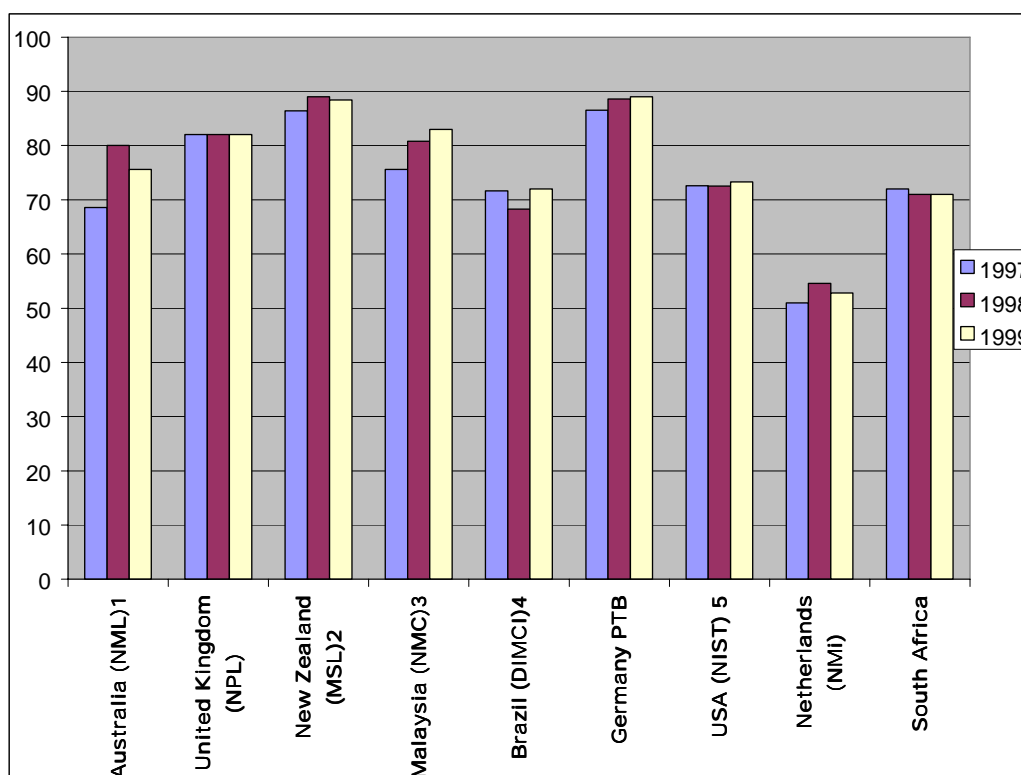


11.3.2 International situation and practices

The levels of government funding stated for surveyed NMIs are shown in Figure 15 below as a percentage of total budget. All surveyed NMIs receive at least 50%, with most receiving 70% or more, of their total funding from government.

Figure 15: Government Funding of National Measurement Institutes as a percentage of Total Income (data for major NMIs only, and excluding funding for capital expenditure)



Notes

- 1 Fees for special government contracts for APEC consultancy and projects not included as government funding. Projected percentage for 2000-01 of government funding is 73.8%.
- 2 Projected percentage government funding for 2000 for MSL is 87.7%.
- 3 NMC funding is included in the overall budget for SIRIM Bhd. The above (estimated) percentages are based on the government funding comprising contributions to general operating funds for the NMC and annual funding for development and maintenance of measurement standards. The data

for total income for NMC was taken as a combination of all government funding plus fees for calibration services. No other income source data was available.

- 4 The government investment for DIMCI in Brazil is for operating expenditure only (for development and maintenance of measurement standards). There was no available information on the salary component of the government investment in DIMCI.*
- 5 The data for NIST shows Government funding as a percentage of total income for development, maintenance and dissemination of measurement standards (including income derived from calibration services and standard reference materials). The level of Government funding shown is for obligated money given as appropriation funding. NIST also receives substantial funding from other Government agencies. If the contributions from these agencies are included, the percentages of total Government funding over the period 1997-1999 ranges from 90.0% to 90.8% of total income.*

The international survey requested information about the extent of government funding in the following categories : (a) development and maintenance of measurement standards. (b) calibration services. (c) consultancies. and (d) any other services. In developing economies, it was difficult for respondents to be specific because accounting systems did not differentiate expenditure in the various categories. It became apparent that, in these economies, governments recognise that a national metrology institute is a prerequisite for technological development and fund the function, often in total or with heavy subsidies for the fees for any spin-off services. In developed economies, the differentiation of expenditure was more marked. Government funding was earmarked for the “national interest” aspects of developing and maintaining measurement standards but, even in this area, some NMIs were encouraged to obtain funding from any industry beneficiaries when establishing new standards. In general, no government funding was available to subsidise calibration services, and full recovery of direct costs from users was sought. The same situation applied to costs of consultancy services and other services (e.g. training, sale of reference materials).

Therefore the international norm is for governments to recognise that there are rarely any commercial sources of funding in the development and establishment of measurement standards and that the full investment must be made from government appropriation. Whether or not government appropriates funds or subsidises other activities depends on priorities in particular economies and sectors.

The international survey illustrated the difficulty of obtaining a reliable index of absolute levels of funding. Indices such as appropriation per unit of GDP ranged from 0.0001% to 0.45 %, with most results around 0.001% to 0.003%, and were not correlated with any other measure of

development of an economy. Hence it is impossible to use techniques of this kind to predict what the optimal expenditure in South Africa should be.

What proved more interesting in terms of the match of government expenditure to national needs was to examine the processes for (a) defining national needs, (b) estimating the costs and benefits of meeting those needs, (c) assessing the effectiveness and efficiency in applying funds and (d) evaluating the impact of the deliverables.

- In defining national needs, many NMIs, particularly in developed economies, commented that the principal driver for predicting metrology needs is international metrology. The NMIs that participate in international activities therefore act as “gatekeepers” for new technologies that may enter their economies, and have sufficient horizon of vision to develop the techniques in advance of industry demand. Industry contributes to the definition of national need by advising its NMI of major new industry sectors that may impact on the economy (e.g. nano-technologies) or new expectations of existing industries (e.g. electromagnetic compatibility, environmentally friendly production). Government contributes both through communicating its technology development perspectives and also by bringing regulatory requirements (e.g. environmental monitoring) into the equation.
- In preparing annual budgets, a number of the NMIs were required by their governments to prepare a cost-benefit assessment. In most cases, these assessments are qualitative and are based on wide consultation with users and beneficiaries in industry and the community. In the UK, an additional step is performed by the Department of Trade and Industry which subjects funding proposals in the measurement standards area to a quantitative evaluation using an economic model of the UK economy. Funding is then granted on a sliding scale of the benefit rating of the various proposals until the total appropriation budget for the period is allocated. Hence the process does not determine the appropriate total allocation, but it does maximise the potential impact of the investment and provides some knowledge of the effect of foregoing additional investment. While desirable, the fact that this approach has not been developed more widely suggests that the complexity and cost may exceed the current capacity of most governments.
- In most NMIs, effectiveness and efficiency of the use of funds was only assessed by financial audit. In the UK, DTI has a process of payment against milestones, thus instituting some control over the delivery process. Ultimately, the technical effectiveness of the process is assessed by whether or not the NMI can participate satisfactorily in international comparisons, but this is not a useful short-term mechanism for evaluation within a budget cycle. Here the use of an advisory committee with some technical peers can go some way

towards evaluating the effectiveness of work in progress but few economies have made that investment.

- The cost of evaluating the impact of deliverables is a problem in all economies. The economic value of a measurement standard extends from the NMI right through the entire chain of users of measuring instruments to the ultimate consumer of the measurement result, and a large and widely distributed set of benefits has to be evaluated. Although some studies have been made by NIST, NPL and PTB of the impact of development of measurement standards, these are general economic studies and are not tied to evaluation of specific investment. The UK approach has been to evaluate the potential cost-benefit at the outset of an annual cycle to maximise investment impact, and only periodically to assess the actual downstream benefit.

Very few governments appear to have concerns about contestability for access to funding for national measurement standards. In general it is assumed that the NMI is the best provider, and in cases where a number of organisations in one country do receive funding, it is because the technologies required to maintain national standards are held in a variety of institutions. In the UK some attempt has been made to introduce contestability by inviting proposals from a broader constituency than the NMI. However, in practice the core measurement standards activities have always been placed with the NMI.

One of the major components of non-appropriation income for NMIs is revenue from calibration services. In most of the surveyed NMIs, there was a policy to encourage the growth of calibration expertise in industry and therefore not to undercut the pricing or services that could be offered by second-level calibration services. Provided that NMIs evaluate all the costs of providing a calibration service, it is generally the case that the cost of equipment, personnel and direct overheads associated with providing high-accuracy measurements exceeds the cost structure in industry. Therefore there is a natural pricing boundary between NMIs and the next level of calibration services. If a government encourages its NMI to reduce dependence on appropriation funds by increasing calibration revenue, it displaces skills in industry and potentially overcharges users who could otherwise manage with lower levels of accuracy.

11.3.3 Conclusions

It is recognised internationally that the major part of the work undertaken by an NMI has a national interest nature and must be funded from government appropriation. If the level of government funding received by the NML from DTI for both operating expenditure and capital expenditure to upgrade or maintain existing facilities is evaluated as a percentage of total

revenue, the results for 19995/96 to 1998/99 lie between 69% and 78% which is in line with international norms. However a steep decline to 58% is noted in 1999/00 and this indicator would be of concern if it became the start of a trend.

The CSIR Parliamentary Grant (STEP) funds are an additional source of government funding for the NML where it is predicted they will contribute around 12% of income in 2000/01. These funds are applied in the main to developments that support CSIR M&Mtek cross-cutting programs and are evaluated in the reporting of CSIR to government. The projects delivered under this program are based on and augment standards capability, and currently are the means of initiating the very important new area of chemical metrology. However, it is not clear why NML has to rely on the STEP program to develop some of its standards capability. If the standards that are being developed under the STEP program are of national significance, it is preferable that they form part of NML's overall strategic and operational plans and be funded as an integrated program by government. If the recommendation to constitute the NML as a separate entity in CSIR is adopted, it would be desirable to amalgamate all sources of NML's government funding and maintain one line of reporting and evaluation.

Of the non-appropriation revenue sources, the major component is the return on calibration services of around 12% (based on the 2000/01 budget). This is very satisfactory when compared internationally and suggests that the NML is pricing its services appropriately. Revenue from services provided to SANAS, at around 4%, should be sustainable. However the contribution of around 3% from SADC contracts may be vulnerable to changes in political priorities and it should not be assumed that this can be sustained. Moreover the NML reports that the earning of SADC funds postpones effort required to maintain the South African national measurement system. While it is essential for regional capability-building that the NML participate vigorously in SADC MET and related development activities, it would be counter-productive for both South Africa and SADC if the maintenance of South African standards was neglected in the process.

Recommendation 30: Government funding, as a fraction of total funding, for the development and maintenance of national measurement standards be maintained at a level at least equivalent to international norms for national metrology institutes (typically 70-80%).

As part of its Annual Report to the Minister for Trade and Industry, the proposed NML Management Board should review the influence of non-appropriation earning targets on the capacity of the NML to deliver the range of activities specified in the MOA between the Government and CSIR and alert the Minister to any adverse impacts. An area that does not

receive adequate funding at present is measurement standards R&D. As noted earlier, the NML is a member of only 3 of the 10 Consultative Committees of the CIPM and it is desirable that the level of participation be increased to serve both South Africa and the SADC region. It is unlikely that the NML can develop a program in any specific area to international standard in less than 3 to 5 years, and funds from government would be required to initiate and maintain the program. The NML should identify the fundamental R&D that is necessary as a foundation for its participation in Consultative Committees of the CIPM. Given the significance of chemical metrology, it would seem appropriate for the NML to consider participation in the Consultative Committees on Mass and Amount of Substance as two high priorities.

Recommendation 31: R&D be recognised by DTI as an essential activity for NML to gain international recognition for its metrology at a level sufficient to support South Africa's membership of key Consultative Committees. NML's R&D requirements be reviewed annually by the NML Management Board and the NML Advisory Board and a prioritised program submitted to DTI for consideration and funding.

The level of government funding for the NML cannot be defined as an absolute. It must be related to the national needs of the time and the priorities attached to these. However, it must be adequate to deliver the programs effectively. Government must satisfy itself that the funds have been applied effectively and efficiently and, if resources are available, may evaluate the impact of the deliverables.

At present, the DTI as the representative of government does not participate formally in the priority setting process in forming the NML budget. This shortcoming could be addressed by DTI participation in the NML Management Board proposed in an earlier Recommendation. The application of funds is assessed by financial audit, but no technical assessment is conducted. This shortcoming could be addressed to some degree by participation of an international expert in metrology in the proposed NML Management Board.

Given that the international survey revealed that only the UK DTI has developed a process for a *priori* evaluation of proposals, it would not be reasonable to expect the South African DTI to adopt this process in the current economic climate. Nevertheless, DTI could consider the process for a *posteriori* evaluation of projects, perhaps by using university economists to conduct case studies.

The DTI has expressed concern over the high level of overhead cost of the CSIR in the NML budget and its impact on the DTI funding vote. If the overheads charged by the CSIR directly support the work of the NML, the overhead would be a necessary expense for the use of CSIR

services. It would appear that DTI has authority within the terms of the MOA to request written advice from CSIR (Clause 2.5) or to obtain access directly to records (Clause 2.6), therefore the mechanisms already exist for the department to address any concerns in relation to overheads.

11.4 The NML meeting the needs of South African industry

11.4.1 Assessment of the NML meeting the needs of South African industry

The ability of the NML to meet the needs of South African industry was assessed by survey and interview, using the following criteria :

- Awareness amongst industry of the role and importance of the NML.
- Effectiveness : the ability to provide the required services.
- Efficiency and overlap with other organisations.
- Constructive involvement in the regulatory sphere. and
- Industry and other stakeholder involvement.

The results of the investigations are shown in the tables in the following subsections.

a) Awareness amongst industry of the role and importance of the NML

Awareness	Very High	High	Average	Low	Very low	Don't know
Percentage	17%	15%	11%	17%	32%	8%
Importance	Very High	High	Average	Low	Very low	Don't know
Percentage	26%	13%	13%	13%	21%	8%

Although the activities of the CSIR-NML are very specific and not used in all organisations, the level of awareness is low (only 32% of respondents had above average awareness), and not in line with the importance that organisations assign to this activity (39% of organisations rated importance above average). Considering that the NML operates under the CSIR banner, which has considerable industry exposure, the low levels of awareness of the NML's function are of concern. The NML profile and its relevance to other elements of the SQAM are largely lost within the M&MTEK and CSIR structure.

b) Effectiveness

The effectiveness of the NML was considered by 43% of respondents to be adequate or better. However, it must be taken into account that the NML deals primarily with laboratories, and that the response from industry is therefore not necessarily based on direct interaction with the NML. The positive impact that the CSIR has had in the rapid and effective establishment of new functionalities, for example the Chemical Metrology function, is also noted.

Effectiveness	Excellent	Good	Adequate	Poor	Very poor	Unknown
Percentage	15%	13%	15%	17%	13%	26%

There were no critical problem areas identified, nor were there any fundamental gaps in the scope of the services provided by the NML. (A fundamental gap would be the total absence of a metrology service).

Nevertheless the NML has identified many gaps within the major areas, for example:

- *Chemical metrology*, where, with the exception of the capability to calibrate breathalysers, most facilities are still under construction.
- Some specific *mechanical metrology* requirements include large air flow, density and viscosity, calibration of autoclaves, etc.
- Specific requirements in the *Electromagnetic metrology* section, including ultrasound and underwater acoustics, magnetic field strength, electromagnetic compatibility (EMC) etc.

It is important to realise that the establishment of metrology infrastructure is capital intensive. During the last three years a number of gaps were closed due to increased funding from the DTI.

It is also recognised that efforts need to be made to disseminate measurement traceability to the shop floor. The NML is considering various activities in this regard, including awareness programmes and training programmes for SMMEs. In this regard, it is relevant to note the concerns expressed by industry about the loss of metrological experience through retirement of senior staff at the NML. It was remarked by some industry respondents that, in some fields, the basic skills are present at the NML but not at a level required to satisfy the needs of industry.

c) Efficiency and overlap with other organisation

Industry has a varied opinion of the efficiency of service delivery from the CSIR-NML, with 30% indicating that it is above average, and 30% indicating that it is below average.

Industry has expressed concern over the fact that the NML is more expensive than private industry. Higher costs can be expected due to the higher levels of accuracy required, but the NML is not managing such perceptions.

The fact that the NML must be capable of calibrating laboratories' reference standards means that it also has the capability to provide most of the services delivered by private accredited laboratories. Therefore, theoretically, it can compete with most private laboratories.

However the MOA between the DTI and the NML states explicitly that the NML "may provide calibration services to the private sector where the market is unable to do so, or fails to provide the required levels of accuracy, provided that the NML endeavours, where possible, to promote the development of such capabilities in the private sector".

The NML therefore endeavours to promote the establishment of capabilities in industry, and when it does provide services, it does not do so at a cost lower than the private sector. It is estimated that less than 10% of NML's calibration activities could be considered as falling in a category that might be considered as overlapping with services provided by accredited industrial services. However, there is no documented evidence that the NML is in breach of its MOA with DTI.

d) Involvement in system of formulating and coordinating technical regulations

NML officers serve on many international, regional and national committees including SANAS specialist technical committees, SABS technical committees, and some committees operating at government department level (e.g. in traffic management). They also work closely with trade and legal metrology services, for example in areas such as fuel tank standards, fuel pump evaluation systems, weigh bridges, etc. In addition, the NML also liases informally with bodies such as the Council for Nuclear Safety.

However the committee involvement is by invitation and is limited to technical areas. The NML is not formally represented on any policy boards of SQAM institutions, government regulators or other stakeholder institutions.

It is noted that the NML requires sufficient lead-time to establish new or modified measurement standards and calibration facilities. The lack thereof could make it impossible to implement a

regulation with any confidence in the measurements required for testing and conformity assessment of such a standard. Therefore it is important that NML is involved in the development or modification of technical regulations whenever there are measurement traceability implications.

The system of collapsing technical content into legislation, as opposed to using the legislation to reference technical standards, makes it difficult for the NML to be adequately involved in the formulation process. Many Government Departments also have insufficient awareness of the regulatory requirement of traceability to National Measurement standards. If the technical requirements in regulations are called up in national or international standards, NML would then need to be involved only in the development of the technical standard and not in the legislative aspects of the regulations. Other SQAM elements should also be represented as appropriate.

e) Industry and other stakeholder involvement

Formal interaction between the NML and industry is technically focussed and occurs through the following mechanisms:

- Industry Technical Advisory Forums (convened by the NML)
- Specialist Technical Committees of SANAS
- Technical Committees of SABS
- National Associations such as the NLA, MIG, SAIMC, SANCI, etc.

The lack of industry representation on the governing structures of the NML has been raised as a concern.

The NML has a system in place with which it monitors and evaluates several service delivery parameters. It also participates in the CSIR's Client Satisfaction Surveys

11.4.2 The international situation and practices

In the international survey, the overwhelming majority of national metrology institutes reported that their participation in international metrology activities was the principal input to their understanding of the future needs for traceability in their home economies. Many commented that the view of industry is short-term and focussed on specific problems and therefore does not provide a basis for strategic planning of national measurement infrastructure.

However most national metrology institutes also institute some mechanisms to obtain feedback from industry on the relevance of their services. The major mechanism is direct feedback from clients of calibration, consulting and training services, but other channels included participation in accreditation and standards-writing activities, membership of scientific, professional and industry societies, and surveys of industry. At least three NMIs (in Australia, New Zealand and Brazil) have advisory committees that included industry representation. In the UK, NPL involves industry in extensive consultations at the time of formulation of its triennial work programs for each measurement area.

Most NMIs that are part of a larger institution report some difficulties in having their function recognised separately by industry. However, in Malaysia and Brazil in particular, the credibility and authority of the parent institution was seen to enhance the standing of the national metrology institute.

Most surveyed NMIs have a policy of not competing with industrial calibration laboratories, especially when there is a government policy to avoid unfair competition with the private sector. In some economies, there is an explicit requirement for the NMI to encourage the formation of private sector services.

Few NMIs reported involvement in the formation of technical regulations, except when asked for specific technical advice by regulatory agencies. In general, the formation of technical regulations was seen as the province of legal metrology authorities and regulators.

11.4.3 Conclusions

Considering the fact that the NML operates under the CSIR banner, which has considerable industry exposure, the level of awareness in industry of the NML can be considered to be unsatisfactory but not atypical in this situation. However it is noted that, during the period of this Review, NML has embarked on a publicity campaign that emphasises its unique identity as the provider of national standards, and this initiative should continue.

Recommendation 32: A higher national profile be established by the NML to enhance its recognition by industry as the national provider of measurement traceability.

The NML itself appears to identify the appropriate scope of services for industry and the gaps in current infrastructure, drawing on its international knowledge, its client base, its participation in accreditation and standards-writing activities, and the use of Technical Advisory Forums as provided for by the MOA between DTI and CSIR. These mechanisms are in line with findings from the international survey. The only additional mechanism that has not been implemented is

the involvement of industry representatives at a strategic level, however this matter has already been addressed in the recommendation to form a NML Advisory Board. The importance of NML's participation in the wider SQAM infrastructure, especially accreditation and standards-writing activities, as a means of obtaining market feedback must continue to be acknowledged and the activities fostered.

Industry has indicated concern that NML's skill base is inadequate in some areas. This is accentuated by the fact that many senior NML staff members are reaching retirement age. Staff development at the NML is, and should be, a priority. Opportunities for staff development as part of the CSIR/University of Pretoria alliance is an important factor that was taken into account in recommending the positioning of the NML.

Recommendation 33: NML staff succession planning and skills development be reviewed at least annually by the NML Management Board to ensure that NML is building appropriate expertise to meet strategic goals.

The service delivery level of the NML is considered to be average by industry, but no problem areas of critical importance were identified. The average rating may result from perception rather than actuality, in which case it could be addressed within the NML's publicity measures. The NML has in place an adequate system for monitoring its service delivery and customer satisfaction for future evaluation.

The NML has recognised that efforts need to be made to disseminate measurement traceability to the shop floor and it is noted that CSIR M&MTek has a so-called cross-cutting program for its Centres to deliver services to SMMEs. The DTI could support specific awareness and training initiatives, especially if aimed at SMMEs.

Recommendation 34: The NML continue its program of training and dissemination of measurement traceability to SMMEs but also seek to identify complementary SMME initiatives in CSIR, other SQAM institutions and government with a view to fostering joint delivery.

The current policy of requiring NML not to compete with calibration services that can be provided in the private sector is appropriate. This policy has two benefits : (i) it avoids any government "over-investment" in infrastructure that can be provided by the private sector; and (ii) it encourages the development and dissemination of metrology skills in industry. DTI has suggested that the policy be reinforced by requiring NML to charge a premium and thus making sure that NML cannot introduce services that would compete with the private sector. However this mechanism is considered by the review team to be inappropriate because, in such a

scenario, the premium charged by NML flows on to calibration laboratories and, from them, to South African industry. The consequence is an additional cost component in South African goods and services which acts against these goods and services being competitive internationally. Instead, it is appropriate to use the policy restriction alone to maintain the separation of services offered by NML and those offered by the private sector.

Recommendation 35: NML continue to be required not to compete with commercial laboratories, and particularly SANAS-accredited laboratories, in the delivery of its services.