Methodological Approach to Identifying Regions with Potential for SME Clustering in the Republic of Armenia

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Հայաստանի Հանրապետությունում տարածաշրջանների ՓՄՁ-ների կլաստերավորման ներուժի բացահայտման մեթոդական մոտեցում

Մանուկյան Իզաբելլա Կ.
3-րդ կուրսի ասպիրանտ, դասախոս, Կառավարման և բիզնեսի ամբիոն,
Հայ-Ռուսական համալսարան (Երևան, ՀՀ)

Ամփոփագիր. Իրենց բնույթով տարածաշրջանային կլաստերները բազմաչափ են և բարդ: Կլաստերային նախագծերի իրականացման արդյունքները կարելի է տեսնել միայն երկարաժամկետ հեռանկարում: Նման պայմաններում մեծանում է բիզնես կլաստերների ձևավորման համար համապատասխան ճյուղերի և տարածաշրջանների ընտրության հարցում ճիշտ որոշում կայացնելու կարևորությունը: Հայաստանի Հանրապետությունում փաստացի չի գործում ոչ մի կլաստեր, որը ստեղծվել է զարգացած մեթոդաբանական ապարատի հիման վրա, հաշվի առնելով առավելագույն կլաստերավորման ներուժ ունեցող մարզերի առանձնահատկությունները: Սույն հետազոտական աշխատանքում առաջարկվում են. նպատակադրման ալգորիթմը, որը բաղկացած է քանակական և որակական ենթանպատակներից և խնդիրներից, որոնք կարող են կիրառվել բիզնեսի կլաստերավորման ամենամեծ ներուժ ունեցող տարածաշրջանը որոշելու համար; տարածաշրջանային ներուժի գնահատման չորս քայլից բաղկացած գործընթաց; տարածաշրջանների ընտրության մատրիցային մոտեցում՝ հաշվի առնելով հիերարխիաների վերլուծության և վերլուծական շղթաների կառուցման կանոնները, որոնք փոխկապակցվել են Triple Helix-ի կոնցեպցիայի հետ (պետություն-բիզնես-գիտություն):
Հանգուցաբառեր և բառակապակցություններ՝ տարածաշրջանային կլաստեր; տարածաշրջանային բիզնեսի կլաստերավորում; տարածաշրջանային զարգացում; Հայաստանի Հանրապետության տնտեսություն; տարածաշրջանային ՓՄՁ կլաստեր; տարածաշրջանային ներուժի բացահայտում; վերլուծական ցանցերի կառուցում; որոշումների կայացում; ռազմավարություն

Методологический подход к выявлению регионов с потенциалом для кластеризации МСП в Республике Армения

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Аннотация. По своей природе, региональные кластеры многомерны и сложны. Результаты от имплементации кластерных проектов можно проследить лишь в долгосрочной перспективе. В этой связи, возрастает важность принятия верного решения относительно выбора подходящих отраслей и регионов для формирования бизнес-кластеров. В Республике Армения фактически не функционирует ни одного кластера, созданного на базе обоснованного методологического аппарата с учетом идентификации особенностей регионов с наибольшим потенциалом к кластеризации. В данной исследовательской работе предложены: состоящий из количественных и качественных подцелей и задач алгоритм целеполагания, который может быть применен при определении региона с наибольшим потенциалом к кластеризации бизнеса; четырехшаговый процесс к оценке потенциалов регионов; матричный подход к выбору регионов с учетом правила анализа иерархий и построения аналитических цепей, привязанный к концепции тройной спирали (государство-бизнес-наука).
Ключевые слова и словосочетания: региональный кластер; региональная бизнес-кластеризация; региональное развитие; экономика РА; региональный кластер МСП; выявление регионального потенциала; построение аналитических сетей; принятие решений; стратегия

Introduction

Multidimensional nature of business clusters sheds light on the fact that the choice of an approach to clustering plays a vital role in its further development. Moreover, it is hardly possible to identify the real impact of a cluster project on a country's economy in the short-term perspective. This, in turn, serves as a high risk for contemporary countries. Hence, there arises the necessity to identify the exact region (or a group of regions) along with a precise cluster specialization sector, in order to develop a model that can leverage the economic growth.

Considering the fact that no cluster currently operates in the Republic of Armenia [**1**], there is a necessity to develop a unique approach to regional SME clustering based on the understanding that the decision to create a cluster is complex and involves uncertainties as well as interdependent factors. Hence, Author proposes a new methodological approach to identification of regional potential for SME clustering in the regions of Armenia.

Methodology

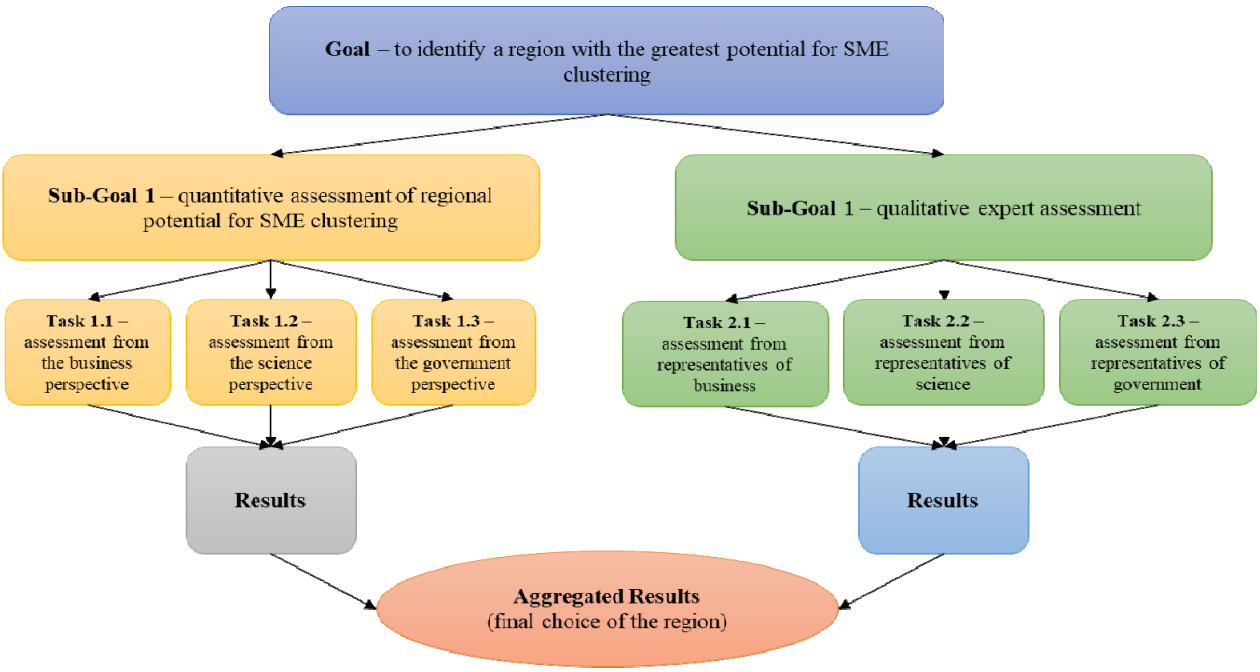
To develop the new methodological approach, Author considers the rules of Analytic Hierarchy Process (AHP), the development of analytical chains and decision-making with dependence and feedback [**2**]. Although AHP is used for resolutions of various multidimensional problems, it has not been implemented into the world practice of assessment of regional potential for SME clustering. This fact served as one of the main assets for the newly developed proposal.

Results

Based on the Author's previous research on the analysis of best international practices, it was revealed that the most successful regional clusters are the ones that unite representatives of three blocks, namely: science, business and government (in other words, the Triple Helix) [**3**]. These three parties have capacities to unite around strategic aims, as well as to catalyze the synergy effect while cooperating mutually. Hence, it is essential to propose a model, which encompasses representatives of all three aforementioned blocks.

Due to the comprehensive composition of business clusters, identification of relevant regional SMEs potential cannot be limited to implementation of solely quantitative or only quantitative indicators. On the contrary, it should be a complex unity of both approaches. The goal-setting algorithm is envisaged in Picture 1.

Hence, if the Goal is to identify a region with the greatest potential for SME clustering, then Sub-Goal 1 is to quantitatively assess the regional potential, whereas the equally important Sub-Goal 2 is to conduct qualitative assessment. Implementation of Sub-Goal 1 is highly dependent on interconnected Tasks 1.1, 1.2 and 1.3, and the achievement of Sub-Goal 2 relies on Tasks 2.1, 2.2 and 2.3 respectively. Each pair of categorial tasks refers to one dimension of the Triple Helix. This means that assessment is done from the perspective of benefits that business, science and government can receive if cluster approach is implemented. After the synthesis of preliminary results, it is necessary to conduct the final synthesis and, thus, to identify the region (or regions) with the highest potential for SMEs clustering in Armenia.



Picture 1. *Goal-Setting Algorithm for Determination of Regions with Potential for Clustering*

In this research article, Author focuses on proposing a methodology for achievement of Sub-Goal 1, which is presented below. Note that relevant information plays a significant role in the accuracy of results. Implementation of all steps that are described below needs to be fulfilled with analyses based on real statistical data from officially published yearbooks and country reports.

Step 1. *Choice of the base of cluster potential (natural VS artificial)*

While global practices of regional SME clustering have witnessed numerous examples of structures that operate efficiently after being artificially created, for a post-Soviet country like Armenia with a developing economy, it is more preferable to develop a cluster based on the natural potential. The natural VS artificial choice is critical, as the creation of new clusters leads to a significant increase in investments, which is accompanied by a proportional rise in risks.

Step 2. *Conduction of an in-depth socio-economic analysis of the country's regions*

Identification of regions with high potential for SME clustering highly depends on the country's social and economic indicators. This analysis is crucial for understanding of strong and weak points, as well as for revelation of differences and similarities among regions.

Step 3. *Selection of the country's key economic sector (up to 2 sectors)*

By reaching this point, it is essential to reveal 1-2 main economic sectors, in which the country operates most efficiently. These will be the sectors of the further cluster's core, and based on their specificities, the assessment in Step 4 should be implemented.

Step 4. *Matrix approach to potential assessment*

Note that the capital of Armenia (Yerevan) will not be considered in the calculations due to its overdevelopment and high economic differentiation compared to the country's regions (marzes). Let there be 10 alternatives (alternative regions: Ararat, Armavir, Aragatsotn, Gegharkunik, Kotayk, Lori, Shirak, Syunik, Tavush, Vayots Dzor) $A_1, A_2, A_3, \ldots, A_{10}$ for cluster formation. Let us develop analytic networks that consist of components, which, according to the theory [4], can influence the choice of alternatives. Let us set the representatives of Triple Helix as components, which means presentation of a series of elements and inter-connected sub-elements (*criteria*) in the context of the assessment of their significance from the perspective of benefits that business *(element* C_n*)*, science (element C_i*)* and government *(element* C_j*)* can receive.

Each alternative is evaluated based on 3 elements. Each element consists of criteria assessing the region's clustering potential. The values for each criterion are summed to determine the overall evaluation. The number of criteria may vary depending on relevance, but it requires innovative context, as well as logical interconnection based on the selected economic sector of the potential cluster's further operation. It also requires adherence to the positive constraint.

For instance, we assess elements for 2 alternative regions, while the number of criteria for business element assessment is 5, for science element is 3 and for government element is 2 accordingly. Hence, to determine the values of the elements, a series of calculations must be performed (see 2x3 matrix **(a)**).

$$\begin{vmatrix} C_{n1} = C_{n1.1} + C_{n1.2} + C_{n1.3} + C_{n1.4} + C_{n1.5} & C_{i1} = C_{i1.1} + C_{i1.2} + C_{i1.3} & C_{j1} = C_{j1.1} + C_{j1.2} \\ C_{n2} = C_{n2.1} + C_{n2.2} + C_{n2.3} + C_{n2.4} + C_{n2.5} & C_{i2} = C_{i2.1} + C_{i2.2} + C_{i2.3} & C_{j2} = C_{j2.1} + C_{j2.2} \end{vmatrix} \text{[a]}$$

Matrix (**b**) is the shortened version of matrix (**a**).

$$\begin{vmatrix} \sum_{\alpha=1}^{5} C_{n1\alpha} & \sum_{\alpha=1}^{3} C_{i1\alpha} & \sum_{\alpha=1}^{2} C_{j1\alpha} \\ \sum_{\alpha=1}^{5} C_{n2\alpha} & \sum_{\alpha=1}^{3} C_{i2\alpha} & \sum_{\alpha=1}^{2} C_{j2\alpha} \end{vmatrix} \text{[b]}$$

Assessment for all 10 alternatives is presented in the final 10x3 matrix (**c**).

$$\begin{vmatrix} C_{n1} & C_{i1} & C_{j1} \\ C_{n2} & C_{i2} & C_{j2} \\ C_{n3} & C_{i3} & C_{j3} \\ C_{n4} & C_{i4} & C_{j4} \\ C_{n5} & C_{i5} & C_{j5} \\ C_{n6} & C_{i6} & C_{j6} \\ C_{n7} & C_{i7} & C_{j7} \\ C_{n8} & C_{i8} & C_{j8} \\ C_{n9} & C_{i9} & C_{j9} \\ C_{n10} & C_{i10} & C_{j10} \end{vmatrix} \text{[c]}$$

Once the relevant criteria are established, the priorities of the alternatives must be evaluated. This is done by determining the value of each element, which is the total of its sub-elements (criteria) shown in Table 1.

Table 1. *Components of the matrix for assessment of alternatives*

Alternative (region)	*Assessment weight of the "GOVERNMENT" component* ***($const_1$ = 0.5)***	*Assessment weight of the "BUSINESS" component* ***($const_2$ = 0.3)***	*Assessment weight of the "SCIENCE" component* ***($const_3$ = 0.2)***
A_1	C_{n1}	C_{i1}	C_{j1}
A_2	C_{n2}	C_{i2}	C_{j2}
A_3	C_{n3}	C_{i3}	C_{j3}
A_4	C_{n4}	C_{i4}	C_{j4}
A_5	C_{n5}	C_{i5}	C_{j5}
A_6	C_{n6}	C_{i6}	C_{j6}
A_7	C_{n7}	C_{i7}	C_{j7}
A_8	C_{n8}	C_{i8}	C_{j8}
A_9	C_{n9}	C_{i9}	C_{j9}
A_{10}	C_{n10}	C_{i10}	C_{j10}

Source: developed by the Author

The matrix includes elements (for example, for alternative region A_1, horizontal blocks for business (C_{n1}), science (C_{i1}), and government (C_{j1})), which are products of sub-elements (criteria) and assessment weights. Note that Author proposes an exact assessment weight for each component, based on the peculiarities of significance of Triple Helix factors in the realities of the Republic of Armenia. Three analytical networks are formed: government component weight ($\mathbf{const_1}$=0.5) with elements $C_{n1,}$ $C_{n2,}$ $C_{n3,}$ …, C_{n10}, business component weight ($\mathbf{const_2}$=0.3) with elements $C_{i1,}$ $C_{i2,}$ $C_{i3,}$ …, C_{i10} and science component weight ($\mathbf{const_3}$=0.2) with elements $C_{j1,}$ $C_{j2,}$ $C_{j3,}$ …, C_{j10}. Each network consists of 10 sub-networks. Assessment matrix is presented in Table 2.

Table 2. *Matrix for Assessment of Alternatives*

	Additive Composition	***Normalized Multiplication***
A_1	$(const_1 * C_{n1}) + (const_2 * C_{i1}) + (const_3 * C_{j1})$	$(C_{n1}^{const1} * C_{i1}^{const2} * C_{j1}^{const3}) / N$
A_2	$(const_1 * C_{n2}) + (const_2 * C_{i2}) + (const_3 * C_{j2})$	$(C_{n2}^{const1} * C_{i2}^{const2} * C_{j2}^{const3}) / N$
A_3	$(const_1 * C_{n3}) + (const_2 * C_{i3}) + (const_3 * C_{j3})$	$(C_{n3}^{const1} * C_{i3}^{const2} * C_{j3}^{const3}) / N$
A_4	$(const_1 * C_{n4}) + (const_2 * C_{i4}) + (const_3 * C_{j4})$	$(C_{n4}^{const1} * C_{i4}^{const2} * C_{j4}^{const3}) / N$
A_5	$(const_1 * C_{n5}) + (const_2 * C_{i5}) + (const_3 * C_{j5})$	$(C_{n5}^{const1} * C_{i5}^{const2} * C_{j5}^{const3}) / N$
A_6	$(const_1 * C_{n6}) + (const_2 * C_{i6}) + (const_3 * C_{j6})$	$(C_{n6}^{const1} * C_{i6}^{const2} * C_{j6}^{const3}) / N$
A_7	$(const_1 * C_{n7}) + (const_2 * C_{i7}) + (const_3 * C_{j7})$	$(C_{n7}^{const1} * C_{i7}^{const2} * C_{j7}^{const3}) / N$
A_8	$(const_1 * C_{n8}) + (const_2 * C_{i8}) + (const_3 * C_{j8})$	$(C_{n8}^{const1} * C_{i8}^{const2} * C_{j8}^{const3}) / N$
A_9	$(const_1 * C_{n9}) + (const_2 * C_{i9}) + (const_3 * C_{j9})$	$(C_{n9}^{const1} * C_{i9}^{const2} * Cj_9^{const3}) / N$
A_{10}	$(const_1 * C_{n10}) + (const_2 * C_{i10}) + (const_3 * C_{j10})$	$(C_{n10}^{const1} * C_{i10}^{const2} * C_{j10}^{const3}) / N$

Source: developed by the Author

To evaluate the priority of alternatives, the additive composition principle is applied. It is, according to the theory [**4**], more accurate to sum global priorities (local priorities multiplied by the weights of parent criteria) rather than multiplying them directly.

In the context of identifying the region with the highest potential for business clustering, priorities are determined by adding the products of element values and their respective weights. The formula is provided in Table 3. The alternative (region) with the highest score is considered as prioritized. Additionally, the multiplication principle can be used to compare the results of both methods, enhancing accuracy. Multiplication formula is derived from the inverse logarithm of the logarithmic operation (see Table 3).

Table 3. *Explanations of formulas*

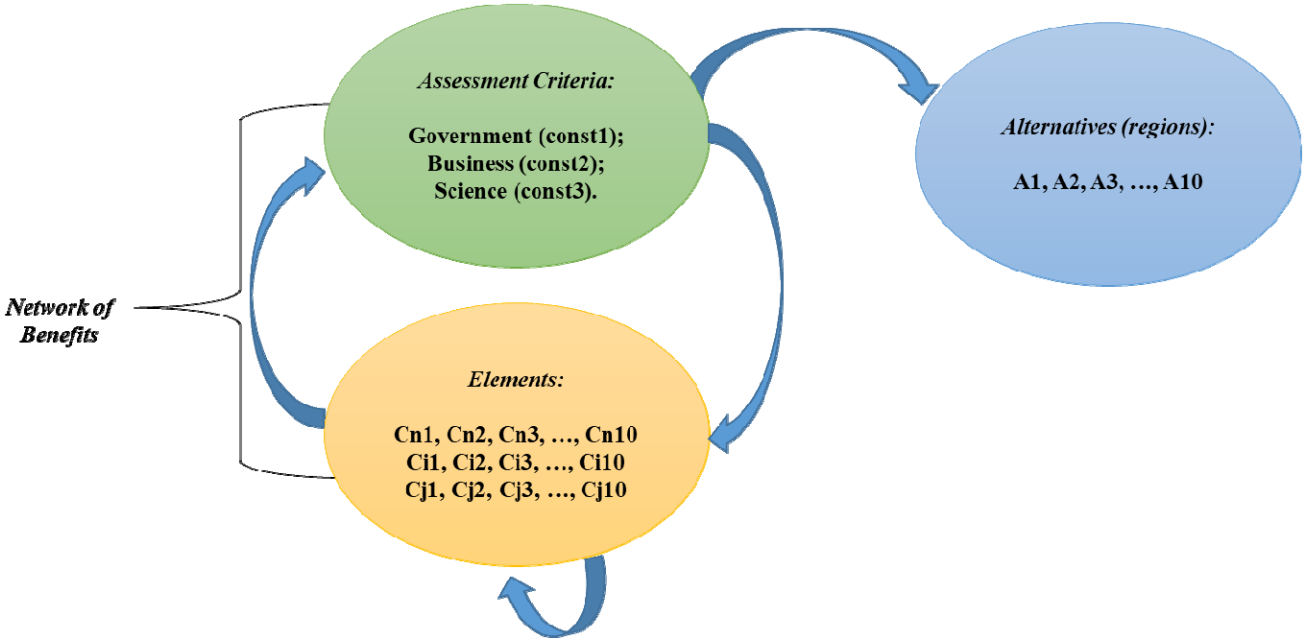
Additive Composition	$\sum_{i=1}^{n} a_i w_i$	[d]	a_i – element, i = 1, 2, 3, …, n, w_i – assessment weight
Normalized Multiplication	$\sum_{i=1}^{n} a_i \log w_i = \sum_{i=1}^{n} \log w_i^{a_i} = \log \prod_{i=1}^{n} w_i^{a_i}$	[e]	Performance of logarithmic operations with the components used in the additive composition
	$\prod_{i=1}^{n} w_i^{a_i}$	[f]	A multiplier obtained by calculation of the antilogarithm of [e]

Source: developed by the Author based on [**4**]

According to the theory [**4**], the results must be normalized by dividing the multiplication value of each alternative by the sum of multiplication values for all alternatives, denoted as **N**.

$$N = \sum_{a=1}^{10} \left(C_{n_a}^{const1} + C_{i_a}^{const2} + C_{j_a}^{const3} \right) [g]$$

The afore-described model is envisaged in Picture 2.



Picture 2. *Analytical Network Model for Complex Decision-Making (Selection of an Alternative)*
Source: developed by the Author based on [**4**]

Final achievement of Sub-Goal 1 is when according to the methodology, which was presented in Step 4, results of additive composition and normalized multiplication are summed up, and a final decision of regional selection is made.

Conclusions.

- Selection of a region (or regions) with potential for SME clustering is a complex process. This is hardened by the fact that no cluster actually exists in the Republic of Armenia.
- As government, business and science play significant roles in the development of contemporary clusters, these components should be of high importance in the process of the country's cluster formation. Hence, Author proposes a goal-setting algorithm for determination of regions with potential for SME clustering, which includes Sub-Goals and Tasks aligned with all 3 aspects of the Triple Helix.
- In order to achieve the quantitative Sub-Goal 1, Author suggests to follow a 4-step process, which includes the following steps: choice of the natural VS artificial base of cluster potential; conduction of an in-depth

socio-economic analysis of the country's regions; selection of the country's 1-2 key economic sectors; potential assessment via matrix approach.

- Description of the last step includes a detailed proposal of methodology for choice of an alternative marz (or a group of regions) for SME clustering in Armenia based on the rules of Analytic Hierarchy Process (AHP), the development of analytical chains and decision-making with dependence and feedback.
- Proposals that were introduced in this research article can also be applied in countries with economic conditions similar to Armenia.

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