



REPUBLIC OF CROATIA

**NATIONAL STRATEGY IN THE FIELD OF METROLOGY  
(2007 – 2013)**



The **National Strategy in the field of Metrology of the Republic of Croatia** has been elaborated under the leadership of the **State Office for Metrology** while actively involving the following institutions:

- **Ministry of Economy, Labour and Entrepreneurship,**
- **Croatian Chamber of Commerce,**
- **Faculty of Mechanical Engineering and Naval Architecture (University of Zagreb)**
- **Faculty of Electrical Engineering and Computing (University of Zagreb)**
- **Institute Ruđer Bošković**
- **Croatian Metrology Society**
- **CROLAB (Croatian Laboratories)**
- **Zagreb Public Health Institute**

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- **Ministry of Foreign Affairs and European Integration;**
- **European Commission, DG Joint Research Centre – Institute for Reference Materials and Measurements (in the framework of a CARDS programme 2004 project entitled "Assessment of national priorities for metrology and conformity assessment")**

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## LIST OF ABBREVIATIONS

BIPM	Bureau International des Poids et Mesures
CARDS	Community Assistance for Reconstruction, Development and Stabilisation program for Western Balkans adopted with the Council Regulation (EC) No 2666/2000 of 5 December 2000
CGPM	Conférence Générale des Poids et Mesures
CIPM	Comité International des Poids et Mesure
CMC	Calibration and Measurement Capabilities
CROLAB	Organisation of Croatian laboratories
DZM	State Office for Metrology
EA	European Accreditation
EC	European Commission
EU	European Union
EUROLAB	Organisation of European Laboratories
EUROMET(EURAMET)	European Collaboration in Measurement Standards
EURACHEM	Network of organisations in Europe dealing with chemical measurements
HAA	Croatian Accreditation Agency
HMD	Croatian Metrology Society
HMI	Croatian Metrology Institute
HZN	Croatian Standardisation Institute
ICT	Information and Communication Technologies
IMEKO	International Measurement Confederation
IRMM	Institute for Reference Materials and Measurements
MI	Measuring Instruments
MRA	Mutual Recognition Arrangement
NMI	National Metrology Institute
OIML	International Organisation of Legal Metrology
R&D	Research and Development
SAA	Stabilization and Association Agreement
SI	International System of Units
SMEs	Small and Medium-size Enterprises
SWOT	Strengths, Weaknesses, Opportunities and Treats
TBT	Technical Barriers to Trade
WELMEC	European Cooperation in Legal Metrology

## DEFINITIONS

**Metrology** is the science of measurements.

**Scientific metrology:** the part of metrology dealing with the organization and development of measurement standards and with their maintenance (highest level).

**Industrial metrology:** has to ensure the adequate functioning of measurement instruments used in industry as well as in production and testing processes

**Legal metrology:** is concerned with the accuracy of measurements where these have influence on the transparency of economical transactions, health and safety.

**Conformity assessment:** any procedure applied, directly or indirectly, to determine that the relevant specified requirements are fulfilled.

**Measurement standard:** realization of the definition of a given quantity, with stated value and measurement uncertainty, used as a reference.

**National measurement standard:** measurement standard designated as a national stated metrological reference.

**Traceability:** property of a measurement result relating the result to a stated metrological reference through an unbroken chain of calibrations of a measuring system or comparisons, each contributing to the stated measurement uncertainty

**Calibration:** operation establishing the relation between quantity values provided by measurement standards and the corresponding indications of a measuring system, carried out under specified conditions and including evaluation of measurement uncertainty

**Reference material:** material, sufficiently homogeneous and stable with respect to one or more specified quantities, used for the calibration of a measuring system, or for the assessment of a measurement procedure, or for assigning values and measurement uncertainties to quantities of the same kind for other materials

## PREFACE

The National Strategy in the field of Metrology is the result of an extensive process of strategic thinking that has included the largest possible list of national stakeholders that are active in the field of the quality infrastructure. The final result is unique in many aspects. Some of them can be listed as follows:

- it is funded on a **commonly shared vision** about the future development of the National Metrology system that unites the State administration, the scientific community and industrial end-users in the widest possible range;

- applies an **economic needs-driven** approach that should foster the efficiency of the nationally available metrological services;

- allows a consistent development of the national quality infrastructure, that is essential to the process of **integration of the Republic of Croatia into the European Union**.

The National measurement infrastructure is an essential element of any industrialised economy. As such, it provides substantial basis for fundamental Research and Development activities. No matter how "invisible" the National measurement infrastructure might appear to an external observer, the importance of the activities that it accommodates is remarkable. The list of examples is endless, but as an illustration it is worth to mention some of them:

- None of the numerous bridges in the Republic of Croatia would be secure for use without precise length measurements of each single piece incorporated in the structure, as well as angle measurement at critical junctions affecting the static, the weight of components, not to mention vibration measuring tests.

- Preserving one of the greatest assets of the Republic of Croatia - the Adriatic Sea - would be clearly impossible without reliable measurement capabilities for contaminants in coastal waters. The same is even more valid in the case of drinkable water.

- Traditional Croatian exporting industries, such as shipbuilding, pharmaceuticals, food-processing, electrical-engineering etc, all rely on traceable measurements in respectively important fields such as pressure, electro-conductivity, mass, electrical current etc.

- Energy being a global matter, reliable flow measurement capabilities for petrol and natural gas are strategically important field. This is valid from the point of view of a net importing country, but also at the level of ensuring reliable measurements at gas-stations, through the optics of consumer protection.

Short-listing few (out of many) practical illustrations of the importance that a proper National measurement infrastructure has for the overall development of the economy brings only part of the answers that this strategy is addressing. The complementary part of the dilemmas concerns the effectiveness and efficiency of a given scope of domestically available measurement capabilities. This is a key driver for strategic decisions to be made on the National level.

On a micro-scale, one part of the answer can be contained in the fact that all Croatian tax-payers jointly finance the costs of maintaining a proper measurement infrastructure. Therefore, there is a clear interest to ensure that the best output is delivered by each kuna of tax contributions to activities that literally affect the performance of the National economy and the quality of life of Croatian citizens.

On a macro-scale, the answers to these dilemmas are highlighted within this document that provides the framework of the National Strategy in the field of Metrology for the Republic of Croatia.

The methodology used in the elaboration of this Strategy includes the establishment of a Working group that has included national experts from the relevant institutions, such as: State Office for Metrology; Ministry of Economy, Labour and Entrepreneurship; Croatian Chamber of Economy; Faculty for Mechanical Engineering and Naval Architecture and Faculty of Electrical Engineering and Computing (both part of the University of Zagreb); Croatian Metrology Society; CROLAB (Croatian Laboratories); Zagreb Public Health Institute and Institute Ruđer Bošković. The Working group had the leading role in identifying the National needs in the field

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of metrology, conducting a SWOT analysis of the existing system, listing the priorities for future development and selecting appropriate strategic actions. In the framework of this process, the industrial end-users, laboratories and certification bodies nation-wide have contributed through answering questionnaires, as well as participating to individual interviews and consultations. Under the leadership of the State Office for Metrology, the Working group conducted four plenary sessions and one concluding meeting, during the strategy elaboration period (October 2006 – July 2007). On the basis of this experience, such exercise would be highly beneficial to the strategic positioning of Croatian metrological infrastructure if it is conducted along a cyclical pattern, as illustrated by the graphical presentation on the front page of this document.

The guiding idea of this strategy is to serve the best purpose of supporting the widest range of our economy through raising the level of competitiveness. Equally important, the Strategy should foster a National Metrology infrastructure that continuously improves the quality of life. Along these lines, this Strategy is perfectly aligned with the consensually agreed overall strategic objectives of the Republic of Croatia.

## 1 INTRODUCTION

Metrology, the science of measurement, critically affects standards, technical regulations and conformity assessment activities and plays a crucial role in development of society. Measurements, as well as the entire quality infrastructure, have become an increasingly critical tool for national and international trade, and for removing technical barriers to global trade. Hence, National governments take responsibility for ensuring the establishment and proper functioning of a credible metrology system, including setting regulations for the legal applications of metrology, developing standards for measurement and calibration, preparing regulations for measuring instruments used by producers, testing laboratory and the general public. **The resources required to develop this infrastructure represent a significant part of the R&D investments of each modern economy.**

The National Program for Integration of the Republic of Croatia into the European Union underlines the efforts on the way of adjusting the existing quality infrastructure in the country. The revision process of the framework laws ensuring proper functioning of the "free movement of goods" mechanisms is certainly one of the key elements on this path. Within this context, the status and development of national metrology system is a critical issue. Thus, nearly 40% of the Directives in practically all sectors contain a metrology link through establishment of necessary requirements for measuring instruments or materials or through the requirements for reference methods<sup>1</sup>.

Formulating a consensual National vision in such a complex field requires an extensively multidimensional approach. **Tradition, available human resources, industrial structure, existing centers of excellence, economic policy priorities, overall competitiveness of the economy** are only some of the basic dimensions that have a direct impact on the National Strategy. The development of an adequate national measurement system and related conformity assessment components is furthermore initiated under the hypothesis of obtaining optimal results from available financial resources, whether it concerns National budget or possibilities for external sources (including future IPA funding etc.)

Finally, this is meant to offer solid ground for future decisions on **investment policy** to be based on. Implementation of the strategy should result in improvement of readiness of the Republic of Croatia to join the EU through support and upgrade of quality infrastructure compliant with requirements of the SAA and strengthening the competitiveness of Croatian economy.

The strategy development process has been conducted under the leadership of the **State Office for Metrology** while actively involving the major stakeholders such as the **Ministry of Economy, Labor and Entrepreneurship, Croatian Chamber of Economy, CROLAB, Croatian Metrology Society, as well as leading Croatian Research Institutes.**

**It is illusive to discuss any fostering of highly technology-intensive industry on a national scale if the measurements perspective is kept out of the decision-making equation on the highest level.** Based on the National "Strategic Development Framework", the Republic of Croatia steers towards dynamic and knowledge-based macro-economic model. It is the one that is based on high added-value industrial outputs and where the mastering of technologies is the core substance.

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<sup>1</sup> Quoted estimation by the European Commission's services

## 2 THE NATIONAL METROLOGY SYSTEM

### The "myth" about Metrology

Visualizing metrology at the scientific level is an extremely challenging academic task. However, modern economic concepts can rationalize this in a commonly understandable way.

At the essence, metrology as a scientific discipline had a very pragmatic driver. This was the basic need of being able to measure. Sovereigns have been fixing standards for the simple reason of enabling trade and economic activity. One of the remaining "monuments" of metrological pragmatism in our country is certainly "Orlando's pillar" in Dubrovnik. In 1418, the prosperous Republic has responded to a logical requirement from merchants. If there was one, the strategy at that time was to support the main economic driver – trade of tissues – by providing a measurement standard for length (defined by the elbow).

### Orlando's pillar in Dubrovnik, 1418



During the XIX and XX century, institutionalizing the standards for all available measurements under the single roof of a State organization has been recognized as a **matter of Sovereignty**. This process has given birth to the National Metrology Institutes (NMI), first in Europe, then all over the world. In the XXI century, the simple fact that - "other's also have"- is not sufficiently pragmatic argument for justification of any state funded activity. Consequently, strategic decisions have to be made about: "what?"...and "to which extent?" is critically important at the National level.

### Key drivers for development of a metrological infrastructure

The modern patterns of metrology world-wide are evolving. Still, metrology's purpose at the National level has to be motivated by the needs of the key Croatian economic activities. In the same time, it should aim at improving the quality of life of our citizens.

On the industrial scale, measurements are tightly associated with quality. Hence, the expression: "one can produce as good, as one can measure". Being competitive on the global market understands having an appropriate level of quality of products. Extending this fact to the technological level imposes the need of having comparable measurements. The latter is valid for all physical, as well as chemical parameters of a product. Having comparable measurements in an increasingly globalised market was the driving force that led 17 countries to the signature of the "Meter Convention" on the 20<sup>th</sup> of May 1875. Since then, the structure of national economies world-wide has dramatically changed. The very basic driver of international trade, getting "best value for money" on a global market, has not. The difference in delivered results in this respect can be expressed through the concept of quality.

The reliability of the measurements is most likely to be the best proxy for "quality". This becomes dramatically more important as the product (and/or service) is sophisticated. **The high added-value products, based on concentrated technologies require the best measurement capabilities to be mastered by the producer.** In theory, enterprises driven by market pressure, find the best way to ensure that they deliver *adequate, reliable* and most importantly - *comparable measurements*. Croatian companies make no exception. In other words, they should be able to deliver competitive products with adequate quality. Thus, the "*global market*" where they compete, is the place where they would certainly find "someone" who can ensure they do have the ability to measure in an adequate, reliable and comparable way.

Why would then a country need a National strategy in this field?

The former statement is certainly valid for a *global company*. In practice, this service has a cost that increases the production expenses for the end-user. In particular, this is valid when this service is delivered *cross-border*.

### **Rationale for a National metrology Infrastructure**

In a number of fields, a country has interest to develop particular measurement capacities linked to essential and strategically important niches of the National economy. In addition, *the proximity, language facilities, creating SME friendly environment* can be only some of many reasonable arguments why this is today part of the missions of any Government in the World leading economies.

Increasingly important in the same context become the measurements linked to the overall living quality of the citizens. Healthy environment and safe food are for instance topics requiring an extensive amount of measurements. Their importance can certainly not be ignored.

Furthermore, the fact that the scope of measurements is virtually unlimited, while the Government's decisions are constraint by budget limitations, makes the need of a common National Strategic vision an essential requirement. In this scope, decisions need to be based on answers to questions:

- 1/ *What are our overall National Strategic objectives?*
- 2/ *What do we need to do in order to achieve them?*
- 3/ *Where the main shares of our Gross domestic product come from?*
- 4/ *In which sectors we would like to create R&D "excellence"?*
- 5/ *What are the legal requirements that our Government has to fulfill?*
- 6/ *How can we make our citizens benefit?*
- 7/ *How can we benefit as a country being part of a larger international framework?*

The purpose of bringing answers to these questions was the main driver for delivering this National Strategy for Metrology and Conformity Assessment. Achieving a wide *consensus* on these priorities is of a crucial importance.

### **Key features of the current national metrology system**

The Metrology Act (Official Gazette No 163/03) provides the **legal framework** for development of the metrological activities and recognizes metrology as a field of special importance for the Republic of Croatia.

The main objectives of this Law can be summarized as follows:

- making the system of legal units of measurement uniform with the International System of Units (SI)

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- establishing the system of national measurement standards and ensuring their traceability to international measurement standards
- establishing metrological uniformity in the Republic of Croatia and credibility of measurement results performed for the purpose of consumer protection of lives, health of persons and animals, environmental protection, general safety and protection of natural resources
- adopting and implementing metrological regulations.

The scope of these activities being extremely large, the system involves a number of components. The list of main **actors** in the national metrology system of the Republic of Croatia certainly includes:

- the governmental body – the State Office for Metrology (Državni Zavod za Mjeriteljstvo, DZM)
- large number of laboratories performing tasks in scientific, industrial and legal metrology
- National Research Institutions
- non-governmental organizations such as CROLAB, the Croatian metrology society (HMD), KoREMA and others.

The key feature of the current disposition comprises tasks and responsibilities on national level being delegated to external laboratories. Thus, the model is qualified as a **distributed system** and includes laboratories within DZM, designated national standard-holders and other legal entities authorized to carry out activities in the field of legal metrology.

### **Components within the system**

1. The **State Office for Metrology** ([www.dzm.hr](http://www.dzm.hr)) is a body within the central administration in charge of performing metrological activities in accordance with the provisions of the Law on Metrology. Most important among the activities are: issuing administrative decisions and regulations, performing metrological supervision, carrying out measurement activities and representing the Republic of Croatia in international metrological organizations. DZM is organized in divisions and departments and employs 115 civil servants. DZM is empowered to designate the national standard-holder laboratories and to authorize legal bodies in the field of legal metrology applications and coordinates and supervises their activities. DZM is a member of OIML, EUROMET and DUNAMET and has associate membership to the CGPM and WELMEC. DZM is a signatory of the CIPM MRA.
2. **National standard-holder laboratories** are an essential component of the national metrology system in their quality of holders of the Croatian national measurement standards and top level providers of measurement traceability in the country. Six designated national standard-holder laboratories already operate in the scope of the system (two within DZM and four at the University of Zagreb). From the currently existing ones, two are DKD and one is SIT accredited. Based on the EUROMET classification (comprising **ten** defined metrological fields), national calibration capabilities are established in *four* metrological fields, namely: **mass and related quantities, length, electricity, thermometry; while the establishment is in process for ionising radiation, as well as acoustics and vibration**. All laboratories take part in EUROMET activities.
3. Several **legal bodies** are authorized to carry out verifications of measuring instruments in the fields where the state office lacks capabilities. The system is complemented by **services** authorized for preparation of MI for verification. Conformity assessment of measuring instruments is in initial stage of development and no designations of conformity assessment bodies have been granted yet. There are several smaller size Croatian companies that produce or assemble measuring instruments.
4. Currently eight laboratories have obtained accreditation according to HRN EN ISO/IEC 17025 for calibration granted by the Croatian Accreditation Agency. There are many institutions in Croatia, holders of national measurement standards that provide calibration and testing services in various fields. Institute Ruđer Bošković with its chemical laboratories, the system of Public Health Institutes, laboratories established at some major companies (in the pharmaceutical, electro-technical, food-processing and petrochemical industries), as well as other accredited and non-accredited calibration laboratories.

The association of national metrological, testing and analytical laboratories, named Croatian Laboratories **CROLAB** ([www.crolab.hr](http://www.crolab.hr)), was established in 2003 as a legal entity and a not-for-profit national association. The goal of CROLAB is to join the laboratories in the Association in order to improve the quality system of each single laboratory and in order to facilitate their integration into the European market by using common resources and potentials. CROLAB's membership exceeds 100 laboratories. The organization is a member of EUROLAB and EURACHEM.

**Croatian Metrology Society (HMD) and KoREMA** are voluntary non-profit and non-governmental association, that contribute to the promotion of metrology on national, as well as international level. KoREMA is a member of IMEKO.

**The existing system is on the way to change**

The elaboration of a National coherent vision, comprising priorities for further economic development has been tackled at the Governmental level. Therefore, the "Strategic Framework for Development 2006 – 2013", has been adopted on 4<sup>th</sup> of August 2006. Inspired from the largest possible national consensus, the document provides basis for pursuing a harmonised economic policy in the next seven-year period. The key assumptions for achieving the envisaged objectives include **openness of the economy, competitiveness as an imperative, necessity of modernising the traditional role of the state, while including all social classes in sharing the benefits from the results of the economic growth and development.**

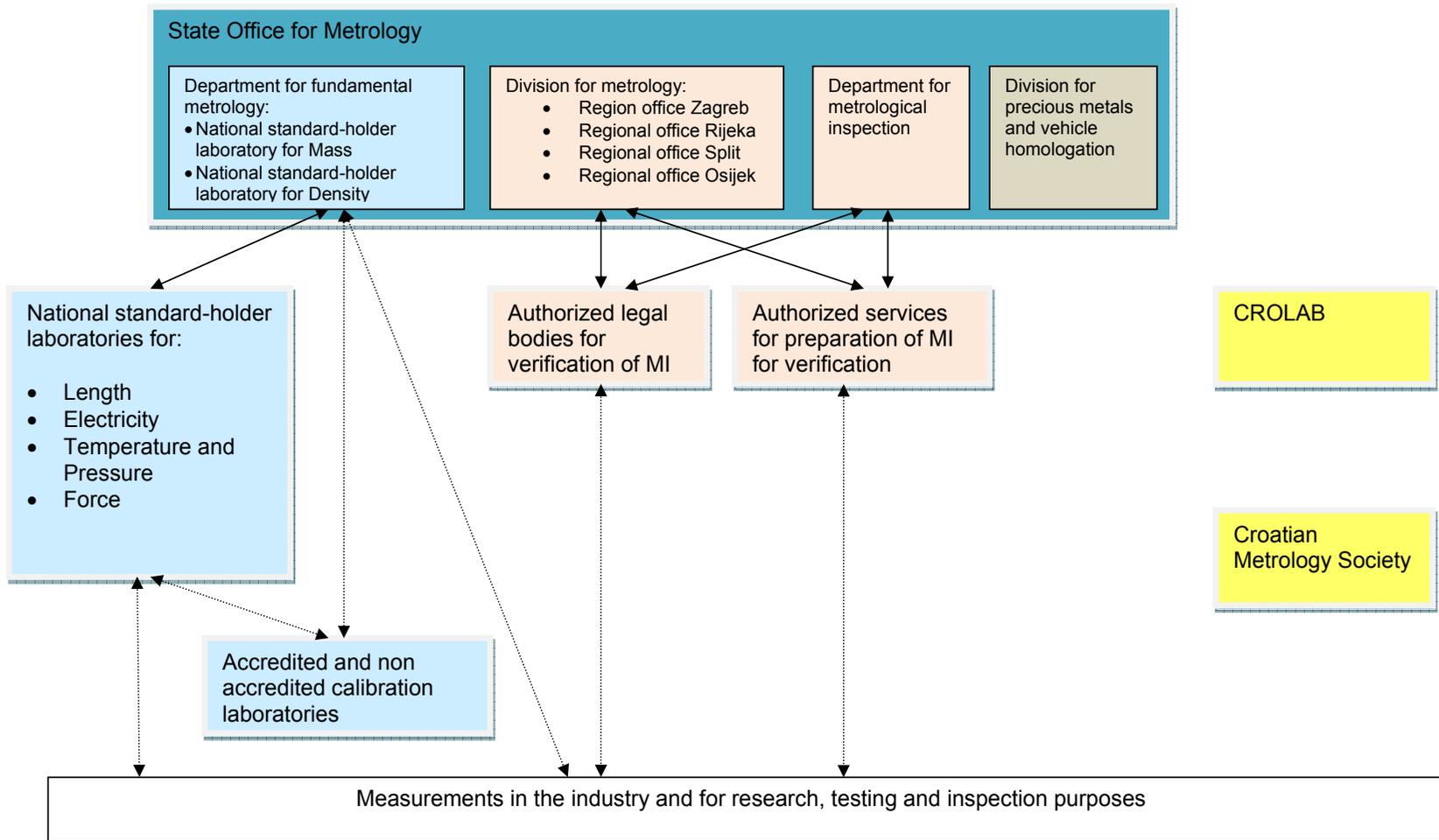
The overall implications from the National strategic perspective have a multidimensional and cross-cutting reflection on the Metrology and related conformity assessment field.

At this stage, Croatian national metrology system's capabilities (in the fields where they are existent) are performed on a highly professional level. The infrastructure needs to evolve and provide services adapted to the needs of prosperous Croatian economic sectors. In line with the latter, existing and potential standard-holder laboratories should be in a position to explore the potentials for extended and improved capabilities. Furthermore, **decisions on establishment or designation of new laboratories have to be needs driven.**

**Metrology as an activity in the field of the quality infrastructure plays a significant role in fulfilling conditions for the country's integration into the European Internal Market and implementation of the *acquis communautaire*.** According to the Implementation Plan for the SAA as well as the National Programme for Integration of the Republic of Croatia into the EU, the harmonisation efforts are in progress. The final objective remains complete alignment of the legislation and enhanced European metrology practices. Despite of the progress achieved in this field, the need to further strengthen the administrative capacity of the competent national institutions and achieve proper implementation of harmonized legislation remains visible.

The Croatian metrology system through its governmental and non-governmental organizations is linked to the international and European organizations. Thus, Croatian representatives actively participate in their activities. In addition, important international metrology events take place in Croatia. **National needs in selected, strategically important areas of interest are the main determinant in decision-making on future development, improvement and possible extension of measurement capabilities.**

CURRENT ORGANIZATION OF CROATIAN NATIONAL METROLOGY SYSTEM



Legend:



### 3 STRATEGIC ANALYSIS

#### 3.1 External analysis

##### The metrological Environment

The Croatian metrology system is developing in the light of the key political and economic processes on national and international scene. The Republic of Croatia is a relatively small but open and rather dynamic market economy. As such, our country is clearly advancing towards EU membership. Thus, the National metrology infrastructure needs to promote **innovation and knowledge based economic activities, as well as** to ensure *acquis'* implementation in the field of *quality of life*, by providing reliable measurements.

The scope of metrology services is extremely wide and covers virtually everything from operating electrical quantities standards in support of any ICT hardware development, to proper protection against non-ionizing radiation or even appropriate tracking of contaminants in drinking, as well as coastal waters. **The assumption of having commercially viable high level metrological facilities has been proven as unsustainable even in countries with large industrial tissue. Consequently, the concept of assignment of metrology as a governmental responsibility and establishment of predominantly state financed national metrology institutes is a widely accepted approach. Croatia makes no exception of this rule.**

##### Distributed competences

Undertaking this role, the state has laid the foundations of a **distributed national metrology system** as defined by the Metrology Act. The steering role in this perspective has been entrusted to the State Office for Metrology (DZM). The latter's mission include development and implementation of the governmental policy in the field and budget support for associated laboratories performing tasks of recognized national importance. **The proposed amendments of the Metrology Act would (if adopted) provide basis for splitting these competences amongst the State Office for Metrology and the newly established Croatian Metrology Institute (HMI).** The former would conserve the purely *regulatory functions*, while HMI would focus on the *scientific aspects of metrology*, as well as ensuring *compliance for measurements linked legal requirements* in the Republic of Croatia.

From administrative point of view, the State Office for Metrology acts independently undertaking the full responsibility for *regulatory, technical and surveillance functions* and directly reports to the Government. Thus, the institutional positioning of metrological activities on the national scene would differ after the establishment of the HMI. The Croatian Metrology Institute would have the status of a public institution, equal to those of the *Croatian Standards Institute (HZN)* and the *Croatian Accreditation Agency (HAA)*.

On the other hand, the European integration process enhances the operational linkage between the respective institutions in the *quality infrastructure fields (standardization, accreditation, metrology and certification, as well as market surveillance)*. **Thus, these topics are interlinked and require a consolidated perception in handling Internal Market issues from the perspective of a future EU member state.** *The Ministry of Economy, Labour and Entrepreneurship (MGRP)* has the steering role in this respect. Policy-wise, the quality infrastructure provides the horizontal base for the **free movement of goods - crucial area in the EU integration process**. Since trade, industry and internal market issues are assigned to this Ministry, its importance as an actor is increasing.

The Ministries competent in the field of agriculture, health, and environment will certainly have an increasing interest in the quality Infrastructure, due to their key monitoring competences linked to the amount of legislation required measurements.

Under this optics, it is realistic to expect that the need for a sound and coordinated quality infrastructure development is associated to the alternative of concentrating the formal administrative responsibility for the quality infrastructure in a single Ministry - an approach chosen by many EU member states.

*One crucial step closer to the EU membership*

**Our National strategic objective is to fulfill the complete range of EU membership requirements by 2009.** From the current perspective, a period of two years is provided for the national metrology system to respond, implement measures and finally adapt. In this context, the issue whether industrial operators would benefit from metrological coverage within the country tends to be marginalized. The option of "importing" measurement traceability is straightforward, while allowing metrology related conformity assessment issues come to the fore. Establishment of conformity assessment bodies for measuring instruments on the base of existing capacity of DZM laboratories is correlated with the segregation of certification and surveillance functions. The Government of the Republic of Croatia has initiated the changes in the metrological and related conformity assessment fields. As a consequence, the State Office for Metrology has triggered modifications of the existent legal framework. The realization at this stage clearly depends on the adoption and implementation of the amended Metrology Act and the institutional capacity to cope with the transformation in the defined timeframe.

In the framework of the EU accession efforts, the readiness of Croatian conformity assessment system for industrial products to integrate into the European Internal Market is a matter of consideration and thorough review. The institutions competent for Metrology and Accreditation are expected to contribute by achieving international recognition of their certificates.

In addition, our metrology system could act under pressure of **increasing domestic needs to strengthen inspection capacity in the fields of agriculture, food safety, veterinary and phytosanitary policy, environment and consumer and health protection.** The current profile of the national system is classically restricted to physical measurements, while the above areas tend to enlarge the scope of measurements to the chemical field. The National metrology system is on the way to meet government's expectations to be able to provide at least the minimum requested services. In this picture, the State Office for Metrology as a key pillar is in charge of defining required measurement capabilities at the national level and derived **needs' driven** investment strategy.

*Research & Development opening*

Recommendations for raising the competitiveness through promoting innovation and knowledge based economic activities, boosting productivity, encouraging certification and extending support in implementation of quality ensuring standards laid down in the government's strategic development framework for 2006-2013 draw attention to the "excellence" of the national metrology competence. Measurements are in the core of R&D activities and technological innovation. The existing system is in a position to provide partnership and high level expertise but within a limited measurement scope. **As far as biotechnologies, new synthetic materials and natural resources (Adriatic Sea, biodiversity etc.) are concerned as well as partially ICT and nanotechnologies, the research community lacks nationally available metrology services.**

Last but not least, the metrology as a scientific discipline offers a wide range of indispensable services in support of Governmental actions towards implementation of quality ensuring standards. As indicated within the Needs analysis results, the Croatian industry in general is capable of recognizing that reliable and traceable measurements are a huge asset contributing to the quality of products and services. However, the existing deficiencies in skills and proper understanding are unfavourable to the upgrade of the measurement practices into the daily activities. Thus, this makes management hesitant to invest in measurements infrastructure, often due to the simple lack of information. The National metrology system assumes the responsibility for such **knowledge transfer.**

Thus, the Croatian metrology system is challenged to respond to clear and time-defined government's expectation deriving from the context of the EU integration related topics.

**End-users driven approach**

**The national metrology system has three main groups of direct customers: industrial operators, testing laboratories and the research community.** Some actors in the system, namely some designated national standard-holder laboratories provide services in the neighbourhood.

It is a matter of fact that the industry is not a homogeneous group in terms of metrology related demands. In many transitional economies, export oriented companies are the first to reflect on tailor-made metrology solutions that open the gate to external markets while the grouping of locally operating SMEs is the last exposed on quality related requests. While big operators are knowledgeable and, when needed, could afford services from abroad, smaller companies are fully dependant on information and capabilities provided on national scale. Since Croatia is not exempted from this rule, metrology related industrial needs have been studied in order to map gaps and identify priorities.

In summary, **industrial operators** represent a share of about one fifth of Croatian economy. The sample group of manufacturing industry contacted has demonstrated a relatively low interest in contributing to metrology and conformity assessment prioritization. Responders profile corresponds to companies with certified quality management systems that identify few metrology related needs and barely mention product certification aspects. The enquiry results coupled with more fruitful face-to-face interviews and inputs from certification and consultancy companies indicate a positive trend of increasing demand in quality management system certification and product certification both in voluntary and mandatory fields and respectively more needs in metrology services. The last is expressed through increasing numbers of annually provided metrology services by different actors of the national metrology system. While traceability dissemination for physical measurements at the highest national level is typically considered to be appropriate, industry's concerns about (local) availability and applied tariffs and delays point to further needs in development of the secondary tier of calibration laboratories. Operators predominantly look for "all-inclusive" supplier's services for many measurements that include calibration of measuring instruments and standards frequently provided from abroad. Implementation of harmonized legislation and quality and safety requirements boost the market of the measuring instruments particularly in some "new" areas (for example, manufacturing related food safety and environment protection aspects) but situation vary from one to another sector. **Establishment of more calibration laboratories (in terms of numbers, local distribution and range of services), international recognition of accreditation, development of a Croatian conformity assessment system, establishment of a Croatian Metrology Institute and availability of metrology related information are among commonly shared expectations.** Thus, industry's viewpoint is based on higher expected demands in diverse metrology applications.

The group of **testing laboratories**, established both in public and private sectors, includes accredited and non-accredited ones. Many of them are direct providers of services to the industry. Belonging to the same professional field, the group is more responsive to metrology and conformity assessment related issues and able to specify particular needs. Some of the observations made for the industry are valid for the testing sector as well. For example, laboratories ask for extension of the range of nationally available calibration services, better access to metrology information, recognition of competence of calibration providers (accreditation) and international recognition of certificates. In contrast to industrial operators, they address needs in more capabilities on national level with **focus on metrology areas that support measurements in Chemistry and enlarging the specter of services in support of inter-laboratory comparisons.** As confirmed during consultations with Croatian Accreditation Agency, such reaction pictures in a realistic way existing needs in laboratory sector. **National metrology system's sole orientation to physical measurements is considered as not satisfactory in the light of growing testing capabilities and respectively increasing needs in demonstrating technical competences and comparability of measurement results.**

The **research community** is represented by Universities and Research Institutes. For the purposes of the strategy development, the group has not been specifically addressed due to current calibration providers' orientation of the national metrology system. In a certain extent R&D needs in metrology are reflected in the analysis through involvement of several researchers in strategic discussions and considerations on research policy recommendations. This group of customers has a potential to expand, while involving innovation oriented private companies, but still remaining a limited shareholder of the total amount of services provided by the national metrology system. The specific feature derives from the facts that its needs are at the highest metrological level usually in few strategically selected niches and depend on sophisticated and expensive facilities. The top layer of the National metrology system is expected to respond to R&D needs complemented by a clear governmental strategy in favour of innovation.

Some national standard-holder laboratories provide calibration services to national metrology institutes and laboratories in neighboring countries. Whether this market will evolve depends on development of respective metrology systems and ability of Croatian national standard-holder laboratories to cope with requirements for international recognition. On the other hand, **the situation is favourable to establish selected “centers of excellence” with a regional dimension exploring unsaturated niches of testing and calibration market.**

In conclusion, the current national metrology system in Croatia is in position partially to satisfy growing customers' needs. **While the national layer is challenged to demonstrate an internationally accepted “excellence” and step further in focusing on top level research related metrology applications, the secondary tier needs substantial growth possibly accumulating some services devolved from the national standard – holder laboratories.**

### **Broader framework**

In order to visualise our broader positioning, we have to consider that Croatia would, following the accession, become a bordering EU country to a region that is also strategically orientated to join the European family. Metrology systems in all neighbouring countries (EU members or not) differ in development but all of them together belong to the same community of European and international organizations. Cooperation exists on several layers:

- National metrology institutes through EUROMET (EURAMET) and the Meter Convention
- Legal metrology through WELMEC and OIML
- Non-governmental organizations uniting laboratory community through EUROLAB, EURACHEM, IMEKO.

Some strategically important developments on the European scene certainly deserve to be considered. The European collaboration in measurement standards has recently been transformed from a voluntary collaboration (EUROMET) into more structured and legally representative non-governmental organization (EURAMET). **The new shape of the organisation is a reflection of a strategic orientation of the European metrology institutes to research topics and an ambition to implement a European Metrology Research Program (EMRP) jointly financed by National governments and the European Union research funds.** Thus, country's participation to the scheme is conditioned by the existence of a specific **National Research Program in Metrology**. At the very initial stage of this process a limited number of members of EURAMET are committed to participate and contribute to the programme and institutes from transition European states are particularly challenged to cooperate on equal base with ones from countries with highly industrialized economies. **This topic is viable for Croatian metrology since national standard-holder laboratories participation in the program could enhance the above listed transformations related to government priorities and customers' needs.**

In other areas, the progress is moderate in comparison to substantial changes within EURAMET. A general consideration to be valid for all of them is that Croatian metrology needs recognition and active involvement in European projects.

## 3.2 Internal analysis

### Legal framework

The Law on Metrology adopted in 2003 follows the guidelines of OIML D1 "Elements for a Law on Metrology". It defines duties of DZM, legal units of measurements, requirements to carry out activities in fundamental metrology, industrial metrology and legal metrology and to perform metrological supervision. The law makes provisions for issuing of secondary regulations: ordinances and technical rules.

European legislation in the field of metrology comprises two groups of Directives from the so-called "Old Approach" and "New Approach" for technical harmonization.

The following metrology linked Old Approach Directives have been transposed into the national legislation through secondary legal acts: 71/317/EEC; 71/347/EEC; 71/349/EEC; 74/148/EEC; 76/765/EEC; 86/217/EEC; 80/181/EEC; 75/106/EEC; 76/211/EEC; 75/107/EEC and 80/232/EEC).

The New Approach Directives 90/384/EC on non-automated weighing instruments and 2004/22/EC on measuring instruments are transposed in regulations issued on the base of the Law on technical requirements for products and on conformity assessment. The Ministry of Economy, Labour and Entrepreneurship is steering the on-going revision process of this act.

Later, during the screening of legislation included in the Chapter 1 "Free movements of goods" a revision of the Law on metrology has been planned in order to improve compliance. The draft Law on amendments to the Law on metrology is currently under adoption procedure by the Parliament.

### Currently available resources

Croatia has many institutes and laboratories where **resources in terms of people, facilities, and equipment** provide solid basis for metrological activities.

#### The "material" foundations

**DZM laboratory facilities are established at four locations: Zagreb, Rijeka, Osijek and Split.** The Zagreb site is used both for maintenance of the mass and density national standards and for legal metrology applications. The other sites are exclusively "*legal metrology*" oriented. While buildings in Rijeka, Osijek and Split are suitable for performance of the assigned tasks, the ones in Zagreb do not entirely meet the requirements. The plans to extend the building have been enhanced by the delivery of new mass measurement equipment in 2005. The completion on this project remains unfulfilled. Currently used office facilities in Osijek serve their purpose to a limited scope. The possibility of shifting activities in a large (unoccupied) DZM owned building in city's suburbs requires some substantial investments. This project appears today obsolete but has not been completely abandoned.

**In principle, the designated national standard-holder laboratories are in a position to provide appropriate conditions needed for maintenance of the national measurement standards.** Their particular position, being part of higher education and scientific establishments, allows them to be financed by hosting institutional budgets, while the resources for maintenance of the national standards, ensuring their traceability, participation in technical committees and EUROMET projects (inter-laboratory comparisons etc.), as well as the salary for one expert operating the equipment are provided by the State Office for Metrology.

The State Office for Metrology as a beneficiary of three CARDS Programme projects was able partially to upgrade and extend the existing national measurement capabilities. Valuable new equipment has been installed both at DZM and designated national standard-holder laboratories. Some laboratories, such as the one for dosimetry, as well as the one for acoustics and vibrations, have been exploring IAEA and the IBRD driven complementary assistance.

Designations have not been granted yet in several other fields, such as: *Metrology in Chemistry, Time and Frequency, Radioactivity, Flow and Photometry and Radiometry*. **Potential resources (human and material) for development of the above listed fields are principally available outside the State Office for Metrology.**

Measurement capabilities in the field of legal metrology allow DZM, as well as the authorized legal persons, to guarantee an adequate level of services. *Conformity assessment bodies* are not established yet, but resources for testing of MI exist mostly outside the State Office for Metrology.

*The "human factor" as a key determinant*

Objectively assessed, the overall technical expertise in our country is at a pretty advanced level. **A common denominator - as in many other modern economies – is that private sector is overwhelmingly dominating the public one in terms of attractive employment opportunities and financial compensations.** This constellation complicates to an extreme extent the task of attracting (and especially maintaining) young and competent staff on the State Office's payroll.

In this respect, designated National standard-holder laboratories are in a considerably more comfortable position, linked to their core Academic opening (e.g. as part of the Zagreb University) and possibility of attracting prosperous junior researchers.

As far as the State Office for Metrology is concerned, 60% of the staff members are technicians. Currently, over half of the employees perform exclusively verification activities (63 out of 115). Thus, a total of only 3 persons work at the National mass and density laboratories and 6 persons at the metrological supervision division.

State funding is steered through the State Office for Metrology with the purpose of fulfilling all legally required activities, as defined by the Metrology Act. The funds generated through verification and providing other metrological services by DZM, as well as by authorized legal bodies are in principle reinvested in the upgrade of the available metrological infrastructure. The portion of State budget financed activities of the designated national standard-holder laboratories covers the salary of one field expert (operating the national standards), the traceability ensurance of these standards and expenses linked to representation of the Republic of Croatia in corresponding European and International organizations.

*State and market drivers on the metrology playground*

The assumption of having commercially viable highest level calibration facilities has been proven as unsustainable even in countries with large industrial tissue. Consequently, the concept of predominantly state financed National Metrology Institutes is a widely accepted approach. Croatia makes no exception of this rule.

Hence, the Governmental funding is targeting the provision of metrological services in the sense of traceability dissemination from the highest National level. This is a critical role the State has to play in providing basis for any existing, and possibly developing, **technology intensive** industry, and even more in assuming some typical responsibilities, such as ensuring healthy environment and *quality of life* for its citizens.

The scope of these services is extremely wide and covers virtually everything from operating "electrical quantities standards" in support of any ICT hardware development, to proper protection against non-ionizing radiation or even appropriate tracking of contaminants in drinking, as well as coastal waters. Thus, it is a matter of National strategic decision which fields should benefit from highest metrological coverage within the country, and whether and/or which measurements would be simply traceable abroad without any (Government funded) National level involvement. The decisions here are based on the hypothesis of theoretically always "scarce financial resources" that need to be invested in the most efficient and effective way, responding accordingly to nationally agreed economic priorities on the longer-run.

On the other hand, while zooming on the public funding scale the accent should be on the **"highest National level" services**, while avoiding any potential **market distortions** on the scale of commercially available (now or in the future) "lower level" industrial calibrations.

### Services and capabilities

The current Croatian metrology system typically provides limited number of available services (Annex 3) according to available capacities. Some of the services are required by the legislation, others are needed in order to implement quality ensuring standards and good practices.

At the current state of art, metrological services required by the Metrology Act are available even if limited by existent calibration capabilities and competences.

### Measurement traceability dimension

Croatian national measurement standards are established at primary (length, density, DC voltage, temperature, acoustics) and secondary level (Annex 3). Thus, each of the existing national standard-holder laboratories identifies needs for improvement of existing capabilities or development of new ones. Several measurement fields remain uncovered at the national level. Designated laboratories in *Metrology in Chemistry, Radioactivity and Radiometry* are still inexistent, besides obvious legislation driven needs for traceability in these areas. Hence, available capacities at existing Croatian laboratories could fill this gap.

As in most of the countries, the ambitions for establishment of national capabilities could be matched only for a limited number of measurement fields. For the rest, traceability would be "imported". Nevertheless, existing national layer lacks capabilities supporting the segment of "quality of life" measurements. A potential to develop new services exists rather outside DZM. On the lower accuracy level, the number of accredited laboratories providing calibration services is relatively limited. The process of accreditation has to continue and the Croatian metrological community, including DZM, HMD and CROLAB could play active role in promoting the assets of accreditation.

Up to date, no Croatian calibration and measurement capabilities are registered in the CIPM MRA database even though DZM has signed the agreement. The Croatian Accreditation Agency is not a signatory of the EA MLA for calibration laboratories.

The national metrology system doesn't provide services as inter-laboratory comparisons with reference values that could enable evaluation of comparability of measurement results even if some laboratories outside the national system organize similar activities. Such services are needed for accreditation purposes. Some capabilities have to be established and **a priority should be given to the needs of accreditation of testing laboratories that support exportability of Croatian products and implementation of legislation.**

### Conformity assessment dimension

Conformity assessment of MI in the context of the recently transposed New Approach directives is inexistent yet. Since the number of Croatian producers of MI is limited and each of them is specialized in production of different categories of measuring instruments it is unlikely to expect a private sector interest in establishing a conformity assessment body. Some producers manufacture legally controlled instruments outside the scope of the New Approach Directives and are successful on the international market. In addition, conformity assessment of measuring instruments also relies on national capabilities in the scope of directives (such as Low Voltage Directive, Electromagnetic Compatibility Directive) where conformity assessment capabilities are in process of establishment. As a minimum, there is a need to improve recognition of testing results through accreditation of laboratories for testing of MI. The best option would be if accreditation is provided by the Croatian Accreditation Agency that becomes a signatory of the EA MLA for testing laboratories.

Existing capabilities to provide verification of legally controlled measuring instruments and control of net quantities of pre-packed products are satisfactorily developed.

However, extensive facilities for type examination of measuring instruments (conformity assessment module B) are not sustainable due to the limited number of national producers. On the other hand, the demand for product verification and unit verification procedures (modules F and G) is objectively expected to increase and therefore these efforts appear realistic. In addition, their local availability will help manufacturers to

maintain cost-effectiveness while avoiding necessity of annual transport of thousands of electricity meters abroad or of inviting foreign bodies on-site to inspect each newly mounted gas pump. Since some producers already operate quality management systems, establishment of a conformity assessment body for the full quality assurance procedure (module H1) is another viable option

### **Competences**

Existent competences at the State Office for Metrology are of primary concern for the national metrology system. Hence, DZM suffers today from some objective difficulties – common for many other state institutions world-wide: **scarcity of human resources inspiring dynamism and motivation**. The results in addressing this major concern would be closely correlated to the internal organisation's evolution in respect to the management, leadership and communications skills. The solid metrology expertise existing in the country could be fully exploited only when it is combined with a developed institutional capacity.

The promotion of such an essential component, as metrology is, in a modern knowledge based economy has to figure on the top of the short-run priorities. At the level of the state administration, stronger links are needed with Ministries competent in the fields of *economy, trade, environment, agriculture and health*. As concluded in the external analysis part, economic operators recognise DZM mostly through its legal metrology services and CROLAB and HMD as training providers. Joint efforts from the State administration and non-governmental organizations could **improve the overall awareness about the insufficiently recognized importance of the metrological activities in supporting economic growth, prosperity and quality of life of our citizens**.

### 3.3 SWOT matrix

In the scope of the analysis of the current measurements infrastructure in the Republic of Croatia, the participants in the system (through the Working group) have identified the following strengths, weaknesses, opportunities and threats. The choice of an alternative strategy, as well as the Strategic planning within the next two chapters of this document are derived in the light of addressing the raised concerns from listed weaknesses and threats, while enhancing the existent strengths and opportunities for future development of the National metrology system.

<b>INTERNAL</b>	<b>EXTERNAL</b>
<b><i>Strengths</i></b>	<b><i>Weaknesses</i></b>
<ul style="list-style-type: none"> <li>• Good traditions in metrology and technology</li> <li>• Solid capacity and existing infrastructure and networks</li> <li>• Solid human resources within the system</li> <li>• Specialized and complete territorial coverage in the field of legal metrology</li> <li>• Advanced stage of harmonization of legislation</li> <li>• Highly competent and relatively well equipped designated national standard-holders laboratories</li> <li>• Impartiality of DZM services secured by its status as a governmental body</li> <li>• Solid reputation of metrological NGOs</li> </ul>	<ul style="list-style-type: none"> <li>• Absence of common vision on the development of the national metrology system</li> <li>• Organizational and performance weaknesses in the existing system</li> <li>• Weak administrative capacity of DZM implying a negative external perception</li> <li>• Low level of public awareness about metrology</li> <li>• Absence of international recognition of calibration certificates</li> <li>• Lack of R&amp;D in metrology</li> <li>• Gaps in calibration and conformity assessment services</li> <li>• Lack of /or obsolete equipment</li> <li>• Lack of space for new laboratories and offices in Zagreb and Osijek</li> <li>• Insufficient second layer calibration laboratories</li> <li>• Relatively low salaries in the public sector</li> </ul>
<b><i>Opportunities</i></b>	<b><i>Threats</i></b>
<ul style="list-style-type: none"> <li>• Clear vision of governmental goals and industrial needs</li> <li>• Increased demand in quality and entrepreneurial spirit</li> <li>• Possibilities for external assistance and funding</li> <li>• Existing connections with European NMIs</li> <li>• Availability of external know-how</li> <li>• Membership in European metrology organizations</li> <li>• Potential for playing a major regional role</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient funding to implement the strategy</li> <li>• Limited support from the stakeholders</li> <li>• Difficulties to recruit young and skilful staff</li> <li>• Decrease in incomes from verification</li> <li>• Slow process of harmonization</li> <li>• Lack of confidence in national human resources and reliance on foreign advisors</li> </ul>

## 4 ALTERNATIVE STRATEGIES

### Dispositional dimension

#### 1/ *Distributed vs Centralised model*

**Using all available resources and avoiding duplication (the opposite implies underused human and material capacities) has been adopted as a guiding idea ever since the initiation of the National metrology infrastructure.** Thus, the distributed system, comprising the coexistence of two DZM operated, and four externally managed National standard-holder laboratories (two more on the way of joining the platform) has manifested a number of advantages in terms of rationalising the overall expenses of the system.

#### 2/ *How much of the "distributed" is optimal*

**Even though it is extremely challenging from overall managerial perspective,** the system seems to be suitable enough through the optics of a complex multi-dimensional approach. As a bottom line, **it allows to maximise the overall output of the available scientific, industrial and legal "nationwide expertise and potentials".**

### Institutional dimension

Number of arguments generated at all layers of the existing national quality infrastructure system is suggesting that further improvements are an objective need. They all figure within the SWOT matrix. However, **no institutional changes can directly address raised concerns unless they are only an element of a broader action that is centered on competences, rather than names of institutions.**

Alternative strategies formulated at the top management level of the State Office for Metrology consider three options - the first constituting no organizational change of the system and the second and the third proposing organisational changes:

#### **Option 1/** Improve DZM institutional capacity

The key fields for improvement deriving from the SWOT matrix are not explicitly institution-centred. Thus, it is perfectly imaginable that (at least some, if not all of) the current sources of concern can be tackled within the existing institutional framework. Still, the overwhelming majority of national stakeholders place the institutional change on the top of the priority list, making this option appear obsolete.

#### **Option 2/** Establishment of HMI as a public institution performing technical tasks in fundamental and legal metrology, while DZM conserves regulatory functions (legal acts, authorisations, metrological supervision, homologation of vehicles and control of precious metals) – as illustrated in Annex 1.

Clearly, two national institutions acting in parallel as part of the national metrology and conformity assessment system does neither appear organisationally optimal, nor it is cost-efficient. Still, this option provides solid ground for separation between operational and regulatory functions. If accepted as an intermediary stage and coupled with a substantial effort in human resources development, this option can be well capitalised.

#### **Option 3/** Establishment of HMI as a public institution performing technical tasks in fundamental and legal metrology, while DZM ceases its activity (Annex 2). Regulatory functions shifted as follows:

- legal acts, authorisations – the ministry competent in the area of the free movement of goods;

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- metrological supervision – State Inspectorate;
- homologation of vehicles – ministry competent in the area of transport / safety

Under the assumption that the establishment of the HMI is today unavoidable (for several previously stated reasons), this organizational adjustment can be defined as the most appropriate one:

- allows the Metrology Institute to focus on its primary tasks;
- shifts the remaining functions to other institutions, having natural interest in respective fields;
- can potentially create favorable environment for scientific excellence and networking.

### The chosen strategy

Considering the three above mentioned hypothesis, as well as other less realistic options, **the outcome of the strategy development process suggested that the second alternative seems to be the most suitable one.**

**Number of arguments has been already listed in favour of adopting this path for institutional development, but they can be summarized in the following lines:**

1/ This alternative allows a ***gradual development*** of the national system, while avoiding major disturbances that would otherwise radically affect the allocation of existent human resources.

2/ It also creates more ***favorable environment for development of scientific and industrial metrology.***

3/ From an EU integration perspective, ***it responds to European requirements*** for segregation of certification and surveillance activities.

*NB: Although it must be strongly emphasised that there are no EU requirements to create certain institutions. The requirement only refers to how the respective responsibilities are separated.*

4/ ***On the National scale***, this option responds to the best extent to ***stakeholders' expectations.***

**On the other hand, the counter-arguments can be summarized, as follows:**

1/ It is indeed a costly option, since it takes into account the social factor.

2/ National metrology system operated under this hypothesis increases the level of complexity while coordinating different constitutive entities.

Hence, the fact that this alternative captures the optimal solution for the National Metrology and related conformity assessment system ***is valid under a limited time horizon.*** The elaborated logic follows needed adjustments of the existing institution ***through gradual changes that would ideally end (on a longer run) in a system described under the third hypothesis.***

## 5 STRATEGIC PLANNING

### 5.1 Vision and mission

The **vision** for the National metrology system of the Republic of Croatia is to be a well-functioning and internationally recognised metrology service provider addressing needs in strategically important areas.

The **mission** of the National metrology system of the Republic of Croatia is to operate the entire metrological infrastructure with the purpose of contributing to the welfare of citizens and permanent improvement of their quality of life and providing support to overall competitiveness of the national economy.

The **actors of the National metrology system** identify themselves with the above mentioned vision and mission and are committed to fulfil the strategic goals and objectives. The success of our National strategy would be closely related to the deployment of the recommended strategic actions into our own organizational strategies. This is valid for all actors of the National Metrology and related conformity assessment system of the Republic of Croatia.

The **National Metrology Council** will provide the forum where implementation of the National strategy is monitored, adjusted and publicly communicated.

The envisaged period for implementation of the strategy is until 2013 and is in line with Strategic Development Framework for 2006-2013 of the Government of the Republic of Croatia. The target deadline for objectives and actions contributing to completion of negotiations aiming at bringing Croatia into the EU is 2009.

## 5.2 Strategic goals, objectives and actions

### Goal 1: Maintain an effective and efficient system

The National metrology system should be designed in order to provide the best available support to the end-users of metrological services. Therefore the institutions being part of it should function as an integral part of the wider quality infrastructure. Managing a National distributed metrology system is extremely complex, but the choice is driven by the objective dispersion of competences in different metrological fields and the willingness to favour an overall cost-effective approach. Under the hypothesis of adopted amendments to the Metrology Act, the future Croatian Metrology Institute would start playing an increasingly important role in maintaining the existing and setting-up new strategic partnerships with institutions having relevant metrological competences.

*Objective 1.1: Better explore opportunities of the distributed model of the system*

Actions		Benchmarks	Competence	Target
1.1.1	Improve the legal framework for the distributed system	Adopted amendments to the Metrology Act	DZM	Oct 2007
1.1.2	Establish a Croatian Metrology Institute (HMI) with a status of a public body	Ordinance on the establishment of the HMI	Ministry of Science (Government of RH)	Mar 2008
		Elaborated Statute and other indispensable documents necessary for establishment of HMI	Ministry of Science DZM & HMI	Mar-May 2008
		Designated <u>Acting</u> Director of the HMI	Ministry of Science (Government of RH) DZM	Sept-Mar 2008
		Assigned staff of the HMI	Directors of the HMI and DZM	Sept 2008
1.1.3	Establish a system for results oriented "assignment" – "reporting" interactions between HMI and the designated national standard-holder laboratories	Memorandum fixing modalities for regular reporting from the designated National standard-holder laboratories	HMI	Dec 2008
1.1.4	Map laboratories with a potential to undertake tasks in the distributed system	A list of laboratories to become National standard-holders	DZM	Dec 2007
		Awareness workshop on metrology for potential National standard-holders	HMI	Dec 2008

Oblikovana tablica

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Objective 1.2: Enhance leadership and strengthen relationships between different actors within the national system

Actions		Benchmarks	Competence	Target
1.2.1	Make the National Metrology Council functional	First Meeting of the National Metrology Council	<u>Ministry of Science DZM</u>	<del>Jan</del> Jun 2008
1.2.2	Clearly define relationship between DZM and HMI	Amended Metrology Act	DZM	Oct 2007
1.2.3	Develop DZM and HMI organisational strategies in line with the national metrology strategy	Organisational strategy for the HMI	HMI	Dec 2008
		Operational plan for the DZM	DZM	Dec 2007
1.2.4	Model HMI as an open and creative platform for metrology excellence	<del>Statute of the HMI</del> HMI web-site available	HMI	<del>Oct</del> Dec 2008

Oblikovana tablica

Objective 1.3: Improve cooperation with all metrology stakeholders as well as with the quality infrastructure in general

Actions		Benchmarks	Competence	Target
1.3.1	Establish or up-date cooperation agreements	Bilateral agreements (with other NMIs) and multilateral agreements (e.g. EURAMET) signed by the newly established HMI	HMI	Dec 2008
1.3.2	Continuously raise awareness about metrology	Organise awareness event on Metrology and related CA topics, including different actors of the distributed system	DZM, HMI, CROLAB, Croatian Metrology Society	Annual
		Elaborate info-leaflets by Metrological field, involving different sectors in preparation process (National standard-holder laboratories, professional associations, business community, Academia etc.)	DZM, HMI	Annual
1.3.3	Publishing activities	Prepare and publish bulletin and/or information	DZM-HMI, while including HAA,	Annual

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		booklet enhancing interaction between National actors of the distributed system	HMD, CROLAB, Chamber of Commerce	
		HMI Annual Report	HMI	Annual

Objective 1.4: Prepare the system for optimization

Actions		Benchmarks	Competence	Target
1.4.1	<b>Merge DZM, fulfilling regulatory functions, within the relevant ministry (ideally within the Ministry competent for the main part of the quality infrastructure system)</b>	Regulatory functions transferred and fulfilled by competent Ministry(ies) (e.g. Ministry competent for economy and trade)	DZM / relevant ministries	2012
1.4.2	<b>Amend the legal framework to enable transfer of DZM functions</b>	Amend the legal framework defining the scope of Ministries and other governmental bodies	DZM / relevant ministries	2012
1.4.3	<b>Transfer remaining functions from DZM to other competent Ministry(ies) and cease functioning of DZM</b>	Remaining regulatory functions transferred to competent Ministries (e.g. vehicle homologation, control of precious metals and metrological supervision)	DZM / relevant ministries	2012
		DZM ceases activity	Department within the Ministry competent for metrology	2013

**Goal 2: Further develop metrology services in response to strategically important needs of Croatian society and industry**

The current focus of the available metrological infrastructure is on providing traceability of measurements. In line with the global trends, the national metrological layer should progressively shift the main interest towards the R&D activities. The emergence of private laboratories disseminating traceability at the industrial level would allow following the former pattern. The needs for nationally available metrological services have to be systematically reevaluated (in multi-annual cycles) and decisions on extended or eventual new designations based on. Access to information and knowledge transfer linked to metrology would increasingly become important for the economic and scientific actors. The State institutions would have to be prepared to respond accordingly to an increased demand in this respect.

*Objective 2.1: Adapt national metrology system's profile and services to Croatian society and economy needs*

Actions		Benchmarks	Competence	Target
2.1.1	<b>Extend the scope and range of services in existing designated national standard-holder laboratories according to existing and anticipated National needs</b>	Elaborated multi-annual (3 to 5 years) plans per Metrological field	Designated National standard-holder laboratories	<del>Jun</del> <del>2007</del> Dec 2008
2.1.2	<b>Designate and/or establish national standard-holder laboratories that will cover needs not covered by existing designated National laboratories</b>	Extended or new designations according to the Investment strategy (viscosity, metrology in chemistry, photometry and radiometry, time and frequency, ionizing radiation, acoustics and vibrations, flow)	HMI	2013
2.1.3	<b>Maintain and improve demand-driven geographic decentralisation and specialisation principles</b>	Assessment on regionally important metrological activities	Current DZM regional centres (4)	<del>Sep</del> <del>2007</del> Nov 2008
		List of defined centres of metrological interest for four existing Regional offices	DZM Director	<del>Oct</del> <del>2007</del> Dec 2008

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Objective 2.2: *Extend national calibration and measurement capabilities and services according to National needs*

Actions		Benchmarks	Competence	Target
2.2.1	<b>Focus the calibration activities of the national standard-holder laboratories to the highest metrological level</b>	Report summarizing metrological fields where distorted market competition is an objective concern	<del>HMI DZM</del> (in consultation with National Standard-holder laboratories)	<del>JunDec 2008</del> <sup>7</sup>
		Report summarizing measurement capabilities relevant to focus on R&D activities in the field of Metrology	HMI (in consultation with National Standard-holder laboratories)	Dec 2008
2.2.2	<b>Elaborate, adopt and implement an investment strategy in response to identified priorities</b>	Elaborated investment strategy that allows National standard-holder laboratories to focus on metrological activities to the highest National level (taking into account the scientific dimension)	DZM (in consultation with National Standard-holder laboratories)	Aug 2007

Objective 2.3: *Support further development of the secondary layer of calibration laboratories*

Actions		Benchmarks	Competence	Target
2.3.1	<b>Shift where possible, routine calibration services from national layer to commercial calibration laboratories</b>	Updated list of market driven calibration services providers	Secondary layer calibration laboratories	<del>SeptDec 2007</del> <sup>8</sup>
2.3.2	<b>Provide basis for proper functioning of a network of industrial laboratories performing routine calibrations, while avoiding any competition between state funded and private facilities</b>	Updated policies of the National standard-holder laboratories	DZM & National Competition Authority	Annual

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*Objective 2.4: Strengthen capacity for implementation of harmonized metrology legislation and European practices in the field of legal metrology*

Actions		Benchmarks	Competence	Target
2.4.1	<b>Review and improve alignment (if needed) of harmonized legislation</b>	Reviewed legislation	DZM	Dec 2007
2.4.2	<b>Demand-driven establishment of Conformity Assessment bodies for Measuring Instruments</b>	Established conformity assessment bodies for selected categories of MI (only where clear need is identified, according to some modules)	DZM / HMI	2009/ 2010
2.4.3	<b>Improve effectiveness of metrological supervision</b>	Ensured effective metrological supervision for measuring instruments and pre-packages	DZM	Oct 2009

*Objective 2.5: Improve access to metrology information and knowledge transfer*

Actions		Benchmarks	Competence	Target
2.5.1	<b>Establish a permanent information and contact point at HMI</b>	Designated and easily accessible National contact point for metrology related topics within HMI	HMI Director	Dec 2008
2.5.2	<b>Coordinate training programs and activities performed by governmental, public and non-governmental organisations (in the field of metrology)</b>	Jointly elaborated training curricula (in a form of annual programme)	DZM, HMI, CROLAB, HMD	Annual

**Goal 3: Strengthen the positioning of Croatian metrology at European and international level**

The National metrology system is part of the European and wider international environment. Being able to participate and contribute to the Research and Development activities in metrology brings numerous advantages to the scientific community, but also ultimately to the National economic sectors. However, this has objective costs that can not be neglected. The feasibility of the scientific objectives would clearly depend on availability of National program that reserves funds for the Research activities in Metrology, as well as the possibility for National actors to be involved in respective European Research projects. Supporting scientific excellence should always be the main motivation for the future developments in this field.

*Objective 3.1: Maintaining membership into European and international organisations*

Actions		Benchmarks	Competence	Target
3.1.1	<b>Transfer membership in EURAMET from DZM to HMI</b>	HMI participation at EURAMET level	DZM	Dec 2008
3.1.2	<b>Undertake necessary steps for the Republic of Croatia to become signatory of the Meter Convention</b>	Republic of Croatia's application to become signatory of the Meter Convention submitted	DZM	<del>Nov-Mar 2008</del>
3.1.3	<b>Maintain active participation in European projects and activities</b>	Participations in EURAMET projects and WELMEC activities	DZM, HMI	Annual

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Objective 3.2: *International recognition of Croatian calibration and measurement capabilities*

Actions		Benchmarks	Competence	Target
3.2.1	<b>Develop and implement a plan for submission of Croatian calibration and measurement capabilities to EURAMET and subsequently BIPM KCDB (Key comparison database)</b>	List of identified strategically important and needs-driven CMCs	DZM and National standard-holder laboratories	Sep 2007
3.2.2	<b>Fulfil obligations implicated from the signature of the CIPM MRA</b>	Completed submission process for previously achieved Croatian CMCs to EURAMET	DZM and National standard-holder laboratories	May 2008
		Completed newly developed CMCs for submission	DZM and National standard-holder laboratories	Annual
3.2.3	<b>Intensify participation in international comparisons where needed (EURAMET)</b>	Annual planning for participation at inter-laboratory comparisons for National standard-holder laboratories	DZM / HMI and National standard-holder laboratories	Annual
3.2.4	<b>Implement and present a quality management systems of HMI and newly designated laboratories to EURAMET (TC-Q)</b>	Implemented quality documentation	HMI	May 2009
		Presentation of quality system	Newly designated National standard-holder laboratories	Annual

Objective 3.3: *Benefiting from participation into European Metrology Program in Research*

Actions		Benchmarks	Competence	Target
3.3.1	<b>Identify selected fields of HMI competence in priority fields with a potential to contribute to the European Research Program in Metrology</b>	Specified potential interest of Croatian participation per metrology field	DZM / HMI	Annual
3.2.2.	<b>Establish a National Metrology Research program</b>	National Metrology Research Programme established	HMI and Ministry of Science	2009

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3.3.3	<b>Join and participate in the European Research Program in Metrology</b>	Number of European Research projects in Metrology including Croatian participant	DZM / HMI, National standard-holder laboratories	Annual – from 2010
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*Objective 3.4: Encourage regional collaboration through selected “centres of excellence”*

Actions		Benchmarks	Competence	Target
3.4.1	<b>Select potential National “centres of excellence”</b>	Number of laboratories providing services cross-border	HMI / Laboratories	Dec 2009
3.4.2	<b>Propose / organise regional activities initiated from the National "centres of excellence"</b>	Number of projects / activities having larger then only national impact	HMI / Laboratories	Annual

### 5.3 Estimated costs and sources of funding

#### Managing the National system

Based on the existing model, the annual contribution covering the basic operational costs of a National standard-holder laboratory (which is just an extremely small part of the overall costs) maintains in average at the level of HRK 250.000<sup>2</sup>. Thus, it represents the annual gross salary of an expert, expenses linked to the maintenance of accreditation and representation of the Republic of Croatia to relevant International level. By the sole provision of calibration services under current market conditions, mainly at a lower (industrial) level,, the National standard-holder laboratories have been in a position to generate incomes. The latter, combined with state budget's contributions, have allowed for an *annual average* of close to HRK 1.5 million worth investments to be steered into the system (unevenly distributed over existing highest National layer laboratories for the period 2000-2006). In addition, EU funded CARDS programme and assistance from member states supplied for the same period metrological equipment at the value of around fifteen million kuna<sup>3</sup>.

On these bases, one might **wrongly conclude** that the current circumstances place the highest layer of the Croatian Metrology system in a rather comfortable position. Hence, **these incomes are in practice highly volatile and subject to budgetary restrictions**. Consequently, state funding (as in practically every corner of the world) is substantial for the proper functioning of the highest National metrological layer. This fact would increasingly become critical as the **National standard-holder laboratories will logically focus on typical R&D activities, while stepping-out from marketable industrial services** – where the further economic development of the country will unavoidably bring commercial competitors. As a matter of fact, this is an evident European and global trend.

The key role in the distribution of domestic funds into the National Metrology system was so far reserved for the State Office for Metrology (State Office for Metrology and Standardization until 2005). Its latest annual budget of nearly twenty million kuna<sup>4</sup> has been essentially driven by the fulfillment of legislation driven tasks. The future development at the National layer should logically be focused on the fundamental, rather than the traditional legal component of metrology. Based on the observations from EU member states having experienced similar trends, the evolution would eventually allow a shift in certain areas of the legal metrology towards increased involvement of the private sector.

The possibility of merging regulatory functions within a single competent ministry could potentially trigger overall efficiency gains at the level of the National system. Making these components more efficient from an overall State Budget perspective, will help reaching the common key objectives. **Supporting the emergence of National R&D centers of excellence, capable of providing needs-driven services (in strategically important sectors of the economy) and capable of taking a substantial role on the European and International R&D scene, figures indeed on the top of the National Agenda.**

As a bottom line, the financial focus of the National Strategy in the field of Metrology can only be useful under the assumption of being realistic. Therefore, the strategy should be focused on achieving an **overall optimum level** of "impact / resources". From a macroeconomic perspective, this means that the State Budget will on the long run tend to be rather restrictive (the average budgetary redistribution - amounting for over half of the GDP<sup>5</sup> - would over time tend to leave more space to the private initiatives in a well functioning market economy as part of the European Internal Market<sup>6</sup>). Hence, the social welfare of citizens will remain in the focus of public spending. **The Research and Development component will therefore have to represent an increasing portion** (Croatian R&D spending of at most 1.25%<sup>7</sup> of GDP remains well below those of EU member states averaging 2% and peaking at 4% for the top scorers).

<sup>2</sup> Approximation of the contractual annual contribution to a national standard-holder laboratory

<sup>3</sup> Total amount of external funding for all National standard-holder laboratories for the period of 2000-2006

<sup>4</sup> Approximation of DZM's annual budget

<sup>5</sup> Detailed data available at the Croatian National Bank's web site ([www.hnb.hr/statistika](http://www.hnb.hr/statistika))

<sup>6</sup> In line with the Strategic Development Framework 2007-2013 / chapter on the role of the State in the economy and public finances

<sup>7</sup> Figure from the Strategic Development Framework 2006-2013

**Strategic guidance for allocation of resources**

Translated into the *National Strategy in the field of Metrology* the formerly elaborated facts would imply the following:

- **We should concentrate on rational spending of already available funding, rather than hoping for radical shifts in Budget lines.** The basic logic of Treasury implies that "more funds for one activity, means less for another". The likelihood that the State Treasury would be in a position (over couple of years) to generate substantial increases in overall funding for the sole Metrology and related conformity assessment activities in the country is pretty low. On the other hand, the logical trend would be to rather focus on maximizing the synergies between key actors in the system and tend to concentrate spending on the strategically important sectors. This assumes **accepting traceability import in some fields, while fostering excellence in Croatia for others.**
- **Within the scope of available State funding for metrological activities, the research and development component should increasingly step forward and ultimately become the essential part of the Budget** (today, its weight is limited). Making decisions on National scale is always under financial limitations. In a competitive world, where the Republic of Croatia is only one of many countries, the former is a **matter of choice between prosperity and stagnation on the longer run.** The common vision is therefore clear: **Nation's efforts have to be focused on the highly sophisticated side of R&D and only in fields where we present (now or in the future) competitive advantages.** Our metrological and conformity assessment activities have to serve this purpose.
- **Material resources certainly provide the basis, but they are vain without the real value of the human resources.** Without introducing possibilities of attracting and maintaining high-profile staff within State-run institutions of the National metrology system they might become a burden (rather than accelerator) for overall development. Only a change in this respect can guarantee prosperity on the longer run. The National metrology system should be designed in order to attract staff that is educated, dynamic and competent. This needs to be equally valid for Research Institutes, commercial laboratories of Croatian companies, the *State administration* or any other stakeholder of the National Metrology system. Under current unfavorable circumstance and in order to achieve this objective, the focus should be on maximizing synergies between existing actors in the Research community, as well as on *defining and implementing a clear policy on human resources development.* Making this sector more attractive to young and prosperous candidates requires a strategic support from the Governmental level and a strong will at NMI's management level.

**Key success factors**

In addition to the "material and financial assumptions", the final success of the National strategy would be closely correlated to a number of actions. The most important are listed as follows:

- Commitment of the actors in the system to identified mission and vision
- Continuous efforts of the actors in the system to achieve strategic goals
- Adoption of the strategy by the government
- Cooperation with stakeholders and the national quality infrastructure
- Timely establishment of the National Metrology Council
- Timely establishment and strengthening of an efficient and highly professional HMI
- Implementation of the investment strategy
- Available human and financial resources
- Successful capitalisation of the pre-accession assistance funds
- Continued integration within the International and European metrology infrastructure

## 6 CONCLUSIONS AND PROJECTIONS

This entire exercise of formulating a **National Strategy in the field of Metrology** is unique in many ways. Firstly, it is unique by the fact that it has never before been presented in a written form, publicly communicated and involving the widest possible panel of stakeholders at the National level. Therefore, the current objective is to open a new dimension within this **continuous process of strategic thinking and adjustment** in order to allow appropriate positioning of the National Metrology and related conformity assessment system.

In a sense, while presenting the current vision for the future, it is also aimed to provide basis for further readjustments. The world is changing today faster and in a more radical way than ever before. The National system is only one piece of this complex puzzle.

Accordingly, there is an increasing need to be more **perceptive, flexible and with multidisciplinary opening** in order for the National strategies to bring the expected results.

In addition, this Strategy having a *horizontal impact*, it has substantial interlinks with the overall vision for development in many vertical sectors, such as: **Research, Environment, Manufacturing, Health, Tourism, Education, Agriculture etc.**

These are the reasons why **the National Strategy is designed to be understandable for the broadest possible audience, including key layers of decision-makers in the Republic of Croatia**. On the other side, technical experts would benefit from consulting complementary documents elaborated in the process of "**strategic thinking**": *Economic Needs Analysis report, Impact Assessment, Needs prioritization report and Investment Strategy document*.

In order to be properly understood and implemented, this strategy has to be scaled at the level of the Republic of Croatia (being part of Europe and the world). Equally, the National Strategy can neither be institution, nor personality centered. Thus, **the vision and defined mission for the National Metrology and related conformity assessment system are clearly supportive to the consensual National strategic objective: Republic of Croatia becoming an EU member state**. Considering our domestically defined target date for fulfilment of the "acquis"-related obligations, the strategic actions in this document (section 5.2) are scaled accordingly.

The former can not be a goal on its own. The Republic of Croatia naturally belongs to the European family since we share the same values and strategic objectives. These include the principle that the **State has a role to play in fostering the Overall Welfare of its Citizens**. Accordingly, a National Metrology and related conformity assessment system needs to be focused on supporting sectors that are main generators of this welfare (expressed through *GDP contribution, employment shares and competitive advantages*). In the case of the Croatian economy, several industrial sectors - such as **petrochemical, agro-alimentary, pharmaceutical** - respond to the above criteria. At least equally important, **tourism and shipbuilding** are key generators of incomes in "hard currency" – so much needed in offsetting the traditionally negative current account (amounting EUR 2.6 bn during the last year)<sup>8</sup>. The latter sector is worldwide state-subsidized activity. On the contrary, the former contains every aspect of Croatian "competitive advantages" (such as preserved environment, high quality food, reliable infrastructure etc.) while capturing **one fifth of the overall economic output** and being the driver for many other sectors (*construction, transport etc.*).

In addition to the purely economic perspective, the welfare of citizens includes (at the same level of importance) **State provisions for an appropriate level of Quality of Life** (Croatia figures today at the 44<sup>th</sup> world ranking in terms of Quality of life, expressed through the synthetic Human Development Index<sup>9</sup>). This also figures amongst the top Croatian and naturally European objectives. In its metrological dimension, the strategic orientation is centered on traceability ensurance for measurements that are substantial for the quality of **drinking and coastal waters** as well as **food products**. Along the same line - **air quality, waste waters, ionizing radiation or noise levels** are all affecting the "quality of life" and consequently subject to **National legislation** that requires a certain level of national measurement capabilities.

<sup>8</sup> Croatian National Bank's bulletin nb.126

<sup>9</sup> UNDP's indicators (for more information <http://hdr.undp.org/en/humandev/hdi/>)

Based on the above, the *strategic objectives* are realistic only if they *provide guidance for their achievement* in an extended European framework. Within this framework, some of the trends are relevant for any future projections:

In its **legal dimension**, a modern metrology concept would tend to shift the focus from a "routine verifications-oriented system" towards "market surveillance centered approach". Merging metrological supervision within an integrated market surveillance State body (for instance, State Inspectorate) appears as an optimal long-term solution. From the same efficiency perspective, other metrology-linked regulatory functions tend to concentrate under "single roof" (often within responsible Ministries).

On the **industrial scale**, reliable measurements will be identified as a key quality parameter by an increasing number of Croatian companies competing on a global market. This environment will gradually attract emerging domestic laboratories providing corresponding calibration services. In parallel, the field of chemical measurements linked to (environmental, health and/or consumer protection) monitoring activities can be drivers for emergence of metrological R&D excellence centers – eventually stepping forward as National proficiency testing organizers. This upgrade would naturally be triggered in strategically important areas of national interest and correlated to the availability of local expertise and funding.

**Metrology-related conformity assessment** playground is dominated by the scale effect: the larger the producing tissue of measuring devices tends to be, the greater the "chances of success" for the conformity assessment bodies are. Isolating "conflicts of interest" complicates additionally the prospects of relatively smaller producers. At the National level, the scope for development of conformity assessment bodies for measuring devices appears rather limited. Therefore, capabilities building process will focus only on economically viable conformity assessment services. The coming integration within the European Internal Market would unavoidably bring conformity assessment bodies from other member states filling-in existent gaps in provision of needed, but nationally unsustainable services.

At last, the substantial State impulse tends to target the **scientific range** of a modern metrology and related conformity assessment system. The focus here tends to be on R&D metrological efforts. The field of opportunities in creating specific National Research excellence in this scope is virtually unlimited. Hence, the National Metrology Institute has a role to play in steering the scientific efforts of a number of distributed National R&D centers. Efficiency requirements impose in this sense the establishment of an objective *"results correlated" funding distribution system* - that will ultimately foster scientific excellence. On the top, the National Metrology Council will provide the forum for discussing, aligning and modifying the strategic orientations – always in accordance with the long-term vision.

Finally, this strategy concerns before anything else the human factor. The National metrology infrastructure would face difficulties to fit within the four above summarized (European and international) playgrounds unless the National system attracts and/or succeeds to maintain competent people, with relevant knowledge and broader understanding of Croatian strategic industries and sectors. The starting point in implementing the National Strategy should therefore be: who can (at all levels) realistically be capable of implementing our common vision in Metrology and related conformity assessment field!? Once we have the answers, ***the actors of the National Metrology system will be in a position to foster scientific excellence, support and educate our exporters on how "quality" affects their success, constantly improve our "quality of life" indicators, increasingly step forward as serious participants in European R&D programs and take the leading role on larger than national scale in certain key fields.***

**ANNEXES**

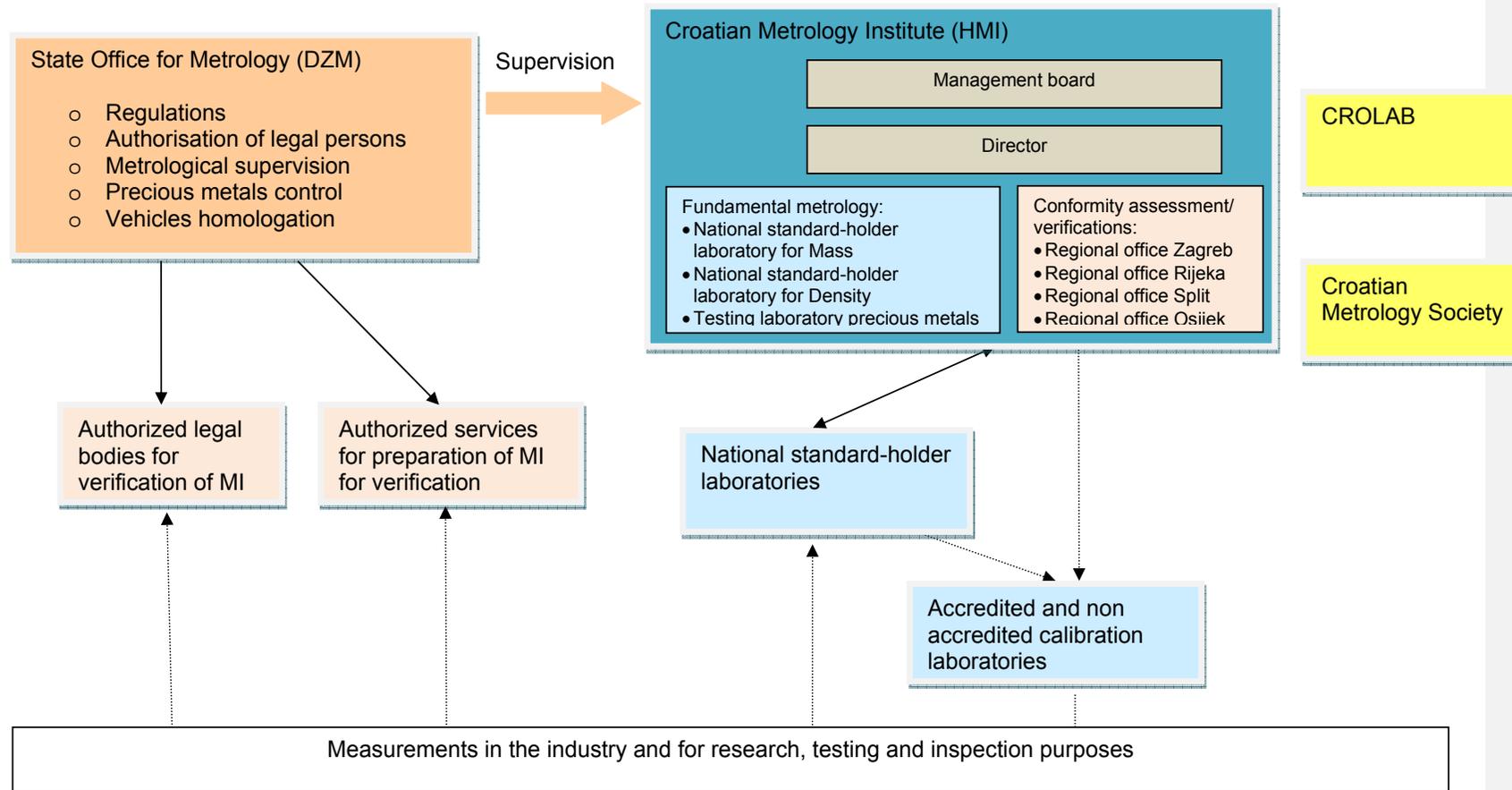
Annex 1: Graphic presentation of organisational changes - option 2

Annex 2: Graphic presentation of organisational changes - option 3

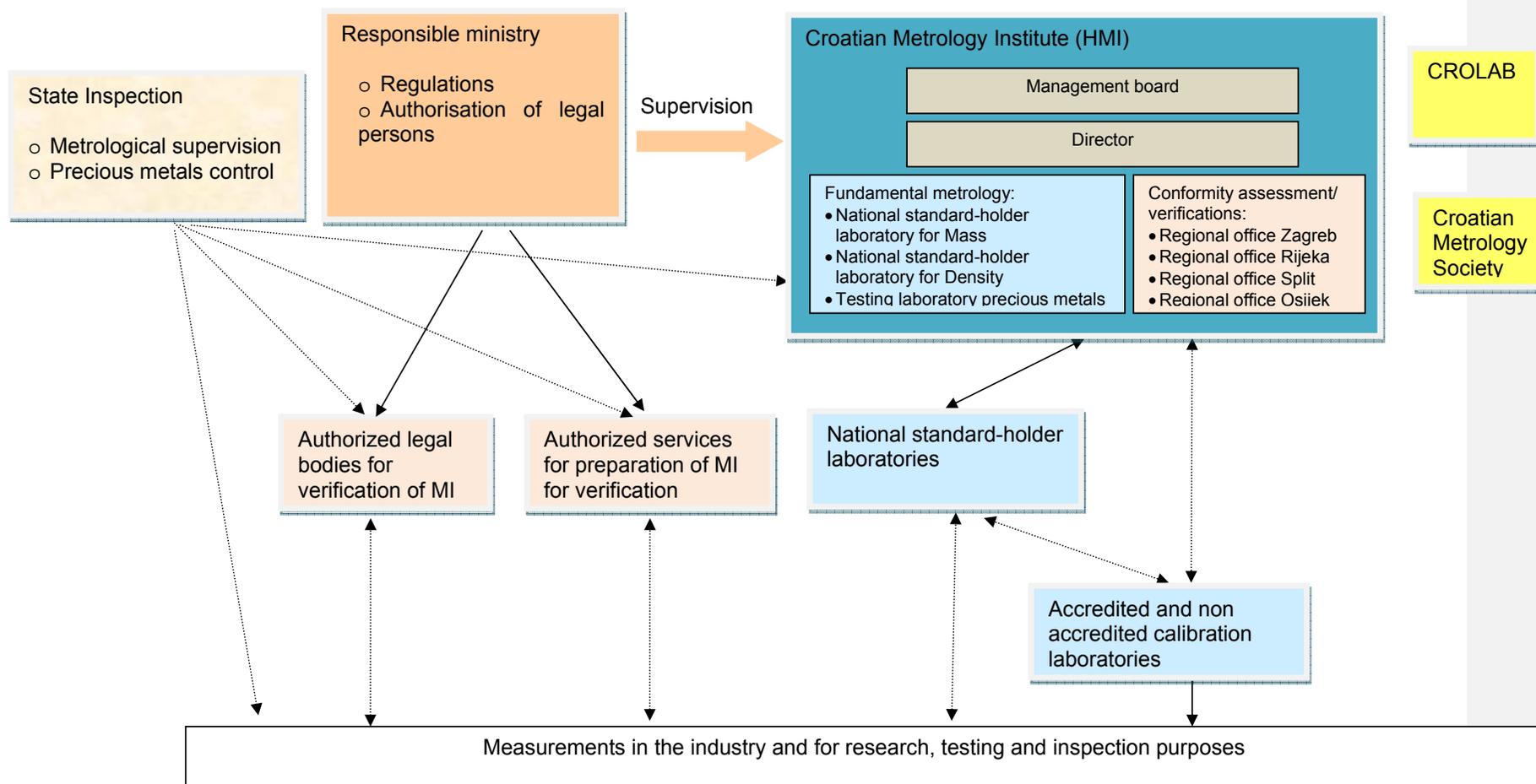
Annex 3: Currently provided metrological services

ANNEX 1: Graphic presentation of organisational changes - option 2

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ANNEX 2: Graphic presentation of organisational changes - option 3



NATIONAL STRATEGY IN THE FIELD OF METROLOGY

**Annex 3: Currently provided metrological services**

<b>Services</b>		<b>Provided by</b>
<b>1</b>	<b>Fundamental and industrial metrology</b>	
1.1	<i>Required by the Law on metrology</i> <ul style="list-style-type: none"> <li>• Maintenance of the national measurement standards</li> <li>• Providing traceability of measurement through calibrations (higher accuracy level)</li> </ul>	DZM laboratories and the designated national calibration laboratories  DZM laboratories and the designated national calibration laboratories
1.2	<i>Others</i> <ul style="list-style-type: none"> <li>• Calibrations (lower accuracy level)</li> <li>• Training</li> </ul>	Calibration laboratories (accredited and non-accredited) as well as the designated national calibration laboratories in some measurement fields or subfields  CROLAB, HMD, DZM / HMI, HAA, HZN
<b>2</b>	<b>Legal metrology</b>	
2.1	<i>Required by the Law on metrology</i> <ul style="list-style-type: none"> <li>• Type approval of MI</li> <li>• Type testing of MI</li> <li>• Initial verification of MI</li> <li>• Subsequent verification of MI</li> <li>• Preparation of MI for verification</li> <li>• Testing of pre-packed products</li> <li>• Official measurements</li> <li>• Metrological supervision</li> </ul>	DZM Authorized legal persons DZM and authorized legal persons DZM and authorized legal persons Authorized services DZM DZM and authorized legal persons DZM
2.2	<i>Others</i> <ul style="list-style-type: none"> <li>• Training</li> </ul>	HMD, DZM / HMI

N.B. DZM is in charge of some associated activities as homologation of vehicles according to the Road Safety legislation and control of precious metals according to the Law on surveillance of the precious metals