EC (%)	Cob. GL (%) 3/1
<b>34. Ease of change, repair or maintain</b>	(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	[6,13,28,1]	89.56	100	92.17
27. Reliability	(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	[6,13,28,1]	78.98	100	84.23
32. Ease of achieving desired outcome	(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	[6,13,28,1]	74.58	100	80.94

16. Duration of action by stationary object	(+) 2. Heaviness of stationary object	(+) 16. Duration of action by stationary object	[2,27,19,6]	88.64	49.88	78.95
13. Stability	(+) 37. Difficulty of detecting and measuring	(-) 12. Shape / composition / configuration	[27,13,1,39]	92.5	16.41	73.48
33. Ease of operation	(+) 33. Ease of operation	(+) 2. Heaviness of stationary object	[6,13,1,25]	85.2	24.36	69.99
20. Use of energy by stationary object	(+) 2. Heaviness of stationary object	(+) 20. Use of energy by stationary object	[18,19,28,1]	83.99	24.81	69.19
35. Adaptability or versatility	(+) 37. Difficulty of detecting and measuring	(+) 2. Heaviness of stationary object	[6,13,28,1]	56.41	100	67.31
39. Productivity	(+) 2. Heaviness of stationary object	(+) 39. Productivity	[1,28,15,35]	76.36	12.37	60.36
38. Extent of automation/ autonomy	(+) 38. Extent of automation/ autonomy	(-) 12. Shape / composition / configuration	[15,32,1,13]	68.63	31.42	59.33

Table VII shows the essential contradictions obtained for each of the defined Needs to Satisfy, taking into account the same undesirable effects that have been evaluated. This table is based on the calculation of a global coverage (Cob.GL), which is determined by combining two values: the coverage from Table IV (Cob.NS) already explained, and a relative coverage (Cob. between EC) that is obtained in this table VII, when each other comparing the essential contradictions identified for the 10 parameters of Needs to Satisfy.

This global coverage (GL) is based on expert weighting criteria to prioritize the solutions for the different Needs to Satisfy. Experience with aatrizinventor indicates that the most effective solutions are those with higher global coverage, preferably exceeding 90%, if possible.

**The Innovation Team may decide if it is appropriate to carry out a new evaluation with another Need to Satisfy, selected from the results provided in Table VII. This decision will be primarily made when the evaluated Need to Satisfy is not ranked in the first position of Table VII. In this table, the position of the evaluated Need to Satisfy is highlighted: 34. Ease of change, repair or maintain.**

#### TABLE VIII. ORDER OF INCIDENCE OF INVENTIVE PRINCIPLES (POS.n)

CHALLENGE: Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea  
Participation analysis of inventive principles in TABLE II SPECIFIC CONTRADICTION MATRIX.

Evaluated parameters for Object LARVA:

Par. UDEs:

(+) 2. Heaviness of stationary object

(-) 12. Shape / composition / configuration

(-) 35. Adaptability or versatility

(+) 37. Difficulty of detecting and measuring  
 Par. NS: (+) 34. Ease of change, repair or maintain

\*\*\*: Inventive Principles from the Specific Contradiction Matrix (Table II) not described in the Recommend Solution (Table IX). It is recommended to perform an additional review following the order of position.

Inventive principles of Table II	IP type	Tables	Contradictions
IP.1. Segmenting/ Integrating (Pos.1)	IP. Str.	II / III / IV	[Par.37][Par.2][ IP(s) : 6,13,28,1] - [Par.35][Par.12][ IP(s) : 15,37,1,8] - [Par.37][Par.12][ IP(s) : 27,13,1,39] - [Par.34][Par.12][ IP(s) : 1,13,2,4] - [Par.12][Par.35][ IP(s) : 1,15,29,0] - [Par.37][Par.35][ IP(s) : 1,15,0,0] - [Par.34][Par.35][ IP(s) : 7,1,4,16] - [Par.35][Par.37][ IP(s) : 1,0,0,0] - [Par.12][Par.34][ IP(s) : 2,13,1,0] - [Par.35][Par.34][ IP(s) : 1,16,7,4] -
IP.15. Dynamics (Pos.2)	IP. Str.	II / III / IV	[Par.12][Par.2][ IP(s) : 15,10,26,3] - [Par.35][Par.2][ IP(s) : 19,15,29,16] - [Par.35][Par.12][ IP(s) : 15,37,1,8] - [Par.2][Par.35][ IP(s) : 19,15,29,0] - [Par.12][Par.35][ IP(s) : 1,15,29,0] - [Par.37][Par.35][ IP(s) : 1,15,0,0] - [Par.2][Par.37][ IP(s) : 25,28,17,15] - [Par.12][Par.37][ IP(s) : 15,13,39,0] -
IP.2. Taking out/ Adding (Pos.3)	IP. Str.	II / III / IV	[Par.34][Par.2][ IP(s) : 2,27,35,11] - [Par.34][Par.12][ IP(s) : 1,13,2,4] - [Par.2][Par.34][ IP(s) : 2,27,28,11] - [Par.12][Par.34][ IP(s) : 2,13,1,0] -
IP.13. Reverse or Indirect Action (Pos.4)	IP. Str.	II / III / IV	[Par.37][Par.2][ IP(s) : 6,13,28,1] - [Par.2][Par.12][ IP(s) : 13,10,29,14] - [Par.37][Par.12][ IP(s) : 27,13,1,39] - [Par.34][Par.12][ IP(s) : 1,13,2,4] - [Par.12][Par.37][ IP(s) : 15,13,39,0] - [Par.12][Par.34][ IP(s) : 2,13,1,0] -
IP.19. Time-Varying Action/ Periodic or Pulsating (Pos.5) ***	IP. Str.	II /	[Par.35][Par.2][ IP(s) : 19,15,29,16] - [Par.2][Par.35][ IP(s) : 19,15,29,0] -
IP.27. Cheap Short-Living Objects (Pos.6)	IP. Str.	II / III /	[Par.34][Par.2][ IP(s) : 2,27,35,11] - [Par.37][Par.12][ IP(s) : 27,13,1,39] - [Par.2][Par.34][ IP(s) : 2,27,28,11] -
IP.7. Nesting/ Dispersing (Pos.7)	IP. Tac.	II / IV	[Par.34][Par.35][ IP(s) : 7,1,4,16] - [Par.35][Par.34][ IP(s) : 1,16,7,4] -
IP.25. Self-service (Pos.8) ***	<b>IP. Oper.</b>	II /	[Par.2][Par.37][ IP(s) : 25,28,17,15] -
IP.12. Equipotentiality (Pos.9) ***	IP. Tac.	II / IV	[Par.37][Par.34][ IP(s) : 12,26,0,0] -
IP.6. Universality (Pos.10)	IP. Tac.	II / III /	[Par.37][Par.2][ IP(s) : 6,13,28,1] -

IP.10. Preliminary Action (Pos.11)	IP. Str.	II / IV	[Par.12][Par.2][ IP(s) : 15,10,26,3] - [Par.2][Par.12][ IP(s) : 13,10,29,14] -
IP.28. Mechanics Substitution (Pos.12)	IP. Str.	II / III /	[Par.37][Par.2][ IP(s) : 6,13,28,1] - [Par.2][Par.37][ IP(s) : 25,28,17,15] - [Par.2][Par.34][ IP(s) : 2,27,28,11] -
IP.26. Copying/ Replicating (Pos.13) ***	IP. Str.	II / IV	[Par.12][Par.2][ IP(s) : 15,10,26,3] - [Par.37][Par.34][ IP(s) : 12,26,0,0] -
IP.29. Controllable Soft Variables (Pos.14) ***	IP. Tac.	II /	[Par.35][Par.2][ IP(s) : 19,15,29,16] - [Par.2][Par.12][ IP(s) : 13,10,29,14] - [Par.2][Par.35][ IP(s) : 19,15,29,0] - [Par.12][Par.35][ IP(s) : 1,15,29,0] -
IP.16. Partial or Excessive Actions (Pos.15) ***	<b>IP. Oper.</b>	II / IV	[Par.35][Par.2][ IP(s) : 19,15,29,16] - [Par.34][Par.35][ IP(s) : 7,1,4,16] - [Par.35][Par.34][ IP(s) : 1,16,7,4] -
IP.37. Useful Perceptible Change (Pos.16)	<b>IP. Oper.</b>	II / III /	[Par.35][Par.12][ IP(s) : 15,37,1,8] -
IP.4. Asymmetry/ Symmetry (Pos.17)	<b>IP. Oper.</b>	II / III / IV	[Par.34][Par.12][ IP(s) : 1,13,2,4] - [Par.34][Par.35][ IP(s) : 7,1,4,16] - [Par.35][Par.34][ IP(s) : 1,16,7,4] -
IP.39. Inert Atmosphere / Environment (Pos.18)	<b>IP. Oper.</b>	II / III /	[Par.37][Par.12][ IP(s) : 27,13,1,39] - [Par.12][Par.37][ IP(s) : 15,13,39,0] -
IP.35. Transformation / Parameter Changes (Pos.19)	IP. Str.	II / IV	[Par.34][Par.2][ IP(s) : 2,27,35,11] -
IP.17. Another Dimension or Field (Pos.20) ***	IP. Tac.	II /	[Par.2][Par.37][ IP(s) : 25,28,17,15] -
IP.11. Beforehand Cushioning (Pos.21) ***	IP. Tac.	II / IV	[Par.34][Par.2][ IP(s) : 2,27,35,11] - [Par.2][Par.34][ IP(s) : 2,27,28,11] -
IP.14. Spheroidality - Curvature - Angle (Pos.22) ***	IP. Tac.	II /	[Par.2][Par.12][ IP(s) : 13,10,29,14] -
IP.8. Anti-Weight/ Compensation (Pos.23)	IP. Tac.	II / III /	[Par.35][Par.12][ IP(s) : 15,37,1,8] -
IP.3. Local Quality (Pos.24) ***	IP. Str.	II /	[Par.12][Par.2][ IP(s) : 15,10,26,3] -

## **TABLE IX. RECOMMENDED SOLUTION ACCORDING TO THE MOST RELEVANT CONTRADICTIONS IDENTIFIED FOR THE EVALUATED OBJECT: LARVA**

**CHALLENGE:** Improve Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea

This table displays the relevant contradictions identified by the algorithm, which are crucial for determining the direction and scope of the solution to the innovation challenge under evaluation. The specific solution will be obtained by applying the updated inventive principles detailed below.

It is essential to bear in mind that we are evaluating LARVA when it interacts with SEAWATER and there is an affected function: Survival of sea squirt larva affected by lack of food headfirst on a rock in the sea, in a specific space and time. LARVA may require changes in space, time, its physical composition, or its functional characteristic, as well as partial or total replacement with another object or other recommended changes. To emphasize this concept, we mark LARVA with an asterisk. Do not read the name of the evaluated object literally; associate it with a possible solution for LARVA\*.

Each inventive principle described here may contain more than one innovation concept recommended by TRIZ, identified as a, b, c, ..., not all of which are applicable to a specific case under evaluation. The Innovation Team must select those innovation concepts that best relate to the evaluated innovation challenge, based on their own knowledge and the analysis of relational thinking that they must carry out.

Additionally, technological research may be necessary for its solution, as the specific solution recommended by the inventive principles described here likely already exists somewhere in the world. The interpretation of the inventive principles, to apply them specifically to the evaluated case, is a recursive process that generally ranges from strategic to tactical and operational levels. We recommend completing the reading of the inventive principles described below to envision a possible solution and then rereading the principles to reinforce the coherence of the emerging solution. As a result of the finally determined innovation solution, there will be a change in LARVA, in a new context guided by the inventive principles, probably not previously imagined.

The Language of Nature's Innovation provides speed and focus for guided and systematic innovation thinking for individuals. The foundation for innovation is a profound understanding of the current situation.

### **IX.A BASE SOLUTION FOR INNOVATION CHALLENGE FOR THE EVALUATED OBJECT LARVA NEED TO SATISFY: 34. Ease of change, repair or maintain**

Strategic inventive principles: Str. IP

Tactical inventive principles: Tac. IP

Operative inventive principles: Oper. IP

Pos.n : Order of importance n of an inventive principle included in Table II.

#### **ESSENTIAL CONTRADICTION**

**Contradiction order wt.1**

**Parameter to improve: (+) 37. Difficulty of detecting and measuring**

TO IMPROVE (UDE): LARVA has More Difficulty in detection and measurement interacting with S2

**Parameter to attenuate or preserve: (+) 2. Heaviness of stationary object**

TO ATTENUATE OR PRESERVE (UDE): LARVA has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

**Inventive principles IP(s) : [6,13,28,1]**

**6. Universality, Tac. IP (Pos.10):**

- a. Make a part or the whole of LARVA\* perform multiple functions.
- b. Eliminate the need of LARVA\* for others parts.

Separation principle for LARVA\* : Separation alternative

Solution strategy for LARVA\* : Improving if a solution has not yet emerged

**13. Inverse or Indirect Action, Str. IP (Pos.4):**

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object (S2)

It should be identified how LARVA\* currently performs an action with S2 Object and from there evaluate an inverse or indirect action.

- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) “upside down”, “change the position”, “change the condition”.

Separation principle for LARVA\* : Separation in space / Separation inverse

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

**28. Mechanics Substitution, Str. IP (Pos.12):**

- a. Replace a direct or manual action in, or for, LARVA\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, LARVA\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of LARVA\*.
- d. Change from static fields in, or for, LARVA\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, LARVA\*.

Separation principle for LARVA\* : Separation by condition

Solution strategy for LARVA\* : Improving attributes

**1. Segmenting/ Integrating, Str. IP (Pos.1):**

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

## COMPLEMENTARY CONTRADICTION 1

### Contradiction order wt.2

#### Parameter to improve: (+) 34. Ease of change, repair or maintain

TO IMPROVE (DE): LARVA has More Desired ease of change, repair or maintenance to interact with S2

#### Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration

TO ATTENUATE OR PRESERVE (UDE): LARVA has Less Appropriate shape, composition, or configuration interacting with S2

#### Inventive principles IP(s) : [1,13,2,4]

##### 1. Segmenting/ Integrating, Str. IP (Pos.1):

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

##### 13. Inverse or Indirect Action, Str. IP (Pos.4):

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object (S2)

It should be identified how LARVA\* currently performs an action with S2 Object and from there evaluate an inverse or indirect action.

- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) “upside down”, “change the position”, “change the condition”.

Separation principle for LARVA\* : Separation in space / Separation inverse

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

##### 2. Taking Out/ Adding, Str. IP (Pos.3):

- a. Separate an interfering part or a property from LARVA\*, or single out the only necessary part (or property) of LARVA\*.
- b. Add new parts or properties to LARVA\*.

Separation principle for LARVA\* : Separation in space

Solution strategy for LARVA\* : Improving attributes

##### 4. Asymmetry/ Symmetry, Str. IP (Pos.17):

- a. Change the shape of LARVA\* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.
- b. If LARVA\* is asymmetrical, increase its degree of asymmetry, or vice versa.

Separation principle for LARVA\* : Separation in space

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

## COMPLEMENTARY CONTRADICTION 2

### Contradiction order wt.4

#### Parameter to improve: (+) 37. Difficulty of detecting and measuring

TO IMPROVE (UDE): LARVA has More Difficulty in detection and measurement interacting with S2

#### Parameter to attenuate or preserve: (-) 35. Adaptability or versatility

TO ATTENUATE OR PRESERVE (UDE): LARVA has Less Adaptability or versatility to interaction variability of S2

Inventive principles IP(s) : [1,15,0,0]

#### 1. Segmenting/ Integrating, Str. IP (Pos.1):

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

#### 15. Dynamics, Str. IP (Pos.2):

- a. Allow (or design) the characteristics of LARVA\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.
- b. Divide LARVA\* into parts that are capable of relative movement between each other.
- c. If LARVA\* (or process) is rigid or inflexible, make it flexible or adaptive.
- d. To enhance the dynamics of LARVA\* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for LARVA\* : Separation in time

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

## COMPLEMENTARY CONTRADICTION 3

### Contradiction order wt.5

#### Parameter to improve: (+) 37. Difficulty of detecting and measuring

TO IMPROVE (UDE): LARVA has More Difficulty in detection and measurement interacting with S2

#### Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration

TO ATTENUATE OR PRESERVE (UDE): LARVA has Less Appropriate shape, composition, or configuration interacting with S2

Inventive principles IP(s) : [27,13,1,39]

#### 27. Cheap Short-Living Objects, Str. IP (Pos.6):

- a. Replace or divide (either fully or partially) LARVA\* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
- b. Comprising certain qualities of LARVA\* (e.g., the degree of participation, complexity, or lifetime), with

no loss of functionality, to achieve the desired objective.

Separation principle for LARVA\* : Separation in subsystem

Solution strategy for LARVA\* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

### **13. Inverse or Indirect Action, Str. IP (Pos.4):**

a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object (S2)

It should be identified how LARVA\* currently performs an action with S2 Object and from there evaluate an inverse or indirect action.

b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.

c. Turn LARVA\* (or process) “upside down”, “change the position”, “change the condition”.

Separation principle for LARVA\* : Separation in space / Separation inverse

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### **1. Segmenting/ Integrating, Str. IP (Pos.1):**

a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..

c. Make LARVA\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### **39. Inert Atmosphere/ Environment, Oper. IP (Pos.18):**

a. Replace a currently harmful or undesirable environment for LARVA\* with an inert one, either fully or partially.

b. Add neutral parts, or inert additives to LARVA\* or its environment.

c. Leave the harmful environment for LARVA\* towards another environment or dimension.

Separation principle for LARVA\* : Separation by condition

Solution strategy for LARVA\* : Improving if a solution has not yet emerged

## **COMPLEMENTARY CONTRADICTION 4**

### **Contradiction order wt.13**

#### **Parameter to improve: (-) 35. Adaptability or versatility**

TO IMPROVE (UDE): LARVA has Less Adaptability or versatility to interaction variability of S2

#### **Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration**

TO ATTENUATE OR PRESERVE (UDE): LARVA has Less Appropriate shape, composition, or configuration interacting with S2

**Inventive principles IP(s) : [15,37,1,8]**

### **15. Dynamics, Str. IP (Pos.2):**

a. Allow (or design) the characteristics of LARVA\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

- b. Divide LARVA\* into parts that are capable of relative movement between each other.
- c. If LARVA\* (or process) is rigid or inflexible, make it flexible or adaptive.
- d. To enhance the dynamics of LARVA\* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for LARVA\* : Separation in time

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### **37. Useful Perceptible Change , Oper. IP (Pos.16):**

- a. Use state, dimension or condition changes occurring to LARVA\*, because of a modification or application of an external or self-generated field, which is perceptible by and can influence to object (S2) with which it interacts.

The change may be permanent or variable in time.

(e.g., use field emissions, thermal expansion (or contraction) of materials, signals, etc.).

Separation principle for LARVA\* : Separation in time

Solution strategy for LARVA\* : Improving attributes

### **1. Segmenting/ Integrating, Str. IP (Pos.1):**

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..
- c. Make LARVA\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### **8. Anti-weight/ Compensation, Tac. IP (Pos.23):**

- a. To compensate for the heaviness/lightness or incidence of LARVA\*, merge it with other objects or independent own parts that provide an effect to improve the current situation.
- b. To compensate for the heaviness/lightness or incidence of LARVA\*, make it interact with the environment.

For example, compensate for the heaviness of LARVA\* subject to a gravitational field, or exposed to a magnetic field, or subject to an economic value or price, or subject to a chemical bond, or subject to intellectual rigidity, a paradigm, or prejudices.

Separation principle for LARVA\* : Separation alternative

Solution strategy for LARVA\* : Improving attributes

## **IX.B SOLUTION TO MORE RELEVANT CONTRADICTIONS BETWEEN NEEDS TO SATISFY (Cob.NS)**

Included in each inventive principle described below is the incidence level or position number it occupies in Table II. If it is not shown, it means that it only appears in Table IV. and requires attention.

### **CONTRADICTION BETWEEN NEEDS TO SATISFY N° 1**

**Parameter to improve 34. Ease of change, repair or maintain**

MEJORAR > LARVA tiene More Desired ease of change, repair or maintenance to interact with S2

**Parameter to preserve 38. Extent of automation/ autonomy**

PRESERVAR > LARVA tiene más efecto deseable por parámetro 38. Extent of automation/ autonomy

**Inventive principles IP(s) : [34,35,7,13]**

**34. Discarding and Recovering, Tac. IP (Pos.):**

- a. Make portions of LARVA\* , which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, etc.).
- b. Conversely, restore consumable parts of LARVA\* directly in operation.

Separation principle for LARVA\* : Separation in time

Solution strategy for LARVA\* : Improving if a solution has not yet emerged

**35. Transformation/ Parameter Changes, Str. IP (Pos.19):**

- a. Change LARVA\*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).
- b. Change the composition or condition of LARVA\* by adding or removing components.
- c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of LARVA\*.

Separation principle for LARVA\* : Separation by condition / Separation alternative

Solution strategy for LARVA\* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

**7. Nesting/ Dispersing, Tac. IP (Pos.7):**

- a. Place LARVA\* fully or partially inside another object; place each object, in turn, fully or partially inside the other.
- b. Make one part of LARVA\* pass through a cavity in the other, or vice versa.
- c. If LARVA\* is nested with another object, and if necessary, apply a dispersing action.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes

**13. Inverse or Indirect Action, Str. IP (Pos.4):**

- a. Inverse the applied action or apply an indirect action to perform the current function of LARVA\* to interact with object (S2)

It should be identified how LARVA\* currently performs an action with S2 Object and from there evaluate an inverse or indirect action.

- b. Make moving parts of LARVA\* (or the external environment) fixed, and fixed parts moving.
- c. Turn LARVA\* (or process) “upside down”, “change the position”, “change the condition”.

Separation principle for LARVA\* : Separation in space / Separation inverse

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

**CONTRADICTION BETWEEN NEEDS TO SATISFY N° 2**

**Parameter to improve 34. Ease of change, repair or maintain**

MEJORAR > LARVA tiene More Desired ease of change, repair or maintenance to interact with S2

**Parameter to preserve 39. Productivity**

PRESERVAR > LARVA tiene más efecto deseable por párametro 39. Productivity

**Inventive principles IP(s) : [1,32,10,0]**

**1. Segmenting/ Integrating, Str. IP (Pos.1):**

- a. Divide LARVA\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a LARVA\* into a single entity..

c. Make LARVA\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of LARVA\*.

Separation principle for LARVA\* : Separation in space / Separation in subsystem

Solution strategy for LARVA\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### 32. Perception/ Appearance/ Color Changes, Str. IP (Pos.):

a. Change how is perceived, the appearance or shape of LARVA\* in relation to the object (S2) with which it interacts.

b. Change the color, or appearance, of LARVA\* or its external environment.

c. Change the transparency of LARVA\* or its external environment.

Separation principle for LARVA\* : Separation by condition

Solution strategy for LARVA\* : Improving if a solution has not yet emerged

### 10. Preliminary Action, Str. IP (Pos.11):

a. Perform the required change in, or for, LARVA\*, before it is needed (either fully or partially).

b. Pre-arrange LARVA\* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

Separation principle for LARVA\* : Separation in time

Solution strategy for LARVA\* : Improving attributes; Improving performance

## Anexo

### List of applicable Inventive Principles for Innovation Solutions

IP.1. Segmenting/ Integrating	IP.21. Skipping/ Avoiding
IP.2. Taking out/ Adding	IP.22. Convert harm in benefit
IP.3. Local Quality	IP.23. Feedback
IP.4. Asymmetry/ Symmetry	IP.24. Intermediary
IP.5. Merging/ Separating	IP.25. Self-service
IP.6. Universality	IP.26. Copying/ Replicating
IP.7. Nesting/ Dispersing	IP.27. Cheap Short-Living Objects
IP.8. Anti-Weight/ Compensation	IP.28. Mechanics Substitution
IP.9. Preliminary Anti-action	IP.29. Controllable Soft Variables
IP.10. Preliminary Action	IP.30. Simple Shapes/ Ways to Interact
IP.11. Beforehand Cushioning	IP.31. 31.Using/ Removing Unused Parts
IP.12. Equipotentiality	IP.32. Perception/ Appearance/ Color Changes
IP.13. Reverse or Indirect Action	IP.33. Homogeneity / Compatibility
IP.14. Spheroidality - Curvature - Angle	IP.34. Discarding and Recovering
IP.15. Dynamics	P.35. Transformation / Parameter Changes

IP.16. Partial or Excessive Actions	IP.36. Phase, State or Condition Transitions
IP.17. Another Dimension or Field	IP.37. Useful Perceptible Change
IP.18. Mechanical Vibrations/ Energy Variations	IP.38. Strong or Quick Reactions
IP.19. Time-Varying Action/ Periodic or Pulsating	IP.39. Inert Atmosphere / Environment
IP.20. Continuity of Useful Action	IP.40. Composite Materials/ Conditions

Available Aatrizinventor solutions: 0 - You can get more solutions in home page link.

### **ALGORITHM AATRIZINVENTOR FROM NATURE'S L.I.**