

Summary of a research and analytical report

**Monitoring and evaluation system**

for the Regional Innovation Strategy for Mazovia

Report developed by PSDB Sp. z o.o.

as a part of systemic project No POKL.08.02.02-14-001/09entitled:

“Development of a monitoring system and the basis for evaluating implementation of

the Regional Innovation Strategy for Mazovia”

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Concept and course of research

The Mazowieckie Voivodeship is the leader in economic activity among all Polish regions. It also has considerable potential for development. Mazovia generates 1/5 of the Gross Domestic Product. GDP *per capita* in this region amounts to more than 150% of the national average. The Mazovia region also has the largest concentration of business entities, high scientific and educational potential as well as level of innovation. However, this innovation level **is not measured systematically**. Moreover, there is no comprehensive methodology for diagnostic and monitoring research which would enable diagnosis of the efficiency of measures taken in this regard by the local government of the Mazowieckie Voivodeship. Therefore, the purpose of the research was to:

develop theoretical basis of the monitoring and evaluation system for implementation of the Regional Innovation Strategy for Mazovia.

As a consequence of the order, the **concept** and **assumptions** for the **monitoring and evaluation system** were developed, aimed at monitoring the implementation of the Regional Innovation Strategy for Mazovia (RIS). The concept and assumptions specified, among others, the manner of data collection, methods of data processing as well as the manner of using information obtained as a result of processing the collected data.

To achieve this objective, it was necessary to carry out the research **at many levels**. Such an approach resulted in an efficient and effective monitoring and evaluation system for implementation of the Regional Innovation Strategy for Mazovia. Naturally, the research procedure included widespread literature study concerning the functioning of systems as well as the issue of non-material resources (knowledge in the form of indicators and methods of obtaining, analysing and presenting these indices), which constitute the **key system contribution**.

Challenges for innovation policy and monitoring system

The primary purpose of innovation policy is to **improve competitiveness of regional economy**. Innovation policy should lead mainly to higher competitiveness of the economy and enterprises. Therefore, the **effects of innovation policy** should be measured using not only the level and quality of enterprise innovation, as it is the case in the majority of research projects, but first and foremost **through competitive performance**.

The issue of key importance for the monitoring system is the necessity to **determine the effects of innovation on development**. The preliminary assumption in research on innovation is that **it has significant impact on development**. This is why measurement of this impact is frequently omitted. Instead, it is assumed in advance that effects such as increased number of innovative businesses, patents, technology transfer infrastructure development, etc. result in increased competitiveness of a given region.

In general, research shows that **the relationship between the level of economic development and the level of innovation is significant and that it takes the form of positive feedback**. Other research demonstrates precisely which components of innovation have stronger or weaker correlation with GDP *per capita.* One example of strong correlation occurs between R&D expenditure and innovative activity, employment in R&D, protection of intellectual property as well as Internet use and GDP *per capita*.

However, the analysis does not really answer the question of what came first — whether increased expenditure on innovation and R&D resulted in higher GDP *per capita* or the other way round — **after achieving a certain level of wealth, regions start to invest in “innovation”**. Research practice shows that the latter is more likely the case. Literature mentions a **“vicious circle”** that poorly developed regions are caught up in. Due to low level of economic development, they allocate fewer funds for research, innovation implementation and human capital development and hence their rate of economic growth is lower. Low growth rate results in lower investment resources — and so on. Thus, high values of innovation indices are the consequence of other measures which have led to the region’s increased prosperity. Although they demonstrate a certain level of regional innovation, **they are not suitable (as a whole approach) for assessing innovation policy** — they fail to measure the influence of individual actions under innovation policy on growth of regional wealth. So far, there is no single perfect tool which would **provide all necessary information** on diverse aspects of the functioning of innovation policy, in particular with respect to regional innovation systems.

Model monitoring system

Monitoring systems must be not only reliable and efficient, but also credible and useful. They also need to ensure data security and transparency of actions. All features of a model monitoring system and the criteria which must be fulfilled by it have been shown on the diagram below:



Diagram 1. Features of a model monitoring system.

Source: Own study.

The existent RIS monitoring system in the Mazowieckie Voivodeship

The current condition of structures involved in managing the regional innovation system development has certain **advantages**. The **Mazovia Council of Innovation** is responsible for **planning, organisation, motivation** and **supervision**, while the functions of **RIS Mazovia Managing Authority** at the Department of Strategy and Regional Development of the Office of the Marshal of the Mazowieckie Voivodeship in Warsaw include **organisation, motivation** and **supervision.**

Taking into account the funding sources of the structures in question, it should be stated that actions of the structure managing the regional innovation system development, involved in **planning processes** (developing the strategy), i.e. the **Steering Committee** responsible for the project and preparing the RIS, were financed from the grant project funds. Its donor was the European Commission, acting within the Sixth Framework Programme. Continuation of the Steering Committee, i.e. the **Mazovia Council of Innovation,** was founded at 14. September 2010 and is financed from the project „Development of a monitoring system and the basis for evaluating implementation of the Regional Innovation Strategy for Mazovia”.

Assessment of RIS Mazovia monitoring system

Before presenting a proposal to be used in the systemic project, it is recommended to assess the existent system in RIS Mazovia in order to find out about its drawbacks, which could be minimised by good practices.

The current monitoring system **obtained slightly more than a half of available points** when assessed in accordance with the adopted criteria. This is why several of its aspects need improvements. First of all, good practices should be sought in the areas of recommendation implementation, automatic data collection for indicators, improvements in institution functioning, communication system between institutions, including communication strategies and actions for different addressees, as well as estimating the effects of policy measures.

Good practices for the Mazowieckie Voivodeship within the scope of diagnostic research and innovation status monitoring

Recommendation implementation mechanism (European programmes)

The mechanism for implementing recommendations has been chosen as an example of good practices for a very specific purpose — to liquidate one of the drawbacks of the existent RIS monitoring system for the Mazowieckie Voivodeship.

The **problem** solved by this good practice is the fact that recommendations are frequently not implemented, whereas research is conducted for the sake of research itself or as a part of a procedure. Institutions, on the other hand, perceive recommendations not as opportunities for development, but as the “necessary evil”.

The **purpose** of introducing this good practice is the necessity to monitor implementation of research recommendations.

This solution **improves** the usefulness of monitoring and evaluation research through increased utility and use of research recommendations.

**Introduction** of this good practice requires organisation of seminars during which research results and recommendations will be presented and discussed, publication of reports on websites, publication of reports in paper version and their submission to institutions involved in strategy implementation, development of “recommendation implementation tables” which will list recommendations the institution intends to implement, as well as a description of tasks to be performed along with a schedule, monitoring actions associated with their implementation, holding institutions accountable for recommendation implementation and justifying rejection of recommendations.

The only **resource** necessary to introduce this good practice is adoption of adequate procedures enabling implementation of the mechanisms.

The **condition for successful implementation** of this good practice is involvement of the monitoring department in implementation of the recommendation, monitoring the work and procedures by the superiors (voivodeship management), and externally — other institutions being willing to implement the recommendations and to participate in research.

Introduction of this good practice will **result** in a higher number of recommendations adapted to the needs of institutions and a higher number of implemented recommendations. The system, on the other hand, will include precise information on the number of implemented, partially implemented and rejected recommendations.

Since procedures can be developed, changed and implemented as a part of professional duties of the employees at the Office of the Marshal of the Mazowieckie Voivodeship, no additional **implementation costs** are expected for this good practice.

Three-level innovation policy analysis tool (EIS)

The tool for three-level analysis of innovation policy (EIS) has been chosen as an example of good practice for a very specific purpose — to liquidate one of the drawbacks of the existent RIS monitoring system for the Mazowieckie Voivodeship.

The **problem** tackled by this good practice is lack of association between the objectives and actions and indicators describing them. Associating actions and indicators with detailed (mid-term) objectives is intuitive and spontaneous. It does not follow from logical analysis.

The **purpose** of introducing this good practice is to improvethe effectiveness of innovation policy and define the three-level logic of innovation policy management.

This solution **improves** the effectiveness of innovation policy through good description of intervention rate at three levels.

To **implement** this good practice, it is necessary to analyse the complexity of policy objectives by assigning them to one of innovation policy types, divide main objectives into detailed objectives and subsequently into actions and assign them to each indicator level.

The **resources** necessary to introduce this good practice include expert knowledge regarding innovation policy objectives and indicators as well as belonging to the appropriate policy type and the ability to perform a cause-and-effect analysis and strategic thinking.

The **condition for successful implementation** of this good practice is correct assignment of the policy and indicators to individual groups.

The **result** of this good practice will be specifying gaps in the innovation policy (missing objectives) as well as demonstrating the logic of intervention and relationships between actions and achieved objectives.

The **costs of implementing** this good practice are associated with the necessity to analyse innovation policy. Therefore, they should be reduced to PLN 10 thousand (the analysis should be outsourced as an expert opinion, without field studies).

IASMINE | Impact assessment system and innovation improvement methodology

Implementation of this good practice can also take advantage of innovation policy self-evaluation methodology, developed by EEDRI, which partially utilises IASMINE methodology.

The **problem** addressed by this good practice is diversified effectiveness and efficiency of actions under innovation policy. They may prove ineffective in certain regions and circumstances. So far, actions under innovation policy have not been measured and their effects were frequently assessed intuitively.

The **purpose** of introducing this good practice is ensuring that decision makers and evaluators have comprehensible knowledge regarding the context in which the policy and variables describing their effect on the region are created — and hence better decision-making and understanding of innovation processes in the region, as well as ensuring common language with the regional stakeholders (RIS actors).

This solution **improves** the effectiveness and efficiency of regional policy interventions and individual actions.

There are seven steps necessary to **introduce** this good practice:

Step 1. Identify / select regional policies for research

Step 2. Build RIS Matrix

Step 3. Collect “hard” indicators

Step 4. Collect “soft” indicators

Step 5. Analyse data and research reports

Step 6. Interpret the analysis results

Step 7. Divide and assign values to impact assessment results

**Resources** required to introduce this good practice include a report characterising regional policy (utilising generally available data and involvement of regional politicians), as well as *ex-ante* evaluation (in-depth analysis of specific policy actions, involvement of regional politicians / managers) and on-going or *ex-post* evaluation (obtaining data related with indicators from different sources: institutions implementing projects, statistical offices, directly from actors: universities, research centres, etc., for instance through questionnaires, data collection (in particular through field research) makes up for the majority of evaluation costs; this is why it should be integrated with ordinary project control procedures).

The **condition for successful implementation** of this good practice is correctanalysis (e.g. qualification of actions under policy fields) and preparing appropriate, accurate indicators for innovation policy measures and assessment of the level of regional innovation.

Introduction of this good practice will **result** in identification of advantages and disadvantages of regional policy projects in the context of expected influence on different indicators describing innovative functioning of regional actors, increased control over internal mechanisms determining global trends at regional innovation level, identification of good practices in development and implementation of policies through comparisons with other regions which have similar policy objectives, improved possibilities for assessing impact of specific policy actions through identification of fields of improvement of regional monitoring procedures (such as data collection, evaluation, audit, etc.).

**Costs of implementation** of this good practice include:the cost of preparing research and preliminary analysis of documents (PLN 10 thousand), cost of research on a sample of 1,000 businesses (PLN 20 thousand), cost of analysis and elaboration of results (approx. PLN 20 thousand or free of charge if the task is performed by the employees of the Office of the Marshal of the Mazowieckie Voivodeship). While preparatory activities constitute unit costs, the costs of field research and elaboration of results must be repeated annually for five years. Therefore, the total cost of research is PLN 210 thousand.

DPSIR | Driving Force – Pressure – State – Impact – Response (Opolskie Voivodeship)

DPSIR model is an extremely selective methodology of preparing indicators for the monitoring system. However, it includes an interesting manner of combining indicators and looking for cause-effect relations between them. In this regard, the experience of Opolskie Voivodeship could be used by RIS Mazovia.

The **problem** solved by this good practice is the fact that authorities and other innovation system entities do not know what makes them more innovative or that effects of innovation measures are more beneficial for the company or the economy. The effectiveness and efficiency of actions under innovation policy are diversified. They may prove ineffective in certain regions and circumstances. So far, the actions under innovation policy have not been measured and their effects were frequently assessed intuitively.

The **purpose** of introducing this good practice is to evaluatethe effectiveness of innovation policy. It provides the possibility to identify an entire cause-and-effect chain with respect to functioning of mechanisms creating innovations in businesses and enabling optimal use of their effects.

This solution **improves** the effectiveness of innovation policy and actions of innovation system entities.

The DPSIR model **is based on linear cause-and-effect correlation** between individual components of the cause-and-effect chain (driving factors, pressure, condition, influence, remedies). Moreover, it takes into account the possibility of feedback aimed at every link of the chain.

The model creates and orders separated indicators while retaining the selection criteria and principles of categorising the DPSIR model. It is recommended that the constructed set of indicators be additionally cross-analysed in order to identify key indicators and material correlations between them, in particular cause-and-effect correlations.

The **resources** necessary to introduce this good practice include expert knowledge regarding indicators and belonging to the appropriate group of indicators, the ability to perform a cause-and-effect analysis supported by the ability to conduct statistical analyses.

The **condition for successful implementation** of this good practice is correct assignment of the indicators to individual groups: driving factors, pressure, condition, influence and remedies.

The **result** of introducing this good practice will be detailed analysis of correlations (e.g. the structure of resources and specific functioning of businesses and innovations by quantity and value as well as the scope of innovations and hitherto implemented innovations and overall results of business activity) which may provide the basis for identification of sources of innovations and real effects.

Another effect is application of the integrated approach in analysis of results and clear formulation of conclusions and recommendations adjusted to the specific character of individual groups of addressees: local government authorities, business environment institutions, SMEs, unions, etc. It is also possible to indicate factors characterised by the relatively highest driving effect in the scope of developing and using innovations in the Mazowieckie Voivodeship (the great majority of indicators were based on primary data, i.e. data collected *ad hoc* on the basis of empirical research conducted among businesses; the use of secondary sources in the form of statistical data is minimal, which shows that collection of information useful for assessing innovation policy is systematically neglected).

**The costs of implementation** of this good practice are associated withthe costs of preparing research and preliminary analysis of documents (PLN 10 thousand), costs of research on a sample of 1,000 businesses (PLN 20 thousand), costs of analysis and elaboration of results (approx. PLN 20 thousand or free if the task is performed by the employees of the Office of the Marshal of the Mazowieckie Voivodeship).

KOSTRA Internet database (Norway)

The **need to ensure system transparency**, indicated in the analysis of the current RIS Mazovia monitoring system, in particular the need to ensure its usefulness and range, can be satisfied by an IT system. A good practice in this scope, valued by the OECD, can be found in Norway.

The **problem** tackled by this good practice is the fact that local governments have no information on pro-innovation services they provide; they do not know their efficiency, range, quality or the actual needs of users.

The **purpose** of introducing this good practice is to improvethe efficiency, effectiveness and usefulness of pro-innovation services.

This solution **facilitates** the use of indicators by different users and improves the availability of indicators as well as the usefulness of resources collected in the system. This, in turn, enables users to compare themselves to one another.

To **introduce** this good practice, it is necessary to develop an electronic system for local governments, including input and output indicators regarding local pro-innovation services and their funding.

The **resources** necessary to introduce this good practice include an IT system on the server of the Office of the Marshal of the Mazowieckie Voivodeship in Warsaw, access to local government accounts, statistical indicators and research on entities using pro-innovation services (on-line).

The **conditions for successful implementation** of this good practice are twofold. Research on entities using pro-innovation services must be obligatory — stipulated, for example, in the agreement on provision of services. Provision of services must be conditioned by filling in a survey after completing the service and e.g. six months after its completion. On the other hand — it is necessary to select the company to implement this system; a company with potential and experience in this scope, since it must ensure security of information sent via the Internet, as well as scalability of the system (the ability for the system to be used by an infinite number of users at the same time).

The **result** of implementation of this good practice will be the fact that local governments, the media, scientists as well as entrepreneurs will have easy online access to information (indicators) about provided services, their range, user needs, quality and cost-efficiency of these services. Local governments can also easily compare themselves to other local governments, develop rankings of provided services, promote themselves in this manner, as well as learn from one another by improving the quality, availability and efficiency of their services (using the experience of other local governments).

The **costs of implementation** of this good practice are associated with the cost of IT system (approx. PLN 350 thousand). However, this system can be integrated with the system described in the following recommendation.

IT system for economic change management (SI RSZZG)

This recommendation is based on the IT system for economic change management (SI RSZZG). The IT system improves the effectiveness of monitoring system results (it enables proper management of knowledge collected in documents and monitoring reports). It also ensures higher participation of users in research and report development as well as in meeting the addressees’ expectations (every user can prepare reports adapted to their needs). Moreover, the IT system will improve the range and scalability of the system by automatically using indicators from the websites of the Central Statistical Office and other institutions.

The **problem** resolved by this good practice is the fact that regions have at their disposal more and more different studies, reports and analyses concerning their economy. Few people have the opportunity and, most of all, time to read them — not to mention their analysis and use in current operations. On the other hand, local governments have impeded access to financial resources for annual collection of information from primary sources.

The **objective** of introducing this good practice is to develop an appropriate tool for data collection, knowledge management and to facilitate the use of knowledge resources.

The solution **improves** collection of knowledge (indicators and research reports), facilities using indicators and knowledge by users as well as intuitive and intelligent management of collected knowledge. It also improves the availability of indicators and knowledge, as well as the usefulness of resources collected in the system. It enables users to compare themselves with one another, browse reports and documents according to indices assigned to text fragments (not to entire documents) and to prepare different reports, including graphic reports, etc.

To **introduce** this good practice, it is necessary to develop an IT system in the form of a three-layer application ensuring high efficiency (given large amounts of data and the number of users) and scalability of the system through scaling each layer with equipment. Other significant requirements concern scalability of data feeding process, in particular loading, division and indexation of files with reports and studies.

The **resources** necessary to introduce this good practice include an IT system on the server of the Office of the Marshal of the Mazowieckie Voivodeship in Warsaw, as well as system users utilising the resources and, at the same time, supplementing the data in the system.

The **condition for successful implementation** of this good practice is users finding the received products interesting enough for them to be willing to provide data about on-line indicators on a cyclical basis. On the other hand, it is necessary to select the company to implement this system; a company with potential and experience in this scope, since it must ensure security of information sent via the Internet, as well as scalability of the system (the ability for the system to be used by an infinite number of users at the same time).

Introduction of this good practice will **result** in collection and analysis regarding innovation and presentation of results in the form of individualised thematic and indicator reports (the possibility of comparison over time and against other users). The system will also ensure communication between stakeholders in the form of an information exchange platform, i.e. an Internet service based on the Content Management System, used for publication of current economic information and information on the monitoring system, including conducted research, organised events and developed innovations, etc.

The IT system itself **can be developed for approx. PLN 350 thousand**. Additionally, approx. PLN 200 thousand is required for system service and filling it with information (report indexation, convincing different entities to use it, etc.). It may also prove necessary to conduct training in the scope of system usage: approx. PLN 100 thousand.

Summary of proposals to be used in the systemic project “Development of a monitoring system and the basis for evaluating implementation of the Regional Innovation Strategy for Mazovia”

Preliminary analysis of documents allowed for preparation of a number of recommendations which can be applied in the monitoring system for the Regional Innovation Strategy for Mazovia:

* an effective monitoring system is a system which fulfils its objectives in an organised manner. All tasks should be **precisely divided among teams and employees** so that each of them is responsible for a given process and at the same time — the tasks do not overlap. It is also crucial to distribute work evenly to prevent teams from being overworked and posts or resources from remaining unused;
* tasks performed by persons involved in RIS monitoring are extensive and responsible (among others, these persons must be well-acquainted with current innovation measurement trends and benchmark of regions). This is why it is necessary to **hire highly qualified employees** and to maintain them at the working place as well as to develop their competences using new trends emerging domestically and abroad;
* an effective monitoring system shows not only innovation research results from the entire region, but primarily **the effectiveness of individual tools of innovation policy** carried out by the region;
* supplying the monitoring system must be related with **indicators specifying the competitiveness** of the region (it cannot focus on the effects in the form of increased effectiveness — it must also investigate how innovation translates into the region’s competitiveness);
* monitoring cannot be carried out solely for the sake of monitoring itself and presenting results in the form of reports. The results must be **analysed by decision makers** and **serve the purpose of decision-making** at the regional level regarding the entire regional policy (e.g. in the context of strategic areas of development or synergy between industries);
* RIS monitoring should rely on **solid information basis**, credible data sources and continuity of data obtained in subsequent periods;
* it is also extremely important to develop **mechanisms of cooperation with institutions** collecting data and innovation indices (primarily the Central Statistical Office, but also others) — preferably automatically;
* cooperation with different partners in the process of obtaining and using data from monitoring is key for translating the obtained RIS implementation results into **improving tools and better adjustment of interventions to the needs** of different RIS stakeholders;
* frequently, the impact of the monitoring system is limited to the Office of the Marshal or, in the best-case scenario, to partners involved in the operation of the monitoring system. However, in order for the system to perform educational, scientific and informational functions, it must **reach all potential users** (of information) within the region and beyond it;
* cooperation, even with multiple partners, within the scope of RIS monitoring will not cause changes throughout the region. This is why, the monitoring system must have a developed **subsystem for communication and presentation of research results**. Thanks to widespread information, such an approach can have considerable impact on creating pro-innovation attitudes, focus on strategic branches of the economy as well as better use of regional resources;
* it is extremely important to have the possibility of further **increase of institutional potential** of the system as well as **adding other operational programmes** for implementation of development strategy;
* durability of the monitoring structure is of key importance. **Ensuring financing** of the structure, also after 2013, and becoming independent of external sources (e.g. outside European funds) will be a valuable solution which can be implemented in the region. An important issue is full system functionality (so that the system operates in an unreduced version); a permanent unit within the office structure must be provided for RIS monitoring.

The analysis of the RIS monitoring system for the Mazowieckie Voivodeship confirms the above observations. Analysis of documents and search for adequate practices were focused on eliminating the drawbacks of the analysed system. **The report did not present good practices** observed in other systems which would not improve the operation of the analysed system. Thanks to this approach, **the analysed good practices covered all disadvantages**. It is also necessary to verify whether all practices can be applied at the same time (due to different organisational structures, different feeding sources, etc.), whether their elements can be simply separated so as to ensure compliance with the condition of full functionality of the monitoring system in Mazovia. To this end, a cross-analysis was performed for individual good practices in the scope of the criteria which are met by more than one good practice. In this way, it was possible to order good practices in the application sense and determine their mutual correlations. What is left is to determine temporal correlations:

Recommendation implementation system

Q2 2012

Q3 2012

Q4 2012

Q1 2013

Q2 2013

Q3 2013

SI RSZZG

KOSTRA

3-level objective analysis

DPSIR

IASMINE

Illustration 1. Temporal correlations between implemented good practices.

Source: Own study.

Three of the good practices can be implemented from the beginning. Since the 3-level objective analysis and DPSIR affect the shape of the indicators, IASMINE can be implemented after their completion. At the same time, IASMINE must be implemented from the moment works on SI RSZZG begin in order to integrate the latter with methodology. Since IASMINE determines the relationships between more general innovation policy measures, KOSTRA should be carried out once IASMINE has been completed, but while works on SI RSZZG are still in progress in order to integrate it with the system. Hence, it can be concluded that **after good practices have been implemented in the above-mentioned manner, the monitoring system will obtain the maximum number of points during assessment according to the adopted criteria**. The research objective in this scope was therefore achieved.

Analysis of the latest trends and initiatives in innovation research and analysis methodology

**Innovation analysis** at the regional level has been generally performed for two purposes. First of all, its result shows the **general innovation performance** of the region — in this sense, the analysis must be carried out with respect to other regions. Comparison of regions provides information on changes which take place in the region and about the region’s place in innovation ranking. Secondly, innovation analysis is performed by regional authorities in order to find out how **effective and efficient** the innovation, scientific, technological and in general — regional **policy carried out by them is**.

Literature mentions not only **many different innovation analyses** of individual regions, in particular Polish voivodeships, but also (albeit to a lesser extent) — comparative analyses of the innovation level of Polish regions and European regions. Hence, it was extremely crucial to analyse all hitherto applied approaches to innovation research and **to develop a generally acceptable method of estimating the level of innovation** of regional innovation systems and the impact of used innovation policy tools or to adopt a single (the most objective and useful) method.

The literature review presented in the report confirmed **unsatisfactory condition of innovation policy monitoring** as well as **lack of uniform methodological approaches** in different comparative research on innovation of countries and regions. The results of analysis of applied methodologies show that:

* in the majority of cases, they can only be applied at the **national level**,
* they are trying to quantify both **innovations** and **innovation capacity** of regional economies as a whole,
* they apply both **quantitative** (objective) and **qualitative** (subjective) indicators, including opinion-based ones,
* in many cases, they are based on **proprietary sets of indicators**,
* they rely on generally available indicators, which makes **comparison of regions take place on the basis of several or about a dozen indicators** and cover limited areas of innovation (i.e. it makes it incomplete).

In many cases, in spite of good methodological attitudes and comprehensive assessment, shortages in data available for indicator calculations cause the composite performance indicators assessing the innovation level to be dominated by quantitative indicators available in public statistics, unfortunately concerning primarily **only the R&D area**. On the other hand, the used qualitative, subjective indicators ensure assessment of achievements in areas where hard data are not available. However, they have their disadvantages. Meanwhile, the use of **proprietary indicators** results in twofold difficulties: first of all, it impedes the long-term analysis of innovation (sets of indicators are frequently modified); secondly, it hinders comparison of regions among one other.

Analysis of the latest trends and initiatives in innovation research and analysis methodology has allowed for development of several recommendations regarding application in the RIS Mazovia monitoring system:

* the choice of the manner of innovation analysis is limited by availability of statistical data — one should choose innovation level assessment methodologies which rely on available data (free or upon charge),
* while aiming at development of a universal method of assessment of Regional Innovation Systems, one should rely on EIS European methodologies (currently IUS). They have ranked highest according to the adopted criteria and provide a good basis for comparisons. On the basis of the conducted analysis, it seems that it is best to compare regions on a European scale based on ERIS methodology — however, it is necessary to remember the limitations of this methodology,
* Polish regions can be compared among one other using methodologies developed domestically since as compared to the ERIS approach, they include more indicators covering a larger area of policy impact and the environment in which is implemented. However, they require methodological and conceptual changes in order to adjust them to the logic of intervention and adopted concept of innovation level assessment,
* indicators adopted to assess the innovation level should enable intra-regional analysis by sub-regions, even poviats. In particular, in the Mazowieckie Voivodeship, the differences between sub-regions are going to be significant and hence their analysis may facilitate better development of innovation policy,
* the indicators currently applied in Polish regions, analysing input and output innovation, are not correlated. It is therefore necessary to find other indicators; the approach to monitoring regional innovation system and innovation policy in the Mazowieckie Voivodeship must be threefold. In each case, one should use three sets of different indicators, although as demonstrated in the diagram below, indicators for international comparisons should be included in the set of indicators for domestic comparisons. In other words — indicators for domestic comparisons should expand ERIS indicators. A separate group of indicators should comprise indicators describing implementation of innovation policy,
* the analysis of different approaches to assessment of innovation level has demonstrated that the most frequently applied are equal weights within partial composite sub-indices — such an approach is also recommended in the approach to analysis within RIS Mazovia,
* an extremely important issue is assessment of changes in the region. Therefore, apart from an innovation level assessment index, one should introduce an indicator assessing the year-on-year dynamics of changes.

Verification of methodology of RIS Mazovia implementation and update and operationalisation of monitoring and evaluation system indices

The system of monitoring the Regional Innovation Strategy for Mazovia is dual and concerns **two levels**: the level of strategy implementation and the macro level (regional innovation). Monitoring the regional innovation level is planned using **two jointly considered composite indicators**: integrated benchmark index and summary regional innovation index.

Both indices consist of many components, which in theory were supposed to enable relatively simple measurement of regional innovation and, at the same time, analysis of the level of implementation of the Regional Innovation Strategy for Mazovia. On the other hand, the level of Strategy implementation is to be monitored using a system of indices corresponding to individual strategy objectives.

Integrated benchmark index

The integrated index reflects the situation in the region against other regions in a synthetic manner and is applicable at the level of strategic assessment, thus allowing for control over achieving the basic objectives of the Regional Innovation Strategy. Mixed approach was applied in construction of this index, combining the principles applied to evaluation, monitoring and benchmarking.

The integrated index is calculated as the reverse of total points specifying the region’s position in sub-rankings, according to individual variables, with every variable having the same weight. Index values were expressed as a percentage of the maximum number of points which could be achieved by the region if it came first in each section. The value of the index is calculated according to the following formula:



*where:*

 *integrated index for the Mazowieckie Voivodeship,*

 *number of component indices,*

 *position in the ranking for individual component indices.*

Such a construction of the integrated benchmarking indicator enables consideration of different indicators with different directions (whose higher values are more positive or negative) because, thanks to creating rankings, we will always order voivodeships according to the index.

The analysis of the integrated benchmark index and summary regional innovation index was conducted at two levels. First, it was analysed what indices are generally available in statistics and other sources. Next, the possibility of their use in each synthetic index was verified. Secondly, component indices were verified as a set of complete elements assessing the level of regional innovation. The analysis of literature demonstrated that apart from assessment of indicators themselves, it is necessary to **assess the entire set of indices.**

The analysis of benchmark index demonstrated that 12 among 29 indicators are not generally available (or have not been assessed sufficiently well with respect to adopted criteria). This means that **it will be impossible to collect 40% of components contributing to the current benchmark index**. Additionally, many indices have different wording from the one adopted in the index and sometimes, they do not mean exactly the same. Moreover, regardless of these issues, one can have a number of reservations regarding the construction of the index and applied elements. On the other hand, the analysis of correlation demonstrated several overlapping indices, in particular within the field of R&D. **Hence, the analysis of the benchmark index demonstrated low availability of data to establish it, as well as numerous subject-matter flaws and different degrees of overlapping of the indices.** In this scope, it is necessary to make considerable changes, even involving updating the approach according to the analysis.

Summary innovation index

The summary regional innovation index illustrates **diversity of innovation level** and **research and development potential** of the Mazowieckie Voivodeship as compared to average values all over Poland.

The summary index is determined on the basis of standardised values of diagnostic characteristics and absolute and relative information value of each characteristic. The original values of variables have been standardised. The summary index assumes non-standardised positive and negative values, which can be transformed in order to move the index scale from 0 to 1. High values of the index demonstrate high R&D potential and relatively high innovation effects in the light of adopted diagnostic characteristics.

The first conclusion which arises after analysing this index is the use of the same four indices as in the case of benchmarking: expenditure on R&D in % of GDP, expenditure on R&D *per capita*, patents per 1 million citizens, expenditure on innovative activity per 1 innovative business.

Such an approach is surprising in the context of assumptions of the monitoring system, according to which indices are to be considered jointly. In this case, **4 out of 13 indices are identical**, so in 30%, the summary index is going to behave similarly to the benchmark index, not to mention the fact that a number of other components are also similar.

Availability of data is far better than for the benchmark index. **Only 2 out of 13 indices are unavailable**. Some indices must also take a slightly different form.

What is also noticeable is the extremely **strong turn of the indices towards the field of R&D** — as many as 7 out of 13 indices concern R&D. Such an approach towards the changing innovation paradigm is not the most appropriate one. Such accumulation of indices concerning R&D has caused — as one could expect — overlapping of indices and in four cases, even nearly identical meaning of indicators in innovation assessment. **The summary innovation index not only multiplies the benchmark index, but it also analyses, primarily, the field of R&D. Additionally, it contains a number of methodological errors.** Its usefulness in the context of comparing the level of innovation is doubtful and a different use should be sought for this index.

Monitoring RIS implementation for the Mazowieckie Voivodeship

The level of strategy implementation is to be monitored using indices corresponding to individual objectives formulated in the Regional Innovation Strategy for Mazovia. This is why, the analysis at this point focused on analysing coherence of indices at the level of the main objective and strategic objectives.

The first stage of verification of monitoring indices involves specifying the impact of implementation of lower-level (strategic) objective indicators on the main objective indicators. The analysis has demonstrated that all main objective indices are fed by lower-level indicators (albeit some of them only potentially). However, three detailed objective indicators contribute to no main objective indicator. This is why, we suggest **adding three indicators** at the level of the main objective (the indicators are available in statistics): the number of clusters with 3 stars in the world class clusters ranking from the area of voivodeship (number) [Europe-Innova], indicators of share of export of groups of products classified as high-tech [Statistical Office in Szczecin — paid data], businesses utilising automatic data exchange as compared to all businesses [Statistical Office in Szczecin — paid data].

Additionally, it should be noted that main objective indices focus on industrial activity, while detailed objectives also concern the services sector. This is why, it is recommended to consider the possibility of adding indicators such as: innovatively active businesses from the services sector as a % of all businesses [Statistical Office in Szczecin — paid data], expenditure on innovative activity in businesses in the services sector by type of innovative activity, size classes and ownership sectors (6.2) as well as sections and divisions of Polish Classification of Activities (6.13) [Statistical Office in Szczecin — paid data], share of sale of products/services which are “new to market” in total income of SMEs [Statistical Office in Szczecin — paid data].

Next, one should take the analysis to a lower level. This is why, the next element is **analysis of correlation between RIS operational objectives and indicators of individual strategic objectives**. Thanks to it, we will verify whether operational objectives are supplied with indicators. The analysis has shown that **two strategic objectives are not supplied with indicators describing strategic objectives.** They apply mainly to enterprises participating in research projects and projects financed from EU funds, as well as the effectiveness of local governments in obtaining funds for RIS purposes.

Systematisation of division of the set of indicators by fields and significance for measurement of a specific feature

Systematisation of division of the set of indicators by fields and significance for measurement of a specific feature — on the basis of conducted analyses — will be multi-layered. It was described in division into individual components of the monitoring system.

In general, it was suggested that **indicators measuring the level of innovation be divided as follows**: the **benchmark** index should measure innovation of Mazovia as compared to **other Polish voivodeships** since it is more elaborate and covers diverse aspects of operation of the innovation system. Thanks to this, one can count not only on improved availability of data in Poland, but also increased possibilities of diverse comparisons of similar systems. On the other hand, the **summary innovation index** innovation can be adapted to the most up-to-date IUS 2010 methodology and used to assess innovation of Mazovia **in the European arena** and outside it.

Integrated benchmark index

The disadvantages of the index, diagnosed above, good practices developed in this scope as well as analysis of different approaches to innovation analysis necessitate **reconstruction of the index** so that on the one hand it uses available indices and on the other hand — analyses innovation system inputs and outputs. It is also necessary to refer to competitiveness level (unfortunately, it is impossible to measure exports at the regional level).

The integrated benchmark level should **measure the level of innovation of the Mazowieckie Voivodeship as compared to other voivodeships** in Poland. This is why, the approaches recommended for this task are Polish approaches, derived from approaches used globally, but relying on available data and using the possibilities offered by division into NUTS2 units.

These approaches were combined with research results included in chapters I–IV of the report, in particular division into input (potential and contribution) and output indicators, as well as assessment of indicators using adopted criteria (the indicator only employed the highest-graded indicators). The division into sub-rankings results from all analysed approaches; however, they were expanded so as to cover the entire innovation development process (from potential through contribution to results).

Additionally, results of analyses conducted in chapters III and IV of the report demonstrated that partial indicators can be obtained (in the majority of cases, upon charge) at the level of sub-regions, i.e. poviats, thanks to which the benchmark index can also be calculated at the local level. Therefore, according to recommendation 4 (see chapter II.3), **the benchmark index can be used for intra-regional analyses**, also in division into the sub-rankings referred to above.

**Weights of individual indices** should be determined at an even level so that every partial indicator has the same weight (the same impact on the value of the composite index).

The table below presents the **benchmark index** comprising four sub-rankings within which input (potential and contribution) and output (innovation results and economy competitiveness) indicators were determined. At the same time, the manner of calculating the indicator which has obtained approval should be compliant with the provisions of the Regional innovation Strategy for Mazovia.

Table 1. Proposal of integrated benchmark index

| Item | Sub-ranking | Input  | Output |
| --- | --- | --- | --- |
| Potential indicator | Contribution indicator | Innovation results indicator | Economy competitiveness indicator |
| 1. | Non-scientific innovations | Tertiary level educational attainment (ISCED 5-6) for age group 25–64, per 100 citizensParticipation in lifelong education of for age group 25–64, per 100 persons | Expenditure on innovation activity per 1 million citizensExpenditure on innovation activity in relation to capital expenditure of businesses | Innovatively active businesses as a % of all businesses or Innovatively active businesses from the services sector as a % of all businessesShare of sale of products/services which are “new to market” in total SME incomeInnovative SMEs which have introduced organisational and marketing innovations as a % of all SMEs | GDP per capita in PLN thousandIncome per 1 entityEmployees in non-financial entities conducting business activity Newly registered entities minus deregistered entities per number of businessesShare of companies with foreign capital in total number of entities (%)At-risk-of-poverty rate (% of persons in households below the threshold) |
| 2. | Impact of ICT | Broadband penetration rate in businesses (% of total businesses) | Employees using computers in businesses as a % of employeesBusinesses using automatic data exchange in relation to all businesses |
| 3. | Influenceof cooperation | Number of entities from the voivodeship participating in EU Framework Programmes in all thematic fields (as subsidised teams) (number) [NCU] | Innovative SMEs cooperating with others as a % of all SMEsNumber of clusters with 3-star rating in the world class clusters ranking from the voivodeship (number) [EuropeInnova] *or* Businesses which have cooperated under cluster initiative within the scope of innovative activity in % of businesses cooperating within the scope of innovative activity [Statistical Office in Szczecin] |
| 4. | High-tech R&D-based innovations | Human resources for science and technology by education as a % of professionally active populationPhD students per million citizensR&D employees as a % of all employeesR&D employees in the enterprise sector as a % of all R&D employees | Domestic expenditure on R&D in relation to Gross ProductBusiness Expenditure on Research & Development (BERD) as a % of Gross ProductExpenditure on innovative activity of industrial enterprises per 1 business in PLN thousand | Number of publications in scientific periodicals, published by affiliated authors at voivodeship scientific units (number) [Scopus]Domestic patent applications per 1 million citizensPatent applications to EPO per 1 million citizensShare of net income from sale of innovative products in industrial enterprises |
| Employment in high-tech sector as a % of total employment |  | Share of income from sale of products of high-tech and medium-high-tech enterprises in total income of the manufacturing section |

Source: Own study.

Thanks to such an approach, it is possible to **analyse the level of innovation of the Mazowieckie Voivodeship at different levels: system inputs, outputs, potential, contribution, performance innovation or competitiveness level**, but also according to certain spheres of innovative activity, R&D as well as cooperation or ICT.

Additionally, it is important to develop the benchmark index on the basis of **changes of individual components**. Go Global! methodology can be used here; however, due to a large number of indices, it is suggested to calculate the average values from dynamics for individual groups (for the purpose of visualisation, it is best to use the change of indicators itself so that the benchmark index assumes negative values (when the situation deteriorates) and positive values (in the opposite situation)). The index would comprise 11 partial indicators assuming values within the range of 〈-1, 1〉. Thanks to this approach, it is possible to find out about the comprehensive change in the voivodeship’s innovative position (by calculating the average from all partial indices) or specify areas in which the situation improved or deteriorated. Such an approach will be extremely helpful for decision makers, who can receive information on the efficiency of innovation policy nearly immediately. In connection with mechanisms proposed in good practices, it could create a perfect system for monitoring innovation activities in the region.

Summary innovation index at the European level

The above analysis of the summary innovation index has demonstrated that the most appropriate manner of changing and updating this index is adjusting it to IUS 2010 and making it the basis for **benchmarking of the Mazowieckie Voivodeship at the European level**. Therefore, it is necessary to verify whether and to what extent it is possible to apply the IUS approach to analysis at the regional level.

Table 2. Proposed summary innovation index at the European level.

|  |  |
| --- | --- |
| **IUS indicators** | **Indicators which can be applied in RIS Mazovia** |
| **ENABLERS** |
| **Human resources**  |
| 1.1.1 New doctorate graduates (ISCED 6) per 1,000 population aged 25-34  | Percentage of people — graduates — in the voivodeship (higher level) in total number of voivodeship population (%) |
| 1.1.2 Percentage population aged 30–34having completed tertiary education | *No equivalent* |
| 1.1.3 Percentage youth aged 20-24 having attained at least upper secondary level education | *No equivalent* |
| **Open, excellent and attractive research systems**  |
| 1.2.1 International scientific co-publications per million population | Publications in scientific periodicals, published by affiliated authors at voivodeship scientific units (number) (the necessity to divide by the number of citizens, the necessity to separate international publications) |
| 1.2.2 Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country  | *No equivalent* |
| 1.2.3 Non-EU doctorate students as a % of all doctorate students  | Foreign students, doctorate students, college students and post-graduate college students (ISCED 5-6) by selected countries [broken down into:] |
| Doctorate students according the educational system and fields of science |
| **Finance and support**  |
| 1.3.1 Public R&D expenditures as % of GDP | Expenditure of the voivodeship’s public sector entities on R&D as a % of voivodeship GDP |
| 1.3.2 Venture capital (early stage, expansion and replacement) as % of GDP  | *No equivalent* |
| **FIRM ACTIVITIES** |
| **Firm investments** |
| 2.1.1 Business R&D expenditures as % of GDP  | R&D expenditure in the voivodeship — enterprise sector — as a % of voivodeship GDP |
| 2.1.2 Non-R&D innovation expenditures as % of turnover | Expenditure on non-R&D innovative activity |
| **Linkages & entrepreneurship**  |
| 2.2.1 SMEs innovating in-house as % of SMEs  | *No equivalent* |
| 2.2.2 Innovative SMEs collaborating with others as % of SMEs | Innovative SMEs collaborating with others as a % of all SMEs |
| 2.2.3 Public-private co-publications per million population | *No equivalent* |
| **Intellectual assets**  |
| 2.3.1 PCT patents applications per billion GDP (in PPS€)  | Percentage of patent applications (number) from the voivodeship per million voivodeship citizens (a different denominator) |
| 2.3.2 PCT patent applications in societal challenges per billion GDP (in PPS€) (climate change mitigation , health)  | *No equivalent* |
| 2.3.3 Community trademarks per billion GDP (in PPS€)  | Domestic trademarks under protection of the Patent Office of the Republic of Poland in the voivodeship (number) (the necessity to divide by GDP) |
| 2.3.4 Community designs per billion GDP (in PPS€)  | Protection rights granted for functional designs by the Patent Office of the Republic of Poland in the voivodeship (number) (the necessity to divide by GDP) |
| **OUTPUTS**  |
| **Innovators**  |
| 3.1.1 SMEs introducing product or process innovations as % of SMEs | SME introducing product or process innovations as a % of all SMEs |
| 3.1.2 SMEs introducing marketing or organisational innovations as % of SMEs  | SMEs introducing marketing or organisational innovations as a % of all SMEs |
| 3.1.3 High-growth innovative firms | *No equivalent* |
| **Economic effects**  |
| 3.2.1 Employment in knowledge-intensive activities (manufacturing and services) as % of total employment | Employment in high-tech sector as a % of total employment |
| 3.2.2 Medium and high-tech product exports as % of total product exports | Structure of exports and imports of high-tech products, indicator of imports to exports relation *or*  |
| Indicators of export share of high-tech product groups |
| 3.2.3 Knowledge-intensive services exports as % of total service exports | *No equivalent* |
| 3.2.4 Sales of new to market and new to firm innovations as % of turnover | Share of production of new/considerably improved products in industrial enterprises in the value of total products sale |
| 3.2.5 Licence and patent revenues from abroad as % of GDP | *No equivalent* |

Source: Own study.

Among 25 IUS 2010 indicators, as many as 15 are available in statistics. It is more than in hitherto research quoted in chapter II of the report, carried out at the regional level among European countries. Additionally, it should be noted that every dimension of an IUS indicator has at least one available indicator. In most cases, there are two indicators available, which will ensure appropriate **contributions to the indicator** and basing the results on **diverse characteristics of the innovation system**.

Some indicators are taken from national statistics (Statistical Office in Szczecin); however, for these indicators, comparability was ensured at the European level, according to chapter III of the report. **Adapting the summary innovation index to the European level on the basis of IUS 2010 approach was successful. An index comprising 15 (out of 25) partial indices available at the regional level was obtained**.

**Weights of individual indices** should be determined at an even level so that every partial index has the same weight (the same impact on the value of the summary index).

RIS monitoring for the Mazowieckie Voivodeship

Systematisation of division of the set of indicators by fields and significance for measurement of a specific feature in the case of RIS implementation must be more comprehensive. RIS implementation monitoring process, according to recommendations from individual partial reports, should be carried out in several stages. The logic of this process has been presented in the diagram below:

Base level of **competitiveness** of regional economy

Base level of **innovativeness** of regional economy

**Actions** under innovation policy specified in the RIS

**Products** of
innovation policy

**Results** of
innovation policy

Output level of **innovativeness** of regional economy

Output level of **competitiveness** of regional economy

*Product*
*indicators*

*Contribution*
*indicators [PLN]*

*Result*
*indicators*

*Competitiveness*
*indicators*

*Innovativeness*
*indicators*

*Innovativeness*
*indicators*

*Competitiveness*
*indicators*

Diagram 2. RIS Mazovia monitoring process with specification of necessary indicators.

Source: Own study.

As presented, some of these processes have already been described and analysed above. At this point, product analysis and results of individual actions are still missing. Since RIS does not contain any indicators regarding actions, it was necessary to **develop product and result indicators for every action** described in the RIS. Three samples sets of indicators have been presented below:

Table 3. Product and result indicators for three selected RIS actions together with reference to strategic objective indicators.

| RIS activities | Product indicators | Result indicators | Impact indicator (strategic objective indicator) |
| --- | --- | --- | --- |
| Regional Innovation Centres | Number of supported sub-regional centres | Number RIC-Warsaw cooperation projectsNumber of persons supported in the scope of innovation | Objective I | Number of businesses which concluded agreements on innovation cooperation with other entities |
| Regional Innovation Forums | Number of RIFs organised | Number of undertaken joint projects of the science sector with business and business environment institutionsNumber of international projects in which entrepreneurs from Mazovia participate | Objective I | Number and value of implemented joint projects of the science sector with business and business environment institutions |
| Mazovian innovation catalogue | Number of records (innovations) in the databaseNumber of printed and distributed catalogues | Number of undertaken joint projects of the science sector with business and business environment institutions | Objective I | Number and value of implemented joint projects of the science sector with business and business environment institutions |

Source: Own study on the basis of RIS.

Additionally, the result indicator was referred to the indicator from the level of strategic objective
(a single indicator which best reflects the result was chosen). Thanks to this, **indicators from the level of products and results were combined with the strategic level and an entire system of interconnected indicators was created**.