# Critical assets and value networks in resilient innovation ecosystems in the EU Outermost Regions

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**Abstract**

The authors share key insights gained regarding the effective management of critical assets in Resilient Innovation Ecosystems (REIs) modelled as Value Networks in the EU Outermost Regions based on individualised coaching and mentoring support provided through a program to "Discover, Incubate, and Accelerate Start-ups and SMEs" (DIAS) applied to 22 Start-Ups and SMEs in the Azores, Canaries, La Réunion and Madeira during the 18-month duration of the EU funded project "Innovation Capacity Building for Higher Education in Europe's Outermost Regions" (INCORE) project.

DIAS is an experimental inductive case-study based research approach based on Qualitative Comparative Analysis and Value Network Analysis. It is used to determine under what conditions a persistent phenomenon of "unfair advantage" in the form of an intensive nexūs of collaboration in REIs emerges.

The authors uncovered existing REIs, evaluated their role in ensuring sustainable success of individual Start-Ups and SMEs, identified what assets were critical, and isolated management practices that were actionable and pragmatic enough to permit Start-Ups and SMEs in the ORs to implement such with minimal effort. The authors furthermore identified a set of key swarm principles that are easily implemented for creating REIs to accelerate the growth of Start-Ups and SMEs.

The research results suggest that REIs have archetypal structures that exist in multiple different constellations of relevant causal variables that may change dynamically over time. For Start-Ups and SMEs this means that identifying the currently most relevant archetypal structure is the most important step towards then identifying what assets are critical at that specific evolutionary phase, and then selecting and applying the most suitable actionable interventions to accelerate the emergence of their REIs through the encouragement of relevant swarm principles.

Due to the fractal and transformative nature of REIs, the cases covered in this study are seen as sufficiently representative to arrive at insights that can support the strategically needed transformation of the regions' entrepreneurial and innovation capacity on the most systemic level.

**Keywords:** Outermost Regions; Innovation Ecosystems; Qualitative Comparative Analysis; Value Networks; Unfair Advantage

## 1. Introduction

Specific EU (sub-) territories that struggle to significantly to improve their economic capability due to their geographic isolation from continental Europe have a special status as "Outermost Region" (OR)[1,2]. They are an integral part of the EU and the European Strategy for the ORs which

[1] The ORs are parts of three EU Member States with territories that are geographically very dispersed and isolated from continental Europe. There are nine of them: French Guiana, Guadeloupe, Réunion, Mayotte, Martinique, and Saint-Martin (France), the Azores and Madeira (Portugal) and the Canary Islands (Spain), spread across two oceans: the Atlantic and the Indian.

[2] Of similar character are EU Overseas Countries and Territories (OCTs); Aruba (NL), Bonaire (NL), Curação (NL), French Polynesia (FR), French Southern and Antarctic Territories (FR), Greenland (DK), New Caledonia (FR), Saba (NL), Saint Barthélemy (FR), Sint Eustatius (NL), Sint Maarten (NL), St. Pierre and Miquelon (FR), Wallis and Futuna Islands (FR). The (scattered) island context is also

encourages these regions to make use of their critical assets[3] through research and development in growth-enhancing areas and the areas defined in their Smart Specialisation Strategies. The ORs give Europe a geostrategic, economic, and cultural position alongside several continents and provide it with unique benefits. They contribute to Europe's international influence and offer unique potential for implementing solutions to the challenges facing the EU. The ORs have been identified as emerging innovative regions, a classification given to regions whose performance in terms of innovation is below 50% of the European Union average. The complex and reactive business environments of these regions call for tailored approaches to their regional innovation ecosystems (RIE).

The researchers use experimental inductive case-study research to examine the conditions under which sustainable value can be achieved in the RIEs of the Azores and Madeira (Portugal), the Canary Islands (Spain) and La Réunion (France). The research hypothesis was tested by a thought-experiment based on a research method applied to multiple case studies investigated through primary research activities. Case studies were identified by co-authors and are seen as acceptably representative since RIEs are of fractal nature. The experimental nature of the approach is chosen to help ensure all possible outcomes of the experiment are considered as valid so that a normalization process is not (unconsciously) applied. The researchers declared a small/scarce data condition to preclude the uncritical extension of previous research.

## 2. Literature Review

ORs are declared as autopoietic place-based nested RIE (Allee & Schwabe, 2015; Mercier-Laurent, 2015; Varela et al., 1974). The research explores the mechanism of value realization through critical assets in RIEs based on the axiom that the more individuals in a RIE exchange knowledge, the greater its sustainability and positive impact on critical assets. The resulting “nexus” of collaborative linkages provides the “unfair advantage”[4] of rapid diffusion of innovations needed for high performance (Rogers, 2003; Schwabe & Almeida, 2022).

RIEs are business ecosystems[5], in which organizations co-evolve capabilities around innovation (Adner, 2006, Granstrand & Holgersson 2020). They are learning communities (Meliciani, 2021) constantly experimenting to do things better. It is this entrepreneurship, that, in deep uncertainty (Aven, 2013), disrupts, disorganises, creates something new, and changes value perceptions. RIEs excel at rapidly diffusing innovation[6] from ideation to late adopters (Rogers, 2003; Amidon & Davis, 2005; Mehmood, 2016) and creating entirely new knowledge, which leads to radical breakthroughs. The RIE, as a living system, moves from solving the problems inherited from past behaviours to exploiting the opportunities arising from new visions. RIEs also pursue social solidarity (Smith, 1790; Homans, 1958;). The degree of valorisation of critical assets in RIEs is based on the attention given to the RIE by each RIE participant. High valorisation is a key attribute of innovation ecosystems.[7]

shared by Cyprus (CY), Malta (MT), and Iceland (IS), the islands of the EU B7 Baltic Islands Network (Åland (FI), Bornholm (DK), Gotland (SE), Hiiumaa (EE), Öland (SE), Rügen (DE), and Saaremaa (EE), as well as the Mediterranean regions Baleares (ES), Corsica (FR), Crete (Greece), Notio Aigaio (GR), and Sardinia (IT).

[3] A resource that is essential to an organization’s operations and in delivering its mission. These assets are necessary for an organization to function and be able to deliver on its core mission in whatever field/industry they are in.

[4] A unique selling proposition that a company has over its competitors, which allows it to operate in a space that is not packed with competitors.

[5] Persistent archetypes of complex adaptive networks (Miller, 2007) populated by individuals sustainably exchanging negotiated (in-) tangible deliverables (Homans, 1958; Allee & Schwabe, 2015; Yang, 2019).

[6] The rise of an idea, its research and early application in various forms, the socialization of the idea to a wider community which leads to a market validation phase followed by a commercialization phase which ends in sustainable market adoption (Rogers, 2003).

[7] Any group of individuals aiming to diffuse ideas from ideation to late adopters and assuming the roles of various actors negotiating / performing the sustainable exchange of (in-) tangible assets (Mercier-Laurent, 2015).

## 3. Methodology

The research methodology is based on the principles of the Diffusion of Innovations (Tarde, 1903; Schumpeter, 1939; Mehmood et al, 2016; Rogers, 2003), related concepts in Value Networks (Allee & Schwabe, 2015, Schwabe et. al., 2020), as well as Knowledge Dynamics and Diffusion (Amidon & Davis, 2005). The research process consisted of (a) identifying relevant organizations and their RIE in the ORs, (b) evaluating the individual organisations and RIEs, (c) assessing the RIE performance using selected change factors (d) aggregating all maps into a generic map, (e) evaluating all assessments for common performance patterns / causal conditions, and (f) validating the assessment results with experienced investment practitioners. Figure 1 illustrates the aggregated RIE map induced from the case study reviews. The system consists of roles assumed by individual human participants who exchange (in-) tangible knowledge in a sequenced manner. The system has open boundaries permitting the constant exchange of knowledge, thus enabling emergent properties and self-organization in a sustainable manner.

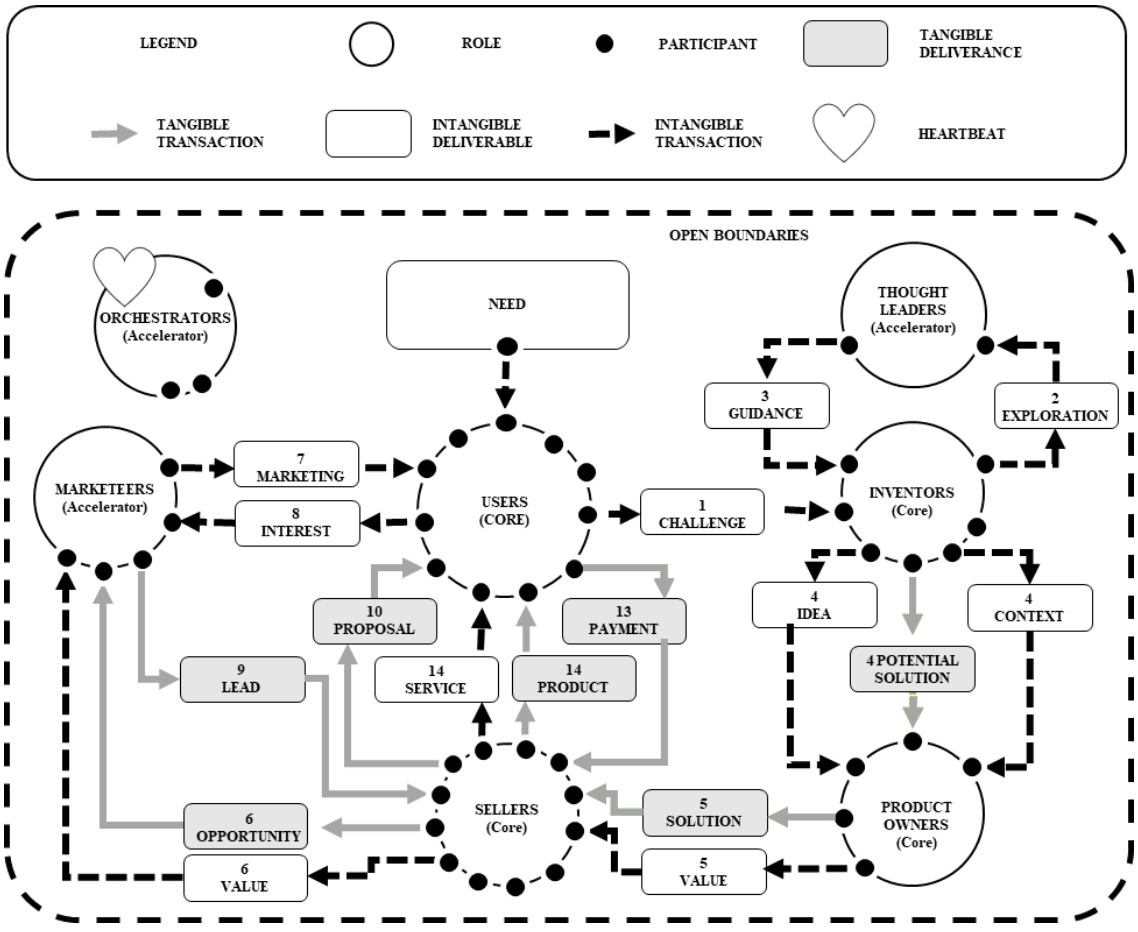


*Figure 1 – Value Network Innovation Archetype*

Qualitative Comparative Analysis (QCA) (Mello, 2022) is used to analyses cases in (dynamic) complex (adaptive) situations to help explain why change occur. Its application of set theory respects small data limitations. The applied change theory is: “IF an RIE has a unique causal condition, THEN it will achieve sustainable success”. Cases of interest are the RIE of organizations in an OR.

## 4. Results and Discussion

Change factors for 22 companies were evaluated between June 2022 and June 2023. 96 workshops were held totalling over 200 hours of evaluation[8]. The assessment was done with multi-item questionnaires on a scale of 0-5. Additionally, for each factor the subjective confidence of the participant in their assessment of these was measured on a scale of 0-5.

*Table 1 – Case Study Analysis Results[9]*

| Case# | TRL | Innovation Stage | Fuzzy | | | | | | ∴ Crisp | | | | | | ∴ CC | k[10] | SU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S | R | I | P | SP | M | S | R | I | P | SP | M | | | |
| 1 | 4 | Socialisation | 0.6 | 0.4 | 0.8 | 0.2 | 0.4 | 0.6 | 1 | 0 | 1 | 0 | 0 | 1 | 1010 | 11 | 2 |
| 2 | 7 | Commercialisation | 0.6 | 0.6 | 0.2 | 0.6 | 0.6 | 0.6 | 1 | 0 | 0 | 1 | 1 | 1 | 1001 | 10 | 3 |
| 3 | 9 | Commercialisation | 1.0 | 0.6 | 0.4 | 0.6 | 0.8 | 0.6 | 1 | 1 | 0 | 1 | 1 | 1 | 1101 | 14 | 3 |
| 4 | 5 | Socialisation | 0.6 | 1.0 | 0.6 | 1.0 | 0.4 | 0.4 | 1 | 0 | 1 | 0 | 0 | 0 | 1010 | 11 | 2 |
| 5 | 7 | Commercialisation | 0.6 | 0.6 | 0.8 | 0.4 | 0.6 | 0.6 | 1 | 1 | 1 | 0 | 1 | 1 | 1110 | 15 | 3 |
| 6 | 9 | Commercialisation | 0.8 | 0.6 | 0.8 | 0.8 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |
| 7 | 6 | Validation | 0.8 | 0.6 | 0.8 | 0.4 | 0.6 | 0.6 | 1 | 1 | 1 | 0 | 1 | 1 | 1110 | 15 | 2 |
| 8 | 6 | Validation | 0.8 | 0.4 | 0.6 | 1.0 | 0.6 | 0.5 | 1 | 0 | 1 | 0 | 1 | 1 | 1010 | 11 | 3 |
| 9 | 5 | Socialisation | 0.6 | 1.0 | 0.6 | 1.0 | 0.4 | 0.4 | 1 | 0 | 1 | 0 | 0 | 0 | 1010 | 11 | 2 |
| 10 | 9 | Commercialisation | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |
| 11 | 9 | Commercialisation | 0.8 | 0.6 | 1.0 | 0.8 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |
| 12 | 9 | Commercialisation | 1.0 | 0.6 | 1.0 | 0.6 | 0.8 | 0.6 | 1 | 1 | 0 | 1 | 1 | 1 | 1101 | 14 | 2 |
| 13 | 9 | Commercialisation | 1.0 | 0.8 | 0.6 | 0.6 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |
| 14 | 4 | Socialisation | 0.6 | 0.6 | 0.8 | 0.4 | 0.6 | 0.6 | 1 | 1 | 1 | 0 | 1 | 1 | 1110 | 15 | 2 |
| 15 | 7 | Commercialisation | 0.8 | 0.8 | 1.0 | 1.0 | 0.6 | 0.8 | 1 | 1 | 1 | 0 | 1 | 1 | 1110 | 15 | 2 |
| 16 | 4 | Socialisation | 0.6 | 1.0 | 0.8 | 1.0 | 0.6 | 0.4 | 1 | 0 | 1 | 0 | 1 | 1 | 1010 | 11 | 1 |
| 17 | 9 | Commercialisation | 1.0 | 0.8 | 0.6 | 0.6 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |
| 18 | 9 | Commercialisation | 0.8 | 0.6 | 0.4 | 0.4 | 0.8 | 0.6 | 1 | 1 | 0 | 0 | 1 | 1 | 1100 | 13 | 3 |
| 19 | 5 | Commercialisation | 0.6 | 0.6 | 1.0 | 0.4 | 0.6 | 0.4 | 1 | 1 | 0 | 0 | 1 | 1 | 1100 | 13 | 3 |
| 20 | 7 | Commercialisation | 0.8 | 0.6 | 1.0 | 0.4 | 0.6 | 0.5 | 1 | 1 | 0 | 0 | 1 | 1 | 1100 | 13 | 3 |
| 21 | 7 | Commercialisation | 0.6 | 0.6 | 0.2 | 0.6 | 0.6 | 0.6 | 1 | 0 | 0 | 1 | 1 | 1 | 1001 | 10 | 3 |
| 22 | 9 | Commercialisation | 1.0 | 0.8 | 0.6 | 0.6 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1111 | 16 | 3 |

Each assessment resulted in a total fuzzy score of 0.0 to 1.0 based on averaging all individual scores without weighting. Fuzzy scores were then turned into crisp values at a default threshold of 1 being >=0.5. The assessment of each change factor is then either a "1" or a "0". Assuming a crisp score of "1" for each change factor in a case study the universal propositional logic formula leads to a numeric sequence of "1111" which is termed a Causal Code (CC). With four change factors there are 16 possible permutations possible. These are assigned unique values from 1-16 based on the sequence of generation[11]. The potential sustainable performance (SP) of each case

[8] Change Factors: (a) Solution Maturity (S) - The actual product and / or service; Degree of Innovativeness, Technical Readiness Level, Budget and Resources, Number of Competitors, Degree of Complexity, Compatibility with Existing Ways of Work, Ease of Understanding, Ease of Use, Ease of Adaptation, Ease of Trialling, Observability of Impact, Urgency of Need, Degree of Certification (Legal / Policy Alignment), (b) Role Maturity (R) - The stakeholders assuming the key roles in the RIE; Considers the Diffusion as Urgent, Places Priority on the Diffusion, Is Motivated, Is Domain Competent, Is Collaborative, Engages Voluntarily, (c) Intent (I) - The alignment with SDG unique indicators. (d) Performance (P) - Valorisation of critical financial assets (International Accounting Standard (IAS) 32) and critical intangible assets as defined by the International Accounting Standard (IAS) 38, (e) Sustainable Performance (SP) - This is based on the subjective assessment of the representative (initial evaluator) of an institutional investor regarding the projected long term (25-year) financial performance, and (f) Overall Maturity (M) - The average of the S, R, I and P scores. The assessment questionnaires are available at https://sourceforge.net/projects/entov-hvm/.

[9] Case studies were: (1) Yasmine E Youssed LDA, Madeira, PT (2) FootAR LDA, Madeira, PT (3) Comply Express LDA, Madeira, PT (4) FETCH Ingenierie SRL, Réunion, FR (5) Elittoral SLNE, Canaries, SP (6) TESELA S.L., Canaries, SP (7) Microgreen, Canaries, SP (8) Olica SARL, Réunion, FR (9) Fibras Naturales, Canaries, SP (10) Canaria Electrica S.L., Canaries, SP (11) GuiaNatura EcoTourism, Canaries, SP (12) BlogsterApp, S.L., Canaries, SP (13) BlueNewables S.L., Canaries, SP (14) CIMPA LDS, Azores, PT (15) Canarias en Verde, Canaries, SP (16) Matizes Lda, Azores, PT (17) Scubanana S.L.U., Canaries, SP (18) Siva Industrie, Réunion, FR (19) Logicells, Réunion, FR (20) Redbox Technology Ltda, Azores, PT (21) Sedicii Innovations SL, Canaries, SP (22) Turitop, Canaries, SP.

[10] See Standford Truth Table Generator link available at https://web.stanford.edu/class/archive/cs/cs103/cs103.1156/tools/truth-table-tool/ for Proposition Logic Formula "(S ∧ (R ∧ (I ∧ P)))".

[11] See Standford Truth Table Generator link at https://web.stanford.edu/class/archive/cs/cs103/cs103.1156/tools/truth-table-tool/.

of interest was then assessed through interviews with representatives of venture capital groups based on a simple scale (3 = High Potential, 2 = Medium Potential, and 1 = Low Potential). The Venn diagram illustrates the overlapping nature of the S, R, I and P conditions and assigns each area a unique ID, i.e., "2" is the area where a score is generated only for S, therefore representing the causal code "1000". Numbers in circles with a dotted boundary are such where cases have achieved SP = 3.

The change theory put forward was that RIE meeting a unique CC with the highest SP (3) will contribute most significantly to the overall OR REI accelerating the progress towards aspired end value. The research results however show that case with SP = 3 corresponded to multiple CC, whereby interviews suggests that such may change over time as well. A RIE may hence be sustainably successful under different CC over time and that this then begs for variable interventions to accelerate the appropriate diffusion to late adopters and sustainable valorisation.

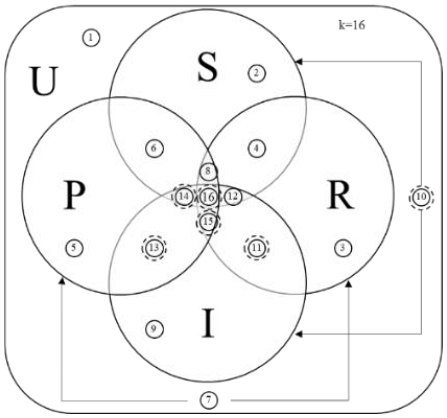

Figure 2 – QCA Analysis Results

The identification of multiple relevant CC also suggests that any data analysis should assume the presence of multiple data centres which precludes the use of general statistical approaches which usually rely on a single data centre.

## 5. Conclusions

Actionable and pragmatic management interventions permitting Start-Ups and SMEs in the ORs to achieve sustainable success with minimal effort were identified as (a) aligning the business goals with the relevant key performance indicators underlying the UN Sustainable Development goals, (b) prioritising physical face-to-face collaboration higher than virtual forms of collaboration, (c) prioritising hiring (part-time) staff higher than outsourcing to contractors, and (d) gaining mindshare in the core business through research publications and intellectual property protection.

Swarm principles[12] identified that are easily implemented for accelerating the growth of RIEs, include (a) seeing its RIE as that team which will enable sustainable commercial success, (b) communicating and serving the true shared purpose of its RIE, (c) funding research, development, and growth through multiple independent revenue streams (i.e., education, consulting, services / products), and (d) maintaining financial independence from the performance of the business.

RIEs appear to have archetypal structures that exist in multiple different constellations of relevant causal variables that may change dynamically over time. For Start-Ups and SMEs this means that identifying the currently most relevant archetypal structure is the most important step towards then identifying what assets are critical at that specific evolutionary phase, and then selecting and applying the most suitable actionable interventions to accelerate the emergence of their RIEs through the encouragement of relevant swarm principles.

[12] Guidelines that govern the behaviour of decentralized, self-organized systems, both natural and artificial.

**Acknowledgements**

The authors gratefully acknowledge support of the EIT Cross-KIC HEI Initiative Project INCORE (P.6076: Innovation Capacity Building for Higher Education in Europe's Outermost Regions) and the Foundation for Science and Technology's through funding UIDB/04625/2020 from CERIS.

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