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# Development of autopoietic economic structures in the Baltic states: analysis of factors

**JEL Classification:** *D21; L22*

**Keywords:** *autopoiesis; formation of a firm; Baltic states*

**Abstract**
**Research background:** Since the introduction of the concept in 1972 Autopoiesis has enjoyed great popularity among academicians representing various fields of science. However, the number of studies devoted to the investigation of factors that have an impact on the formation of autopoietic economic structures is quite limited. This paper addresses the gap in scientific research on autopoiesis of economic structures in small open markets, specifically in the Baltic States.
**Purpose of the article:** The paper aims to identify and evaluate factors that turn on self-organization mechanisms of autopoietic economic structures in the Baltic States, in particular in Latvia.
**Methods:** Expert survey was used to identify the most important factors affecting the formation of meso-economic entities in the Baltic States. The factors' assessments provided by seven experts were analyzed. Analytic Hierarchy Process (AHP) with fuzzy numbers was employed to process the data. Two different scales of evaluation (inverse linear and balanced) were used.

**Findings & Value added:** The factors influencing the process of formation of business groups were evaluated by experts. Research results allow for making conclusions regarding the causes of the business integration, and impact of diversified integrated business structures on the country's business system in Central Europe.

## Introduction

The concept of autopoiesis was initially developed by Humberto Maturana and Francisco Varela in 1972 in the field of biology, and it was used to explain the behavior of biological systems (Maturana & Varela, 1980). However it has been successfully applied in other fields of science, including economics and management. Although research on economic entities using autopoietic systems' theory are performed in Western Europe and USA, this scientific approach is still not developed in the Baltic countries.

The goal of the research is to identify and evaluate factors that turn on self-organization mechanisms of autopoietic economic structures in the Baltic States. The pilot study, conducted by Morkunas in Lithuania (2017), has been prolonged, and the results are reflected in the current paper.

Based on the results from the pilot study, the following hypothesis was stated by the authors:

> *H1: The most important factor influencing formation of meso-economic entities in the Baltic States is the "big market entry barriers".*

In order to achieve the research goal and to test the stated hypothesis, experts — top-executives of international companies or their separate business units' managers, as well as academicians with the expertise in management theories and international management — were surveyed. The authors used their own research instrument, developed for the purpose of the study.

Respondents were offered to make a pairwise comparison of six factors, influencing the self-formation of large entities. A nine-point scale was suggested to the experts for completing individual comparison matrices. To identify the most important factors, procedures within AHP (Analytic Hierarchy Process) method were performed. AHP consensus index was estimated to evaluate the level of consistency between experts' viewpoint.

## Concept of autopoiesis

During past three decades the concept of autopoiesis has been used not only by biologists, but also technological and social sciences adopted theory of autopoietic systems as one of their paradigms. Now, the concept of autopoiesis is being studied in law (Nobles *et al*., 2002, pp. 897–954; Duncan, 2010, pp. 333–413; Priban, 2015, pp. 481–495), architecture (Rosenberg, 2003, pp. 163–185), education (Pina & Mendoza, 2016, pp. 120–129), accounting (Khan & Gray, 2016, pp. 36–55) and management science (Gregory, 2006, pp. 962–972; Jackson, 2007, pp. 78–91; Alaa, 2009, pp. 19–34, Zeleny, 2010, pp. 191–204; Dittus & Vásquez, 2016, pp. 136–146; Vásquez & Benavente, 2015, pp. 269–274).

The systems theory postulates that „object", as well as its' structures and components emerges as a result of its' inner processes, but not as a result of some external actions, nor as a result of a one-sided cause-effect relations (Brocklesby, 2012, pp. 418–430). In the self-organization theory, the term autopoiesis means a result of a previous coherent transformation — the overarching reconstruction of a system in a self-organizing way. The concept of autopoiesis was introduced by Maturana and Varela (1980) in biology, and meant the ability of biological systems to create and recreate various forms of systems' architectures using system's inner elements' interactions.

Autopoietic systems are operationally closed. This means that all actions that create or support autopoiesis are generated by the system itself. Philosophical insights on self-referential organization can be found in Allen and Friston (2016, pp. 1–24).

The term „structural determinism", which is usually used in an analysis of autopoietic systems, implies that in all circumstances, the complex autopoietic system is always dependant on its architecture and inner mechanisms of self-creation. If external fluctuations are accepted by the system, they can awaken the inner activity and the resulting internal changes.

A rationale for researching all types of organizations through a perspectives of self-organization, autopoiesis and complexity science was provided by Goldspink and Kay (2003, pp. 459–474). The role of autopoiesis in creating large socio-cultural or organizational/economic structures was explored by Chettiparamb (2007, pp. 263–281). Radosavljevic (2008, pp. 215–230) proved that firms can be viewed as autopoietic systems. Multinational corporations, conglomerates, business groups and concerns also can be analyzed as autopoietic systems. The autopoietic systems theory postulates, that autopoietic systems should have the following features: 1) ability to create the elements of which are composed by themselves, 2) be

self-organizing, e.g. can independently define the boundaries of the system and generate an internal system architecture, 3) be self-sufficient, and 4) at least for a short period of time they can become closed. Such characteristics of the sophisticated autonomy were epistemologically discussed by Mirazo and Moreno (2004, pp. 235–259) and Bich (2012, pp. 215–232). The unique feature of autopoietic systems is that by acting in a closed circle, managing cyclically fluctuating elements of the system inner elements' connections, they are able to continually innovate and thus maintain a stable state. In addition, the formation of a new autopoietic structure is usually accompanied by a significant decrease in the entropy of the system, which is not only a signal of stability, permanence and predictability of certain development vectors, but also creates the prerequisites for the system cybernatization, i.e. for selection and adaptation of certain system management models. In fact, when an autopoietic structure is completely formed, the degree of system entropy reaches the minimum possible value, determining not only the aforesaid properties of the system, but also resistance to external stimuli (induction), such as additional resonating external fluctuations and sufficiently significant external pressures. The existence of autopoietic structures depends from the fluctuation vectors of the system's elements. Dissipative self-organizing autopoietic systems can occur because of a number of revolutionary changes in their environment, and because of intermittent development steps, if only external fluctuations and the resultant excitation are large enough. In some cases, these fluctuations can be moved through the system stability threshold, and then in an unstable state, due to the positive internal feedback, these changes may even be strengthened. Once such a critical point of instability is reached (mainly characterized by almost a random movement of an element), mesoeconomic structure, as a complex system, will self-organize or transform itself into another, more complex form or structure. This very short period of time can be called intrinsic system reorganization. Certain mechanisms are established by responding to external environmental effects, stimulants, or initiating a system's internal fluctuations and determining the status of the system are called feedbacks. Negative feedbacks are those fluctuations, which help to maintain system stability (homeostasis), i.e. compensates for the external environmental impact, positive ones that reduce the stability of the system. This paper aims to reveal and to determine the importance of a factors, which turns on the positive feedbacks within autopoietic economic structures in the Baltic States.

## Factors, influencing the formation of meso-economic entities

Investigation of factors affecting the formation of integrated diversified business structures was made by Granovetter (1995, pp. 93–130), Khanna & Riwkin (2001, pp. 45–74), Morck *et al.* (2005, pp. 655–720), Buchanan (2007, pp. 133–134).

For the research purposes, the authors selected six main factors: (1) big market entry barriers, (2) risks related to production specialization, (3) the ability to more efficiently allocate resources, (4) the necessity of adaptation to weak market regulatory institutions by reducing transaction costs, (5) bargaining power in the development of relations with the state for state orders, and (6) bargaining power in the development of relations with the state for more favourable legislation. The list of factors is not limited by those six (Masulis *et al*., 2009, Granovetter, 2010, pp. 429–450, Duanmu, 2012, pp. 64–72). The choice was substantiated by the results of the previous research made by Morkunas (2017), which yielded these factors as the most important ones in Lithuania. The selected factors correspond to Alaa's determined preconditions for the emergence of autopoiesis of economic entities (Alaa, 2009, pp.19-34):

**Big market entry barriers** (Mahmood & Lee, 2004, pp. 513–531). In some business sectors, economic activity can be characterized as requiring large scientific and / or economic resources, being in high dependence on economies of scale or specific commercial activity. If acting individually, for some companies such barriers can be insurmountable.

**Risks related to production specialization** (Knudsen, 2007, pp. 117–138; Ferrary, 2011, pp. 181–192). The opposite side of economies of scale in production is its increasing degree of specialization, dependence on specific skills. This leads to caution among companies regarding formation of specific competencies / deepening specialization or the adoption of liabilities of such kind, reducing the company's economic activity compared with the situation when risk sharing is of consolidative nature that is a characteristic of a business group owned enterprises.

**The ability to more efficiently allocate resources** (Khanna & Yafeh, 2007, pp. 331–372; Carney *et al*., 2011, pp. 437–460). This factor is understood as the efficiency of internal business group's capital (loans to group's companies), production (purchases from group companies), human resources (rotation of the best managers / specialists) markets and maneuvering them within the business group, due to the high coordination level from one (or several) center. By maneuvering resources within the group it can be considered an establishment of several, belonging to a business group, companies a joint training, R&D centers, including cases, when companies

are transferring a wide range of technical, industrial equipment, high tech products, underdeveloped innovations to each other through these centers, avoiding some accounting issues.

**The necessity of adapting to weak market regulatory institutions by reducing transaction costs** (Chang *et al*., 2006, pp. 637–656; Meyer *et al*., 2009, pp. 61–80). With market institutes being under development, a relatively high level of transaction costs is due to the low level of trust between the parties, frequent breaking of agreements or even disregard to property rights. This results in making supply contracts with the unfamiliar, or firms that are in distrust quite expensive, but in some cases necessary, in the cases when a company believes that it makes sense to include suppliers into their structure and by such mean at least partially control them.

**Bargaining power in the development of relations with the state for state orders.** When merged into large economic entities, companies become more attractive partners not only to other companies, but also to public authorities in its economic policy. Often the governance structures initiate and /or promote such integration with the hope that such an integrated structure will help to achieve the objectives of the state for the country's economy. This factor has much more significance in emerging markets (Thacker, 2006; Claessens, 2008, pp. 554–580; Cooper *et al*., 2010, pp. 687–724). However, it was also the second most important factor in Lithuania (Morkunas, 2017), measuring the impact of large diversified business groups on self-formation.

**Bargaining power in the development of relations with the state for more favorable legislation** (Guriev & Rachinsky, 2005, pp. 131–150). Indirect impact on inter-enterprise integration makes public institution's policy, when influential politicians tend not to interact with many, but only with some of the strongest / most influential businessmen. The result of these heads of state's actions, is the desire of companies to have direct contact with the decisive for determining state's policy politicians, which results in merging into large economic entities in order to gain more power and access to decision-makers, which is converted into even greater economic benefits and market power.

## Research methodology

For research purposes the authors developed an original research instrument that was offered to experts in the field: representatives of the academic environment (professors with the background or research interest in finance, economics, management and / or business administration) and repre-

sentatives of business environment (top-executives of national business units of large diversified business groups).

For the purpose of getting reliable research results the following requirements were set for the experts: 1) to have work experience in a company which is a part of a bigger business group; or to have research experience in business integration; 2) to have at least a Master's degree in one of the following study areas: finance, economics, management and / or business administration. In order to conduct the survey, the group of experts was selected based on non-probability sample. There were eight experts in the group. The information about the experts' background and expertise is summarized in the Annex (Tables A1–A6).

Selected factors (see Table 1) were inserted into the evaluation matrix, combined in pairs.

According to AHP method experts compare alternatives with each other by filling pairwise comparison matrices (formula (1)):

$$\mathrm{A} = (a_{ij})_{n \times n}, \tag{1}$$

where: $a_{ij} = \frac{\omega_i}{\omega_j}, \forall\, i, j = 1, 2, \ldots, n,$

$\omega_n\ (n = 1, 2, \ldots n) -$ priority vector,

$a_{ij} = \frac{1}{a_{ji}}, \forall\, i, j = 1, 2, \ldots, n.$

For completing individual comparison matrices experts were suggested to use nine-point scale, where "1" means that factors are equally important and "9" means that one factor is extremely important over another. Every expert had to evaluate $(n(n-1)\,/\,2)$ pairs ($n$ – number of alternatives). For the purpose of data processing balanced scale (Salo, Hämäläinen, 1997, pp. 309–319) and inverse linear scale (Ma & Zheng, 1991, pp. 197–202) were used. Characteristics of the scales are presented in Table 2.

Scales, which characteristics are presented in Table 2, were chosen as they provide higher consistency level of the pairwise comparison matrices (Franek & Kresta, 2014, pp. 164–173; Goepel, 2013, pp. 1–10).

After experts complete a pairwise comparison of the factors, all the assessments have to be written in standardised matrix form and arithmetic mean of each line is calculated. In this way, the main factor is identified. However, if the level of inconsistency is higher than the set limit, the matrix has to be modified into a consistent one, or should be eliminated from the further calculations as consistency of the matrices shows whether ex-

perts' factors evaluations were logical and reliable. A pairwise comparison matrix is considered as consistent if $a_{ik} = a_{ij}a_{jk}, \forall\, i,j,k$. In other words, there is such priority vector $w = (\omega_1, \ldots, \omega_n)$ that $a_{ij} = {}^{\omega_i}/_{\omega_j}, \forall\, i,j$.

In order to determine the consistency index, eigenvalue $\lambda_{max}$ of pairwise comparison matrix ought to be calculated (formula (2)).

$$\lambda_{max} = \sum_{j=1}^{n} \frac{(A \cdot v)_j}{n \cdot v_j}, \tag{2}$$

where:
$\lambda_{max}$ is the largest eigenvalue of matrix A,
$n$ means number of independent rows in the matrix,
$v_j$ is eigenvalue of the matrix.

If experts' pairwise comparison matrix A is consistent, then $\lambda_{max} = n$. If there are minor $a_{ij}$ changes and matrix A does not satisfy the consistency condition, then the $\lambda_{max}$ value is close to *n*. After the value of $\lambda_{max}$ is computed, consistency ratio *CR* could be calculated (see (3)) (Zhang *et al*., 2017, pp. 1–13).

$$CR = \frac{(\lambda_{max} - n)/(n-1)}{RI}, \tag{3}$$

where:
CR is consistency ratio,
RI is random index.

The values of consistency ratio depend on matrix order *m.* They are presented in Table 3.

For experts' pairwise comparison matrices that fulfil the consistency condition (CR < 0,2), the aggregated experts' assessment is calculated. Aggregated experts' assessment $a_{ij}^{A}$ is calculated using geometric mean.

The consistency ratio calculation procedure is repeated for the resulting matrix, and if the aggregated matrix is consistent, priorities are computed using the normalized geometric mean method (see ,  ) (Franek & Kresta, 2014, pp. 164–173).

$$\omega_j = \frac{\sqrt[i]{\prod_{j=1}^{i} a_{ij}^{A}}}{\sum_{j=1}^{i} \sqrt[i]{\prod_{j=1}^{i} a_{ij}^{A}}}, \quad (4)$$

where:
$\omega_j$ is weight of $j$ alternative.

Besides, consensus index introduced by Goepel (2013 pp. 1-10) was calculated (Formula 5).

$$S^* = \frac{{}^{1}/_{exp(H_\beta)} - {}^{exp(H_{\alpha min})}/_{exp(H_{\gamma max})}}{1 - {}^{exp(H_{\alpha min})}/_{exp(H_{\gamma max})}}, \quad (5)$$

where:
$S^*$ is consensus index,
$H_\alpha$ is Shannon alpha diversity,
$H_\beta$ is Shannon beta diversity,
$H_\gamma$ is Shannon gamma diversity.

AHP consensus index compares experts' numerical estimations of criteria. The results vary from 0 to 100 percent, and show the level of agreement between the experts.

## Research results

Experts' individual comparison matrices are presented in the Appendix. Analysing experts' individual comparison matrices it was found that the matrix constructed by expert Nr. 5 appeared to be inconsistent; hence, it was eliminated from further analysis. The results of the factors' assessments are presented in the Table 4.

Testing for consistency yielded values of the consistency ratio (CR), lambda (λ) and consensus index (S*), which are summarized in the Table 5.

The consistency ratio and lambda meet the stated requirements; consequently, experts' aggregated assessments could be used for obtaining general results.

Based on the results provided in Table 4, the highest rank was assigned to the ability to more efficiently allocate resources. In fact, this factor's weight is more significant than the other factors' weights, and exceeds 28 percent limit according to balanced and inverse linear scales. This, in turn, corresponds to the statements of the common theory on large business enti-

ties for developed markets, which states that the possibility to more efficiently allocate resources within business group is the main reason for formation of business groups or other large diversified economic structures. It is also an evidence of maturity of the Baltic market.

The experts ranked big market entry barriers at the second position. The weight of the factor is 0.146 according to balanced scale, and 0.152 according to inverse linear scale. Such a high ranking of this factor points to the globalization effect onto small open markets, such as the Baltic States market. In recent years, a range of big international companies entered the Baltic States, such as LIDL, Telia, E.ON, Nordea. In order to respond to the competitive pressure, small local firms choose cooperation or even a deeper integration.

Bargaining power in the development of relations with the state for more favourable legislation was ranked at the third position by the experts. Hence, high ranking of this factor when determining the formation of large autopoietic economic entities in the Baltic countries, shows a clear contradiction to a factor that was positioned at the first place. The reason is that in mature developed markets there are almost no possibilities to affect politicians in order to get a more favourable legislation, which is being converted to economic benefits at the expense of other market players. Therefore, the results indicated some weaknesses in market regulation institutes, especially those which ensure equal rights to all market players, or lack of transparency of State's decision markets. The positive fact is that the Baltic countries are admitted to OSCE, which pays high attention to those issues, hence it can be expected that in the future those market deficiencies will be removed and a bargaining power in the development of relations with the state for more favourable legislation will become less important in motivating companies to merge into business groups.

Experts ranked the necessity of adaptation to weak market regulatory institutions by reducing transaction costs at the fourth position. In developed markets, this factor should not be so important. However, some business groups in the Baltic States were formed in 1990s or at the beginning of the 2000s. At that time, market regulation was relatively weak. Consequently, the necessity to adapt to weak market regulatory institutions is important when analysing the motives of formation of large integrated diversified business structures in the Baltics.

The risks related to production specialization are the factor which was ranked at the fifth position. Such a low position can be explained by the fact that the Baltic States' economies are dominated by the service sector, so there are very few large scale mass production companies which would require some specific parts for their production.

Based on the experts' evaluation, bargaining power in the development of relations with the state for state orders was at the last place. The weight of this factor is 0.129 according to balanced scale, and 0.136 according to inverse linear scale.

## Conclusions

The current paper reflects the results of the authors' conducted survey on investigation of the factors influencing the formation of large diversified economic systems in the Baltic States.

The economies of the Baltic States and mesoeconomic structures in their economies can be considered as autopoietic systems, as they meet all criteria mentioned in the theory: 1) all Baltic States economies can create their own inner system elements: new firms or business groups can emerge, new self-regulation mechanisms of a market can evolve (confederations, associations and etc.), 2) systems' architecture is determined by their own market players, some independent firms can be merged, some business groups can change their own organizational structure, 3) mesoeconomical entities in the Baltic States can be considered as self-sufficient, since they have the ability to maintain their short-term capability using own resources. Baltic economies as a whole also meet self-sufficiency requirement. For a short period of time, they can operate using their highly developed inner markets of labour, production and financial capital.

The results of the experts' survey allowed for identifying the most important factor influencing the formation of meso-economic entities in the Baltic States — the ability to more efficiently allocate resources within the business group. In the pilot study this factor was also highly ranked — it took the third place. Thus, the research hypothesis is partially rejected, since the factor regarding market entry barriers was evaluated as the second most important by the experts.

The ranking of other factors, mainly, corresponds to the theory and the results of the previously conducted pilot study in Lithuania. The only contradiction with the previous results is related to the last positioned factor "bargaining power in the development of relations with the state for state orders". In the pilot study, conducted only in Lithuania, this factor was placed at a much higher place than the "bargaining power in the development of relations with the state for more favourable legislation". It can be explained by the fact that in this survey the participants from all three Baltic countries, and as the Estonian market is considered more mature, transparent and developed than the Lithuanian one, so there are almost no possi-

bilities for companies in Estonia to achieve its' economic goals of winning government contracts by infringing other market players. This finding also offers a new ground for researches aimed at finding differences in the factors influencing the formation of large autopoietic economic structures in the Estonian and Lithuanian markets.

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## Annex

**Table 1.** Labels of factors

| No. | Factor | Factor's label |
|---|---|---|
| F1 | Big market entry barriers | Entry barriers |
| F2 | Risks related to production specialization | Risks |
| F3 | The ability to more efficiently allocate resources | Resource allocation |
| F4 | The necessity of adaptation to weak market regulatory institutions by reducing transaction costs | Cost reduction |
| F5 | Bargaining power in the development of relations with the state for state orders | Bargaining power I |
| F6 | Bargaining power in the development of relations with the state for more favourable legislation | Bargaining power II |

**Table 2.** AHP scales used in the survey

| Type of scale | Mathematical expression | Parameters | Approximate scale values |
|---|---|---|---|
| Inverse linear | $s = \frac{9}{10-x}$ | $x = \{1, 2, \dots, 9\}$ | 1; 1.13; 1.29; 1.5; 1.8; 2.25; 3; 4; 5; 9 |
| Balanced | $s = \frac{w}{1-w}$ | $w = \{0{,}5; 0{,}55; 0{,}6; \dots; 9\}$ | 1; 1.22; 1.5; 1.86; 2.33; 3; 4; 5.67; 9 |

Source: Franek and Kresta (2014, pp. 164–173), Ishizaka and Labib (2011).

**Table 3.** Values of Random Index (*RI*)

| *n* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *RI* | 0 | 0 | 0,58 | 0,9 | 1,12 | 1,24 | 1,32 | 1,41 | 1,45 | 1,49 |

Source: Van Laarhoven and Pedrycz (1983, pp. 229–241).

**Table 4.** Factors' assessment

| | Normalized eigenvector, $w_j$ | | Rank | |
|---|---|---|---|---|
| | **Balanced** | **Inverse Linear** | **Balanced** | **Inverse Linear** |
| F1 | 0.146 | 0.152 | 2 | 2 |
| F2 | 0.135 | 0.139 | 5 | 5 |
| F3 | 0.307 | 0.282 | 1 | 1 |
| F4 | 0.137 | 0.142 | 4 | 4 |
| F5 | 0.129 | 0.136 | 6 | 6 |
| F6 | 0.145 | 0.149 | 3 | 3 |

**Table 5.** Consistency test results

| Ratios | Balanced scale | Inverse linear scale |
|---|---|---|
| λ | 6.093 | 6.054 |
| CR | 0.015 | 0.009 |
| S* | 77.1% | 81.5% |

**Table A1.** Information about the experts

| No. | Education | Interest to business integration/experience within large business group | Current position |
|---|---|---|---|
| Exp1 | MBA; Master degree (Education Management) | 18 years | Regional manager for the Baltics |
| Exp2 | Doctor of economics | 10 years | Training and quality manager |
| Exp3 | Master degree (Business Analysis and Finance) | Since 2004 | Finance manager |
| Exp4 | Doctor of economics | 10 years | CEO; Assistant Professor |
| Exp5 | Doctor of economics | 5 years | Assistant Professor |
| Exp6 | Master degree | Over 10 years | Head of Sales and Purchasing |
| Exp7 | Master degree (Economics) | 5 years | Director of the Department of Personnel Management |
| Exp8 | Doctor of economics | 20 years | Professor |

**Table A2.** Expert 1 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 0,667 | 0,667 | 0,444 | 0,444 | 0,889 |
| F2 | 1,500 | 1,000 | 1,500 | 1,500 | 0,778 | 1,000 |
| F3 | 1,500 | 0,667 | 1,000 | 2,250 | 1,000 | 1,000 |
| F4 | 2,250 | 0,667 | 0,444 | 1,000 | 1,500 | 1,000 |
| F5 | 2,250 | 1,286 | 1,000 | 0,667 | 1,000 | 1,800 |
| F6 | 1,125 | 1,000 | 1,000 | 1,000 | 0,556 | 1,000 |

**Table A3.** Expert 2 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 3,000 | 0,111 | 1,800 | 1,800 | 1,000 |
| F2 | 0,333 | 1,000 | 0,111 | 1,000 | 1,000 | 1,125 |
| F3 | 9,000 | 9,000 | 1,000 | 9,000 | 9,000 | 9,000 |
| F4 | 0,556 | 1,000 | 0,111 | 1,000 | 1,000 | 1,000 |
| F5 | 0,556 | 1,000 | 0,111 | 1,000 | 1,000 | 0,889 |
| F6 | 1,000 | 0,889 | 0,111 | 1,000 | 1,125 | 1,000 |

**Table A4.** Expert 3 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 1,000 | 0,556 | 1,286 | 0,556 | 1,125 |
| F2 | 1,000 | 1,000 | 0,444 | 1,000 | 0,889 | 1,125 |
| F3 | 1,800 | 2,250 | 1,000 | 4,500 | 3,000 | 3,000 |
| F4 | 0,778 | 1,000 | 0,222 | 1,000 | 1,286 | 1,125 |
| F5 | 1,800 | 1,125 | 0,333 | 0,778 | 1,000 | 3,000 |
| F6 | 0,889 | 0,889 | 0,333 | 0,889 | 0,333 | 1,000 |

**Table A5.** Expert 4 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 9,000 | 1,800 | 1,800 | 1,500 | 3,000 |
| F2 | 0,111 | 1,000 | 0,556 | 0,556 | 1,000 | 0,889 |
| F3 | 0,556 | 1,800 | 1,000 | 1,800 | 3,000 | 1,000 |
| F4 | 0,556 | 1,800 | 0,556 | 1,000 | 1,286 | 1,286 |
| F5 | 0,667 | 1,000 | 0,333 | 0,778 | 1,000 | 1,000 |
| F6 | 0,333 | 1,125 | 1,000 | 0,778 | 1,000 | 1,000 |

**Table A6.** Expert 5 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 3,000 | 2,250 | 1,000 | 1,500 | 4,500 |
| F2 | 0,333 | 1,000 | 4,500 | 1,500 | 2,250 | 1,000 |
| F3 | 0,444 | 0,222 | 1,000 | 1,800 | 1,800 | 3,000 |
| F4 | 1,000 | 0,667 | 0,556 | 1,000 | 0,333 | 0,333 |
| F5 | 0,667 | 0,444 | 0,556 | 3,000 | 1,000 | 0,111 |
| F6 | 0,222 | 1,000 | 0,333 | 3,000 | 9,000 | 1,000 |

**Table A7.** Expert 6 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 0,556 | 0,556 | 0,444 | 1,800 | 0,556 |
| F2 | 1,800 | 1,000 | 0,556 | 0,556 | 1,800 | 0,556 |
| F3 | 1,800 | 1,800 | 1,000 | 1,800 | 0,444 | 0,556 |
| F4 | 2,250 | 1,800 | 0,556 | 1,000 | 2,250 | 0,556 |
| F5 | 0,556 | 0,556 | 2,250 | 0,444 | 1,000 | 0,889 |
| F6 | 1,800 | 1,800 | 1,800 | 1,800 | 1,125 | 1,000 |

**Table A8.** Expert 7 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 0,778 | 0,333 | 1,800 | 0,556 | 1,000 |
| F2 | 1,286 | 1,000 | 0,556 | 0,889 | 0,556 | 1,000 |
| F3 | 3,000 | 1,800 | 1,000 | 1,800 | 0,556 | 1,000 |
| F4 | 0,556 | 1,125 | 0,556 | 1,000 | 1,000 | 1,000 |
| F5 | 1,800 | 1,800 | 1,800 | 1,000 | 1,000 | 0,778 |
| F6 | 1,000 | 1,000 | 1,000 | 1,000 | 1,286 | 1,000 |

**Table A9.** Expert 8 individual comparison matrix

| | F1 | F2 | F3 | F4 | F5 | F6 |
|---|---|---|---|---|---|---|
| F1 | 1,000 | 0,556 | 1,286 | 0,333 | 1,800 | 1,500 |
| F2 | 1,800 | 1,000 | 0,556 | 2,250 | 3,000 | 1,800 |
| F3 | 0,778 | 1,800 | 1,000 | 2,250 | 3,000 | 1,800 |
| F4 | 3,000 | 0,444 | 0,444 | 1,000 | 1,286 | 0,333 |
| F5 | 0,556 | 0,333 | 0,333 | 0,778 | 1,000 | 0,333 |
| F6 | 0,667 | 0,556 | 0,556 | 3,000 | 3,000 | 1,000 |