



ORIGINAL PAPER



DOI: 10.26794/2220-6469-2024-18-2-17-28
UDC 332.1(045)
JEL O31, O39

Innovative Ecosystem of the Territory: Design, Assessment and Management Models

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ABSTRACT

The necessity of creation and implementing innovations, as well as the growth of ecosystems, are significant trends in modern economic development. Their combination and unification in the format of an innovation ecosystem opens up new opportunities and poses new research challenges. Therefore, the purpose of this article is to identify promising models for coordinating network interactions in the process of creating common innovative value, as well as developing tools for justifying the choice of the most appropriate formats for coordinating ecosystem interactions (an orchestration, in other words). The theoretical and methodological basis of the study includes: the concept of ecosystems, innovative value creation networks, role design and models of ecosystem interactions coordination, the concept, and models of assessing digital maturity. Based on the results of the analysis, promising models of ecosystem management were identified: hybrid orchestration, multi-orchestration and multi-tier orchestration. The characteristics of ecosystem roles are given, their influence on the success of creating overall innovative value is noted. An approach is proposed to determine possible ecosystem roles based on the ratio of maturity levels of participants and the ecosystem as a whole. A structured analysis of various approaches to assessing ecosystem maturity was carried out. The tools developed by the authors to justify the choice of ecosystem orchestration formats have scientific novelty: a framework for the formation of management and cooperation models in an innovation ecosystem and the structure of a flexible multi-component model for assessing the maturity of a territory's innovation ecosystem. The practical significance of the proposed tools is that they will allow making more informed decisions in the field of ecosystem orchestration by combining and systematizing key aspects of creating shared innovative value and modern management models.

Keywords: innovative ecosystem of the territory; overall innovative value; network coordination models; ecosystem roles; ecosystem maturity; ensemble of models

For citation: Gileva T.A., Khussamov R.R. Innovative ecosystem of the territory: design, assessment and management models. *The World of the New Economy*. 2024;18(2):17-28. DOI: 10.26794/2220-6469-2024-18-2-17-28

INTRODUCTION

Different types of ecosystems, aspects of their development and management models are now the focus of numerous researchers [1–4]. However, the proliferation of ecosystems raises more and more questions: for example, there is still no universally accepted classification of ecosystems [5]. In addition, the development of cooperation models corresponding to the principles of non-hierarchical coordination (orchestration), overcoming all sorts of barriers to effective interactions between relatively independent participants (actors) of an ecosystem, etc. are urgent tasks. [3–7].

- One of the relatively independent areas is innovation ecosystems research [4]. The distinctive feature of this type is that their focus is on the complex process of interaction between heterogeneous actors who cooperate to create and commercialise innovations of high integrated value for consumers [4, 6]. The importance and complexity of the organisation of interactions is determined by the following factors:

- the diversity of participants of the innovation process along the entire chain (network) of innovation value creation [8] and, accordingly, the large number and diversity (heterogeneity) of actors in the innovation ecosystem [6];

- determining role of interactions for the successful activity of all participants in the innovation process — if coordination within the ecosystem is insufficient, innovation will fail [4];

- relative independence of ecosystem actors, which requires the development of fundamentally new models of non-hierarchical cooperation [2–4; 7, 9];

- the “open innovation paradox”, according to which the models of interaction in the innovation ecosystem should be open enough to stimulate the activity of partners, their complementarity and cooperation, but at the same time — closed enough to guarantee each or-

ganisation a fair, from its point of view, assignment of value [6].

The process of managing the creation and distribution of value in any ecosystem is called orchestration [5, 10, 11]. In one of the papers [11], four key tasks of an ecosystem orchestrator are formed: defining the value proposition, its realisation (including selection of participants and distribution of ecosystem roles), coordination of suppliers and partners in the process of value creation, and ecosystem development (bringing new ideas). Thus, ecosystem orchestration refers to a set of intentional and purposeful actions taken by an ecosystem organiser to encourage voluntary collaborative contributions that create value and coordinate effects among hierarchically independent actors [5]. Due to the specific nature of the innovation ecosystem, the task of ensuring the coordinated interaction of various participants of the innovation process is particularly relevant for it.

This paper identifies promising models for coordinating network interactions in the process of creating shared innovation value, and develops tools to justify the choice of the most appropriate orchestration formats.

INNOVATION ECOSYSTEM DESIGN

There are two approaches to analysing and forming an ecosystem: it is considered as an affiliation and as a structure [3]. The concept of an ecosystem as an affiliation has allowed us to go beyond industry boundaries, to ensure the growth of flexibility and adaptability of companies necessary for survival in an unstable environment due to the possibilities of faster and wider access to necessary resources and competences, as well as the expansion of network interactions [8, 9]. Many of the above opportunities have been provided before, for example, in the format of innovation clusters. However, there are features in the nature of interactions that give reason to consider these organisational forms as different [3, 12]. One of them — the possibility of obtaining network

effects — is largely implemented by organising the interaction of ecosystem participants through digital platforms [10, 13, 14]. Therefore, the concept of “ecosystem as belonging” considers it as a community of connected actors defined by their networks and belonging to platforms.

The concept of ecosystem as a structure proposed by R. Adner [3] is based on the fact that its formation is not simply based on the expansion of interaction opportunities, but on the creation of a common value, which is the meaning and foundation of all subsequent communications. According to this concept, an ecosystem is understood as a structure for agreeing on a multilateral set of partners that need to interact in order to materialise a core value proposition. From this position, the obligatory elements of an ecosystem are: activities (a set of actions necessary to realise the value proposition); actors (ecosystem participants carrying out various activities); roles associated with the process of transferring functions between participants, and links (material, financial, administrative, informational) that arise in the process of interaction in order to create shared value [3]. The necessity of singling out roles as a separate element is determined by the fact that one and the same participant can fulfil several of them; moreover, the role structure of an ecosystem is capable of changing even if the composition of actors remains unchanged.

There are also different approaches to the definition of innovation ecosystem [2, 15, 16]. In some works, the view of the innovation ecosystem is largely formed at the intersection of the concepts of regional innovation system and digital platform [15, 17].

Closely related to the concept of innovation ecosystem is another one — “entrepreneurial ecosystem”, which is most often focused on the development of innovation potential within a certain local space [18]. In one of the works, it is called “a complex adaptive system that includes a set of proactive actors, cooperative links be-

tween them and environmental factors (including institutional, infrastructural, cultural and social) that provide more efficient use of labour, financial and intellectual resources within the region in order to effectively use the resources of the ecosystem in the process of producing goods and services and meeting public needs” [19, p. 1507].

The authors of another paper conduct a similar analysis of mainly foreign studies and draw conclusions:

- Despite the localised nature of entrepreneurship, national innovation systems research suggests that entrepreneurial ecosystems often operate at a national scale;
- Discussions of entrepreneurial ecosystems are largely focused on their key components, while much less attention is paid to the processes of interaction and the changing nature of relationships (i.e., the ecosystem is predominantly approached as an affiliation);
- The integrity and effectiveness of an entrepreneurial ecosystem is more likely to be the result of the strength and type of linkages rather than the number of participants [18].

Research in the field of entrepreneurial ecosystems provides interesting and important results from the point of view of activation of innovation processes of the territory. However, in essence, they are an organic component of the innovation ecosystem. This integral approach is reflected in the framework proposed by analysts at the MIT Sloan School of Management.¹ Traditionally, the design of the innovation ecosystem (as well as the regional innovation system) is defined by the models of triple or quadruple spirals [17]. However, within this approach five groups of stakeholders are represented: research institutions, entrepreneurs, corporations, investors, and government, which are connected by a strong social fabric of mutual interests, complementary needs and resources, as well as trust.

¹ URL: <https://sloanreview.mit.edu/article/strategically-engaging-with-innovation-ecosystems/>

In general, based on various studies, we can conclude that the innovation ecosystem is a multi-level network structure that ensures equal interaction between participants (actors) with different levels of integration: from individual enterprises and organisations, joint ventures, and alliances, to clusters, digital platforms, and ecosystems (entrepreneurial, partnership, industry, etc.). It is also of the digital type: its core is a digital platform, and since it can include several platforms, it is considered multi-core [17]. Most definitions of the innovation ecosystem emphasise diversity and hierarchical independence, but refer to the interconnectedness and complementarity of actors within the value proposition being created. Thus, there is a definition according to which an innovation ecosystem is an evolving set of actors, activities and artefacts (products and services, tangible and intangible resources, etc.), as well as institutions and relationships, including complementary and substitute relationships that are important for the innovative activity of an actor or group of actors [16]. The innovation ecosystem is also defined as a community of hierarchically independent but interconnected heterogeneous actors that collectively generate consistent results associated with a common value proposition oriented to a certain audience of users [5].

The relative independence of participants in the innovation ecosystem of the territory — on the one hand, and the key role of coordinated interactions in the creation of common value — on the other hand, as well as the dual nature of relationships based on both cooperation and competition at the same time [9], require the search for new models of non-hierarchical coordination [4, 7].

MODELS OF ECOSYSTEM ORCHESTRATION

To date, several promising research directions in this area can be identified. Firstly, it is the concept of hybrid orchestration in

multi-stakeholder innovation networks [7]. As in any organisation, different management styles can be used in ecosystems: both dominant and consensus-based. The effective application of each depends on certain conditions. Dominant orchestration is most often carried out by an initial orchestrator company [6], which then acts as the central (leading, focal) organisation or hub of the ecosystem (these names are used in different works to denote the same role). At the first stages of the life cycle, it is such a company that is able to shape the overall value proposition and initiate the selection of the participants required for this purpose. However, the process of creating innovative value itself, due to non-hierarchical relations between the hub and ecosystem participants, may require more flexible management based on trust and co-operation (co-evolution). Hybrid orchestration implies the application of both management styles, with the choice of one or the other influenced by the number of actors, their diversity, the level of competences of the orchestrator and the nature of the tasks to be solved.

Secondly, it is multi-orchestration. There are three main management models: single, dual, and multiple orchestration ecosystems [11]. One of the prerequisites of this approach is the presence of phases in the innovation process that differ significantly in content and, therefore, require completely different competences. This applies to the processes of innovation creation and commercialisation — in some cases, researchers consider the innovation ecosystem as a set of two subsystems: innovation creation and business development [10]. Thus, not all companies have a high level of development in the full set of competences to coordinate the activities of the ecosystem at all stages of innovation value creation. Similarly, to distributed leadership, in high-performance teams the role of an orchestrator can be fulfilled by various participants of the ecosystem. This is

Table 1

Framework for the formation of management and cooperation models in the territory's innovation ecosystem

Ecosystem roles	Orchestrator	Strategic Partner	Complementor	Supplier	Satellite
Tasks of an orchestrator	Strategic		Tactical		
	Defining the value proposition	Bringing new ideas to the table	Implementing the value proposition	Coordination of suppliers and partners	
Type of orchestrator	One orchestrator	Two orchestrators	Multi-Orchestrator (multiple companies)		
Management models	Dominant orchestration	Orchestration by consensus	Hybrid orchestration	Application of digital platforms	
Aspects of management	Technological	Economic	Behavioural	Institutional	

Source: compiled by the authors.

determined by the presence and development of their respective competences, which are a component of the overall maturity level for each of the participants in the innovation process. That is, if one company (the initial orchestrator) does not have the necessary competences to both create and realise the value proposition, two or more firms can act as the ecosystem coordinator, taking on different tasks to orchestrate the ecosystem [11].

Thirdly, the concept of multi-tiered orchestration. It has been proved that in the presence of a large number of diverse (heterogeneous) participants, ecosystem orchestrators form well-managed groups (tiers) of complementors to which a common management approach is applicable [6]. Such an approach also combines formal and informal (or prescriptive and consensus-based [7]) management styles and tools, the choice of which depends on the domains of uncertainty relevant to each task. Where uncertainty is high, the research role of complementors is supported precisely through models based on trust and co-operation: e.g., joint ventures, co-investments, etc. A well-known and well-established co-operation model is outsourcing [20]. The role design of the

ecosystem is also important: how close to the core or periphery is this or that participant (group of participants)?

The most common approach to defining ecosystem roles is to identify (in addition to orchestrator) strategic partner, supplier, complementor and satellite.² The choice of role in this case is determined by two criteria: the value of the resources and data received and the partner's ability to provide operational support and help scale the business.

Taking into account the peculiarities of the innovation ecosystem, requirements and promising trends in the field of ecosystem orchestration, we have built a framework for forming models of management and cooperation in the innovation ecosystem (Table 1).

This format systematises the key factors and opportunities in managing the interaction of heterogeneous actors in the innovation process to create shared value. It allows you to see and select the methods and models that will fit the most appropriate formats of interaction.

² URL: <https://hbr.org/2022/03/how-to-choose-the-right-ecosystem-partners-for-your-business>

Table 2

Ecosystem roles configurator

Ecosystem roles		Participant's level of digital maturity		
		low	medium	high
The level of ecosystem maturity	High	Recipient	Implementer or donor	Collaboration designer
	Medium	Recipient	Co-evolution zone	Task provider, strategist, or orchestrator
	Low	"Dead zone"	Achiever	Pilot or orchestrator

Source: compiled by the authors.

In the context of the innovation ecosystem of the territory, depending on the content of the tasks to be solved, within the groups of strategic partners, complementors, etc., different roles can also be distinguished: leadership roles (ecosystem leader and dominator); roles directly creating value (supplier, assembler and complementor); value creation support (expert and champion) and entrepreneurial ecosystem (entrepreneur, sponsor, and regulator) [21]. A more extended classification³ includes 23 roles, also organised into several groups. It has been shown that the choice of ecosystem roles is influenced by the correlation between the maturity levels of the participating companies and the ecosystem as a whole [17]. The configurator of innovation ecosystem actor roles is presented in *Table 2*.

While a large number of models have been developed to assess the maturity of individual companies [22, 23], these issues are much less developed in relation to ecosystems.

INNOVATION ECOSYSTEM MATURITY: CONCEPT AND ASSESSMENT

Despite the existence of many digital maturity models, they assess not only and not so much technological aspects, but also the readiness of

organisations and other structures (industries, ecosystems) to operate successfully in the digital environment [24]. Since the ecosystem as a management model was able to reach this level of development only with the help of digital technologies (including digital platforms), "we will consider the concepts of maturity" and "digital maturity" to be identical in relation to ecosystems.

The success factors of digital maturity are: increased customer focus; the emergence of the ability to create digital products or add-ons; improved operational efficiency, significantly reduced time to market, etc. The advantages of digital maturity models as management tools are that they provide a better understanding of the phenomenon of digital transformation; they play the role of a catalyst on the way to digital transformation; they substantiate digital transformation strategies; they prioritise areas of development (products, processes); they provide an opportunity to measure positions relative to competitors and development dynamics; they are focused on a continuous process of adaptation and improvement. At the same time, they cover on average 5–6 aspects (the most common: strategy and business model, organisational culture and personnel, operational processes, digital technologies) and 4–5 maturity levels [23, 24]. Ecosystem maturity models are constructed in

³ URL: <https://www.cerri.iao.fraunhofer.de/content/dam/iao/cerri/>

Table 3

Approaches to assessing ecosystem maturity

Name and developer	Aspects	Characteristics
1. Innovation Ecosystem Maturity Model	Assessment areas	Monetisation, participants, management, knowledge, network
	Number of levels	5: Beginner, Builder, Experimenter, Connector, Expert
	Other features	Visual one-page presentation format
2. Ecosystem Maturity Model, Workspan	Assessment areas	Target setting, business model, number of partners, interaction formats, digital platform, scalability
	Number of levels	5: Pre-idea, Starting, Progressive, Mature, World-Class
	Other features	The list of assessment areas is not explicitly labelled, but a detailed characterisation of the state of the ecosystem at each level is provided
3. Digital business ecosystem maturity model [25]	Assessment areas	Transparency, governance, scalability, cybersecurity, knowledge base, standardisation (as a unification process based on consensus of actors)
	Number of levels	5: Initial, Managed, Defined, Quantitatively Managed, Optimized
	Other features	The model is based on a systematised literature review, expert interviews, and online surveys. It provides a detailed characterisation at all levels for each of the identified areas of assessment
4. Digital business ecosystem maturity model	Assessment areas	Products and services, process and organisation (knowledge management, collaboration, agility and flexibility), technology (infrastructure, use of ICT systems), customer focus (customer satisfaction, customer interaction), strategy and leadership (business model, digital culture).
	Number of levels	5: Infancy, Developing, Transforming, Optimized, Digital Maturity
	Other features	The model is based on expert interviews. It contains a characterisation of all levels for each of the identified areas of assessment
5. Pie Model	Assessment areas	1. Ecosystem value proposition. 2. Consumer segments. 3. Actors. 3.1. Resources. 3.2. Types of activities. 3.3. Contribution to value creation. 3.4. Receiving value. 3.5. Relationships, trust. 3.6. Risks
	Number of levels	No maturity levels have been established. Purpose of the model: a strategic tool for mapping, analysing, and designing innovation ecosystems
	Other features	The assessment is carried out at two interrelated levels: the ecosystem as a whole (Assessment Areas 1 and 2) and individual actors (Area 3 with further detailing)
6. Ecosystem Maturity Map	Assessment areas	The state of stakeholders at each stage of the ecosystem life cycle. The main groups of participants of the innovation process are identified as stakeholders: scientific and financial organisations, entrepreneurs and business support structures, corporations, and the government.
	Number of levels	5: Pre-idea & Culture, Ideation, Start-Up, Valley of Death, SME
	Other features	Visual one-page presentation format

Source: compiled by the authors.

Table 4

Structure of a model for assessing the maturity of a territory's innovation ecosystem

Evaluation block	Sub-models (areas of assessment)	Content (elements)
The core of ecosystem	1.1 Value Proposition	Target segments, products and services, customer centricity
	1.2. Governance	Ecosystem strategy and culture, ecosystem orchestration methods and models (hybrid multi- and tiered orchestration, etc.), scaling up
	1.3 Network structure	Composition and interaction of participants (actors) with different levels of integration: from individual enterprises and organisations, joint ventures, and alliances, to clusters, digital platforms and ecosystems (entrepreneurial, partnership, industry, etc.).
Actors (participants)	2.1 Creating innovations	Universities, research organisations and divisions of large corporations, scientific collaborations and consortia, etc.
	2.2 Implementing innovations	Industry and business
	2.3 Entrepreneurship	Categories of entrepreneurs: potential, owners of newly established (up to 3 years) and established (over 3 years) businesses. By format: individual entrepreneurs, SMEs, start-ups.
	2.4 Infrastructure	Platforms, technoparks, venture capital funds, business incubators and business accelerators, shared-use centres, testing facilities, etc.
	2.5 Government	Structures and programmes of state support for innovation activities
Interaction	3.1 Motivation and trust	Relationships and interaction formats in the process of creating and capturing value
	3.2 Continuity of the innovation process	Innovation value creation network, role design and role dynamics
	3.3 Formats and technologies	Digital platforms, cyber security
Risks	4.1 Systematic risks	Risks of changes in legislation, natural risks, etc.
	4.2 Non-systematic risks	Risks of unclaimed value proposition, technological risks, as well as risks of configuration (wrong combination of actors), interdependence, lack (loss) of trust, asymmetry (imbalance of power), coordination (loss of control), etc.

Source: compiled by the authors.

a similar way. *Table 3* summarises the research in this area.

Although at first glance the presented models appear to be different, they share the same basic characteristics. All of them have 5 maturity levels, which in 5 of the 6 models are assessed depending on the progress made in the selected areas of assessment (only the Ecosystem Maturity Map model considers the stages of the ecosystem life cycle as levels). The most common assessment areas are: value proposition (target, products and services, monetisation), actors, processes and formats (network, platform, infrastructure), their interaction and management (ecosystem orchestration). From the perspective of the innovation ecosystem, the area related to knowledge creation and dissemination is particularly emphasised.

When developing a model for assessing the maturity of the territory's innovation ecosystem, in addition to the analysis performed, we will use a constructive idea, the essence of which is the formation of a structured dynamic complex (ecosystem, ensemble) of models that assess various aspects of the ecosystem [26]. This approach allows us to:

- avoid the complexities of building and using a single, “comprehensive” model;
- provide an opportunity to customise the assessment tool for the specific situation by selecting the necessary modules from the general “menu” presented;
- provide the necessary depth of detail within each submodel without overcomplicating the model as a whole;
- to make the tool more dynamic and capable of development by modifying and/or supplementing individual submodels and even blocks.

The structure of the proposed model for assessing the digital maturity of the territory's innovation ecosystem is presented in *Table 4*.

The formed structure is the basis for building a multi-component model (ensemble of models) for assessing the maturity of the territory's in-

novation ecosystem. In order for the selected submodels to serve as a full-fledged tool for maturity assessment and subsequent justification of decisions on the design of role design for the implementation of a particular value proposition, and then contribute to the selection of the most appropriate models for the organisation of actor interaction, their specification for each block is required. The solution of this problem is considered by the authors as a promising direction for further research.

CONCLUSIONS

The article identifies promising directions of ecosystem orchestration development: hybrid, multi-, and tiered orchestration, which should be considered as complementary approaches. A framework for forming models of governance and co-operation in an innovation ecosystem is constructed, which visually integrates key aspects and methods of ecosystem management and establishes the need to take into account ecosystem roles when choosing the most appropriate model of actor interaction.

As in any ecosystem, these roles include orchestrator (usually the initiator of the innovation value creation and coordinator of the actors needed to implement it), strategic partner, supplier, complementor and companion (satellite). However, the roles in the innovation ecosystem are very diverse due to the existence of multiple processes required to develop and implement innovations. At the same time, one and the same participant can simultaneously fulfil several roles, and the role structure itself changes over time, which is related to both the parameters of the value proposition and the relationship between the maturity levels of an individual participant (actor) and the ecosystem as a whole.

While there are many models for assessing the digital maturity of companies, there are far fewer for ecosystems. Most of them do not take into account the specifics of innovation ecosys-

tems themselves. The authors have identified such consolidated areas of assessment as: value proposition (target, products and services, monetisation), actors, processes, and formats (network, platform, infrastructure), their interaction and management (ecosystem orchestration). The

structure of the model for assessing the digital maturity of the territory's innovation ecosystem developed by the authors (*Table 4*) can be the basis for building a multi-component model (ensemble of models) for assessing the maturity of the territory's innovation ecosystem.

ACKNOWLEDGEMENTS

The study was financially supported by Russian Science Foundation under the scientific project No. 23-28-00395

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was received on 31.03.2024; revised on 17.04.2024 and accepted for publication on 11.05.2024.

The authors read and approved the final version of the manuscript.