METALS AND MINERALS SECTOR

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1. Scope of the Metals and Minerals Position Paper

The metals that are covered in this paper are the following:

- Carbon steel
- Stainless steel
- Light metals and alloys
- Precious metals

} Minerals through to beneficiation

The major industries of application include the following:

- Transport
- Household products ("white goods")
- Building and construction
- Jewellery
- Mining
- Packaging

The key role-players needed to ensure successful delivery are the following:

- Industry
- Appropriate training institutions
- Science councils
- Industry associations
- Government
- International partners

2. Strategic Context

2.1. Carbon Steel - International

- Crude steel production and consumption growth over the last 30 years has averaged 1% per year – the industry remains volatile.
- Geographical shifts in world steel consumption sees China becoming a driving force.
- European market economies reached equilibrium and will accept less traded steel in the future.
- CIS will remain a net exporter of 40 - 50 million tons of finished steel in the near future.
- Competition in the face of this huge over-supply will force competitors to become cost leaders or to supply products that are more superior.
- Mergers, alliances and joint ventures are driving the consolidation of the steel industry.
- Trade barriers and subsidies cause global distortion.

2.2. Carbon Steel - Domestic

- South Africa exports 45% of finished steel produced in the country.
- Total South African steel over-capacity is 4,2 million t/annum.
- Consumption of steel correlates only 60% with GDP.
- The largest application sectors are construction, automotive and engineering.
- Growth is largely export led and project orientated.
- Consolidation drive of primary steel manufacturers is ongoing.

2.3. Stainless Steel - International

- Average world growth in apparent consumption of ~6%, is expected to continue.
- Continuing consolidation of major primary mill producers into integrated plants to reduce costs and increase efficiencies.
- China is fastest growing region but is expected to show negative supply gap.
- Strong growth potential in new application areas, e.g. automotive structural parts.
- Ni price volatility remains problematic, driving a trend towards lower Ni stainless steel in some applications.

- Continuing alloy development and product range extension to better match client or application needs in developed markets, such as Europe.

2.4. Stainless Steel - Domestic

- Continued domestic growth at 12% p.a.
- Resilient domestic market.
- Growth is largely export led.
- Two sectors have developed a global market position (tank containers with 60% market share and catalytic converters with 12 -15% market share).
- Technology focus in growth areas, e.g. automotive.

2.5. Light Metals

Aluminium – International:

- Aluminium is the second most commonly used metal after steel.
- A major growth area is the automotive industry with 120 kg/car and growing.
- The world aluminium industry consumes about 26 million tons of Al per year.
- The world market is growing by 3% per year. Secondary recycling market is vibrant – shortage of world scrap supply.

Aluminium - Domestic:

- With the current Hillside and Mozal expansions, South Africa will boast a primary smelter capacity of 1,35 million t/a.
- Hillside will be one of the largest single-site producers of aluminium.
- Semi-fabrication capacity is 270 000 t/a, (180 rolled, 50 extruded, 40 redraw rod).
- Secondary manufacturing capacity exists at about twice the current demand of 30 000 t.
- Downstream conversion of almost 200 000 t/a has grown by a factor of 3,5 over the past 30 years. A major contributor is a single product, aluminium alloy wheels at some 20 000 t/a.
- The domestic consumption of 4,5 kg per capita is about 1,5 times the world average for the per capita contribution to GNP. Increases in domestic conversion must thus be export led.
- Downstream conversion turnover is about R15 bn, while export value is about the same, but unfortunately the latter comprises low-value-added products.

Magnesium - International:

- Mg is produced in 10 countries with an average annual growth of 3,9%.
- China has the leading capacity.
- Current world capacity of 432 kt is expected to grow to 795 kt in 2005.
- Automotive manufacturers are the major investors in magnesium plants.
- Secondary Mg metal production is limited to a handful of countries.
- Mg price has declined from a high of $4 400/t in 1995 to $1 880/t in 2001 due to an increase in world capacity.

Magnesium - Domestic:

- South Africa has sufficient raw material – technology to produce Mg is the problem
- Various alloys are made and ingots are imported.
- South Africa does not have magnesium production plants or magnesium die-casting plants.

Titanium - International:

- World production capacities are currently 102 kt, with Japan leading with 26 kt.
- The USA is the biggest consumer of titanium metal, with 65% of the applications in aerospace.
- If the price could be reduced, various other industry applications could open up, e.g. the automotive industry.
- Ti world over-production (80% into pigment).

Titanium – Domestic:

- South Africa holds 22,1% of the world's reserves but has no Ti metal production.
- A number of companies import titanium and fabricate equipment or materials for the protection industry, e.g. cathode protection anodes.
- Some custom-made jewellery is also manufactured.

2.6. Precious Metals

Gold - International:

- Jewellery remains the biggest consumer of gold at about 85%.
- The largest decline was in the electronics sector.
- In the investment sector, implied disinvestments of 53 tons were recorded.
- These disinvestments led to a fall in total gold supply in 2001.

- Official coin demand was up by nearly 18%.

Gold - Domestic:

- South Africa's output dropped below 400 tons for the first time in 48 years.
- SA remains top producing country.
- Three South African companies are in top 10 producing companies.
- South Africa is still weak in gold fabrication.
- Main markets are jewellery and electronics.

Platinum -International:

- Platinum price is currently $525 per troy ounce.
- South Africa remains top supplier in the world.
- The demand for platinum applications is led by auto catalysts and jewellery.
- The highest demand per region comes from Europe and Japan.

Platinum - Domestic:

- South Africa remains top supplier with 4 080 000 oz.
- Autocatalytic market increased by 14%.
- Jewellery decreased by 1%.
- Off take in computer hard discs and LCD glass increased by 8%.
- Investment down – large bars sold back and coin sales halved.

3. Key Issues Related to the Metals and Minerals Industry as derived from a Metals Industry SWOT analysis

- Industry sectors, which should be exploited because of their application and growth include:
  - The automotive industry
  - "White goods"
  - Metal pipes and pipe fittings
  - Building and construction
  - Jewellery
  - Packaging
  - Mining

- Improve stability and access of government support measures to become world competitive in order to facilitate domestic industrial growth and foreign direct investment.

- Support the development of the industries through the application of appropriate technologies such as logistics, product and process technologies.

- Strengthen industry and investment development efforts through partnerships with leading international role-players. Synchronise technology development efforts with industry and market development programmes – where relevant, establish design and technology centres. A market pull approach is thus imperative. South Africa has a good supply of many raw materials, which should be used as a springboard to launch its beneficiation programmes.

- The expansion of sustainable downstream value-added exports is a current priority because of an over-supply of most primary metals on the world markets.

- Two preconditions for the expansion of the Mg market are an assurance of long-term supply of Mg at a competitive price and the development of an active secondary market for die-casting alloys.

- The Ti metal industry has stagnated because its applications are restricted by the high price of the metal and low yields during fabrication. If the price was halved and fabrication was more efficient, a new range of Ti products would become available, particularly to the automobile trade. There is a need to produce a cheaper, non-aerospace grade of Ti. This would greatly increase the consumption of Ti metal. Any new process for producing Ti metal would have to be cheaper than the CIS price.

- Support the platinum development initiative to generate new impetus.

- Encourage platinum jewellery applications – research into new alloys/techniques for decoration of platinum jewellery alloys is needed.

- Develop relevant human resources to support the development of a vibrant metals industry in South Africa.

4. General Comments

The role of government is imperative in creating an environment for investment and development and to provide the necessary supply-side measures.

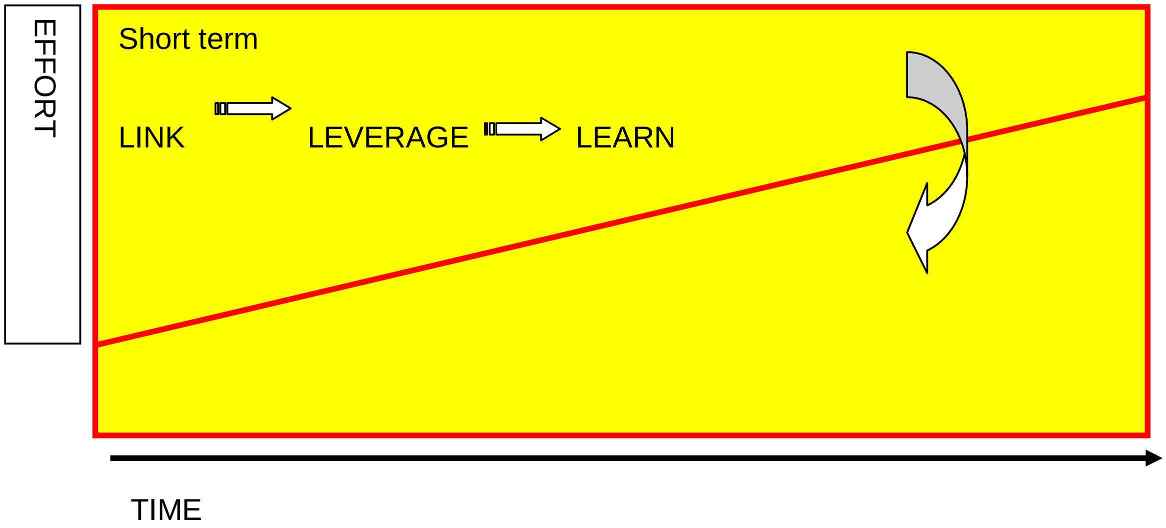
The projects address the issues highlighted in the SWOT analysis.

In order to acquire the appropriate technologies and learning, the following approach will be built into the proposed projects:

LINKING – connecting with international alliances to acquire needed technologies and skills.

LEVERAGING – going beyond arms-length transactions to squeeze as much as possible from the new relationships with those international alliances.

LEARNING – making every effort to master process and product technologies, consciously building the foundation for improving current technologies and creating new ones.



Notes:

- Create the abilities to accelerate the acquisition of new technologies, upgrade them over time and ultimately create new technologies – in other words, to innovate and learn.
- Participation in global value chains can accelerate the process of innovation and learning.
- Choose particular value chains, access the leading players in them, and engage in collective efforts to use those relationships to acquire right technology and knowledge and to learn.
- This process requires establishing a nurturing environment, rich with supporting institutions, that assists firms in building their capabilities.
- It requires the government and private sector to work in partnership.
- Building industrial capabilities needs extensive policy support from government.
- To become a leading industrial country, domestic R&D remains important, but this ability depends on the availability of skilled HR.

5. Proposed Projects

The projects are submitted as mini business plans per industry sub-sector. Please refer to the attached proposals as follows:

Carbon steel

- Tailor welded blanks feasibility study.

Stainless steel

- Stainless Steel Fabrication Industry Development Centre
- Development of SMME and BEE in the stainless steel consumer ware industry

Light metals

- New lightweight materials development and application research initiative.

Precious metals

- Platinum beneficiation initiative
- Autek.

5.1. Metal sub-sector: CARBON STEEL (Also applicable to other metals)

Project name:

Feasibility study to establish Tailor Welded Blank competence in South Africa.

Project description

A revolutionary concept in sheet metal fabrication is rapidly attracting attention in the automotive industry. Tailor welded blanks provide designers with a new capability that mates steel pieces together before they are stamped. This apparently subtle difference has a profound impact on design and cost by optimising steel utilisation.

Prior to 1993, tailor welded blank technology had been applied most extensively in Japan and Europe but very little was known about how and why they used it.

Tailored blanks are constructed of two or more blank pieces typically with different properties of steel gages, different metallurgical grades (mild and high strength), or different coatings (bare and galvanised). A traditional body side panel might require five separate sets of dies to make reinforcement parts at critical points. This is replaced by one tailor welded blank that contains all of the metal strengths joined together and only requires one set of dies. The ability to optimally assign the needed steel grade, gage, and coating to the part only where it is needed revolutionises the traditional design approach. With this flexibility, the number of parts and the shape of the blanks become more efficient and help achieve higher performance, lower cost and lighter weight.

Many potential benefits can be achieved with the use of tailored blanks. The impact of using tailored blanks is often systemic, affecting weight, material costs, design and fabrication costs, and performance simultaneously.

Weight reduction is achieved through part consolidation and the flexibility of placing optimal steel thickness and grades where they are needed.

Part consolidation can occur by eliminating reinforcements or integrating separate parts and is often achieved concurrently with weight reduction.

Improved material utilisation is achieved through better blank nesting, reduction of stamping offal, selective use of coated or multigrade material, and reclamation of offal (from blanking or stamping).

Improved functional performance results from better structural rigidity, longevity, and dimensional stability. This increases dimensional stability of the body and integrity of body fit, reducing wind noise and water leaks, and improving the body appearance.

Impediments to implementation

Although automobile companies have identified numerous candidate applications for tailored blanks on the car body, many have not yet been implemented. In nearly all cases, the benefits are readily apparent, yet the cost of producing a tailor-welded blank can be prohibitive. There are also concerns in some applications about the impact of the weld line on the forming operation, which might cause splitting. Other forming problems can also occur if the gage differential between two blanks is too severe.

Cost has been the leading impediment to more extensive use in North America. Worldwide, Toyota and Volvo are among the most aggressive users of tailor-welded blanks. All of their applications are welded in-house, which they credit with lowering costs. There is minimal in-house welding capability in North America, but the outside supply base is expanding.

Outsourcing tailored blanks has become a booming industry but can entail the high cost of transportation between blanking, welding, and forming operations, which may be several hundred miles apart. New forms of cooperation are needed with tailor welded blank producers before their full potential can be realised. Close supplier relationships must be developed or a competitive disadvantage relative to companies that co-develop product and process in-house will occur.

One factor hindering the implementation of tailor-welded blanks has been inadequate evaluation of their benefits. Traditional analyses only take direct labour, material, and tooling investment into account. Indirect savings, especially when parts are eliminated, enhanced functional performance, weight reduction, and other significant savings in engineering, inventory levels, scrap and rework, and logistical costs such as material handling, shipping and dimensional quality need to be taken into account.

The advantages of tailor-welded blanks are beginning to overcome the impediments. Chrysler, Ford and GM all have applications in production today, and many more are planned over the next year or two. Volume could more than double over the next two years. The initial applications are simple with short weld lengths and easily formed shapes. More applications that are complex may evolve in a few years as experience is gained, and the potential of ten to twenty applications in a single car body will eventually become a reality.

Implementation Plan

In order to decide if it would be viable to transfer the technology to South Africa, a feasibility study and negotiations with the vehicle manufacturers must be done.

Preliminary results are positive, with costs being the major impeding factor. It would be important to maximise the volumes, and therefore the negotiations with OEMs are important. It is also important to focus on other metals and applications to minimise the costs.

If successful, the availability of such a facility will increase local content and increase the level of technology available to local vehicle manufacturers.

5.2. Metal sub-sector: STAINLESS STEEL

Project name

Stainless Steel Fabrication Industry Development Centre

Project Description

During the 1990s, the stainless steel fabrication industry was characterised by fluctuating demand and erratic workloads, and consequently experienced a serious loss of skills and expertise at all levels. Recently, however, increased demand has been experienced from the petrochemical, chemical, pulp and paper, and sugar industries in particular, as well as for special products and vessels for the food and wine industry. Driving this demand are expansions in these industries, as well as competitive material costs and foreign exchange rates, which make exports more attractive than ever before.

Unfortunately, the fabrication industry is not optimally positioned to take advantage of these opportunities. Experience has shown that both local and foreign suppliers are unaware of, or reluctant to comply with, the requirements of clients for high-performance stainless steel pressure equipment, such as the Sasol Group.

Because of ongoing liaison between potential clients and the fabrication industry, as well as engineering supply houses, SASSDA (Southern Africa Stainless Steel Development Association) has initiated a comprehensive development programme for the fabrication industry. The present proposal details how this initiative may be supported and implemented through the development of a stainless steel Fabrication Industry Development Centre (FIDC).

Project impact

The vision of this initiative is to develop the South African stainless steel fabrication industry into a globally competitive leader recognised for its quality, reliability and technical excellence and the African Continent's preferred supplier.

As such, the initiative will contribute to increased value addition to locally produced stainless steel input material by ensuring that appropriate work is placed in South Africa rather than abroad, which is commonly the case today. Also, the initiative will promote export opportunities, for example wine tanks and food industry equipment to the USA, and chemical plant to Europe.

Initial discussions with key clients such as Sasol have indicated that some R2 billion worth of projects could be obtained by this industry sector over the following three years, if it can comply with the quality and technological requirements of this work. This illustrates the potential return on investment of this initiative.

Implementation Plan

It is envisaged that the functions of the centre will include:

- Liaison with clients to establish project and supply requirements and timing. Through this formalised process, the skills and technology requirements will be audited to guide the future interventions of the centre.
- Creation and maintenance of a resource database. This will include schedules of both technical and human/service resources, including availability and suitability of specialised staff such as designers, draughtsmen, quality management and inspection personnel, project managers and artisan staff. The material and service sections will include information on the availability of specialised component manufacturing facilities both locally and abroad, service centre and machining facilities, transport groups, and related industries. This initial benchmarking is important to guide interventions, but also to facilitate the optimisation of the value and delivery chain.
- Vendor capability auditing. The FIDC will assist potential suppliers in the industry with audits to client requirements. This will include quality audits but will also encompass suitable interventions to improve the internal quality and operational systems of the companies concerned, where necessary.
- Training. The centre will facilitate training in the following disciplines:
  - Design
  - Draughting
  - Quality assurance
  - NDT
  - Client specifications
  - Document control

  - Specialised fabrication skills
  - Graduate training scheme – i.e. the placing of Technikon graduates in industry for in-service training. SASSDA has initiated such a programme in 2002 with two graduates, with great success. Both graduates have now found employment in the industry following the completion of their 6-month training period.
- Supply chain auditing and optimisation. This function will research the overall material requirements in the industry and identify bottlenecks in the supply chain. Suitable programmes will be put in place to then optimise the supply chains against this background. This may include improved planning and project management, the negotiation of early release of designs by clients, and the standardisation of components such as flanges and valves. It is relevant to note here that SASSDA has had some good success with a similar programme in the stainless steel tank container industry, which has enabled that industry sector to increase its global market share from 40% to over 60% over a period of three years.
- Business Development and Marketing. The centre will not interfere with the existing business development processes in the industry. However, a focused business development function is required for penetrating export markets in Africa and elsewhere. This will include research into those markets, the promotion of local and international joint ventures, as well as technology transfer.
- Technology support and development. This is covered in more detail in the following section, but it is clear that a key function of the FIDC will be to facilitate the development and transfer of key materials and fabrication technologies to the industry. This will enable our industry to compete at the complex, high-technology end of the market, where the competitive advantages of the location of South Africa are greatest.

Technology Support

The following technology support will be needed:

Advanced Production Technologies, specifically in the area of metal forming. The focus will be on mechanical forming technologies, such as hydro forming, advanced blow moulding (a new and emerging technology for thin-wall tanks), and advanced pressing, including tooling. Where appropriate, the proposed FIDC will work together with other initiatives, such as the National Tooling Initiative.

Another important aspect is that of joining, specifically by welding. It is proposed that a Stainless Steel Welding Technology Group be set up in cooperation with the South African Institute of Welding (SAIW). Initial discussions have already been held between SASSDA and the SAIW in this regard, and in principle, agreement has been obtained. This group would work together with other role-players, such as the National Laser Centre (NLC) to research, develop and demonstrate advanced and high-quality welding techniques, and also to train operators in these techniques for transfer to industry. The SAIW has a long and proud track record in carbon steel welding.

Advanced Product Technologies are required particularly in the area of design. Stainless steel has a unique combination of properties, i.e. high mechanical strength, corrosion resistance, superior energy absorption, combined with superb weldability and formability. To optimally realise the potential benefits (weight reduction, superior structural performance), it will be necessary to research the property windows of selected stainless steels (e.g. 3CR12), and then translate these properties into appropriate design guidelines and codes. The lack of such information is at present hampering the introduction of stainless steels into a number of attractive market sectors. Also included will be research into the optimisation of properties for particular applications, e.g. the optimisation of microstructures for improved low-temperature impact properties, which is important in many fabricated products for overseas markets. It is proposed to collaborate with RAU (Professor Rudolf Laubscher) as well as the SABS in this regard.

The application of ICT will be confined largely to two areas:

- Project management and supply chain tracking (i.e. logistics).
- Design guidelines and codes.

Performance Measures

- Increased order flow into the stainless steel fabrication industry, measured by turnover. Increased exports of South African stainless steel fabricated products; number of staff trained, both within the industry and as part of the graduate training scheme.
- Number of new fabricators qualified to internationally accepted standards.
- Elevation of technical competence of the industry in terms of fabrication and welding technologies.

5.3. Metal sub-sector: STAINLESS STEEL

Project name

Development of SME and BEE in the Stainless Steel Consumerware Industry

Project description

South Africa is home to one of the fastest growing stainless steel industries in the world. Currently both primary production as well as downstream conversion into fabricated product is growing at rates in excess of twice the world average.

In order to sustain this growth, it is necessary to focus not only on large, established business, but also on the creation and promotion of smaller businesses (SMMEs), to broaden the base of the stainless steel manufacturing industry. The consumerware sector is particularly attractive as a focus area, since it comprises a huge variety of products such as cutlery, hollowware (i.e. pots and pans, etc.), gifting and domestic architectural fittings (e.g. decorative light fittings). However, product quality and outstanding design are prerequisites for success. Where these can be attained, demanding export markets can be attained and very attractive margins generated.

Also, SASSDA has recognised that the stainless steel industry needs to become more representative demographically.

The proposed project aims to address these two issues by focusing on product (design) and production (product quality) technologies, promoting the establishment of new SMMEs in this sector, and by promoting BEE both in existing and in new firms, for instance by developing joint ventures between BEE shareholders and existing, white-owned businesses.

Project impact

The vision of this initiative is to create a new, SME-based and export-focused stainless steel consumerware sector, with meaningful BEE participation. One example is that SASSDA is already creating a new cutlery manufacturing enterprise between a local BEE partner, a local cutlery manufacturer and a Korean technology partner.

Implementation plan

It is envisaged that the proposed project will address the following aspects:

- Development of SME and BEE opportunities in the consumerware sector. This will include researching potential opportunities in sectors such as cutlery, hollowware, gifting and domestic architectural fittings. Particular attention is to be paid to market size and location (especially export markets, but also import replacement), quality requirements and design requirements. This information will guide the interventions in the product/production technologies as well as the enterprise creation activities. For the development of SME and BEE enterprises, the existing Stainless Steel Incubator in Middelburg will be utilised, which is the first operating incubator in South Africa and at present houses 11 aspiring entrepreneurs. Cooperation with the existing Middelburg Stainless Steel Cluster is also envisaged to promote joint ventures with existing firms.
- Production technologies and training. These will be covered in more detail in the following section, but will essentially focus on low-volume, high-quality and labour-intensive forming and fabrication technologies, their development and demonstration as well as relevant training of personnel. Cooperate in this regard is envisaged with organisations such as the South African Institute of Welding (SAIW) and the Eastern Cape Training Centre, which has a good track record in this regard.
- Product technologies. Again, this is covered in more detail below, but the main issue here is functional and especially aesthetic product design.

Technology Support

The following technology support will be needed:

Manufacturing technologies. The focus will be on low-volume, high-quality and labour-intensive forming and fabrication technologies such as simple deep drawing, metal spinning, polishing and finishing, appropriate tooling and aesthetic welding. Activities will include the development and demonstration of these technologies for stainless steel, as well as appropriate technology transfer, to enable South Africa SMMEs to manufacture advanced designs for export. This is at present not possible. It is proposed that other initiatives such as the National Tooling Initiative and the SAIW should work together.

Product technologies. The issue here relates mainly to the development of functional and aesthetic designs for stainless steel consumer products, taking account of international design and market trends as well as the possibilities and peculiarities of stainless steel as a material of construction. This will include relevant design research both locally and abroad. The possibility of establishing a design centre will also be explored. Collaboration is envisaged with the National Product Development Centre, the Middelburg Incubator and Cluster and industrial designers.

Performance Measures

- Number of new SMMEs and/or JV's established.
- Number of black entrants into this industry sector, both as employees (job creation) and as owners/shareholders (empowerment).

5.4. Metal sub-sector: NEW LIGHTWEIGHT MATERIALS

Project name

New lightweight materials development and application research initiative

Project description

The battle lines are being drawn between various materials for increasing competition into the 21st Century especially in the automotive industry. The drive for weight reduction, environmental safety and vehicle performance improvement are continuing and all the proponents of the main materials have claimed their share of benefits. Unfortunately, the various opinions are not always objective and are being skewed by personal agendas.

It is important to understand that the automotive industry will continue to develop vehicles with the appropriate mix of a variety of materials. It is important that collaborative R&D is done with the automakers in order to provide them with the most up-to-date information so that they can best design their next generation of vehicles.

This is not only true for the automotive industry, which is booming, but also for other industries such as the building and construction, aeronautics and household goods industries.

The need therefore exists for an initiative that can provide objective application research and, from this, appropriate materials research and development.

Project impact

This project will ensure the objective use of materials based on the specific needs of the client. Optimisation of materials in all applications will be ensured. This initiative could stimulate a revival of industries that could not keep up with the changing needs due to a lack of research back-up.

It would also give the automotive industry local material research support to improve local content.

Finally, research of new and old materials could lead to new applications, which could lead to the establishment of new industries and job creation.

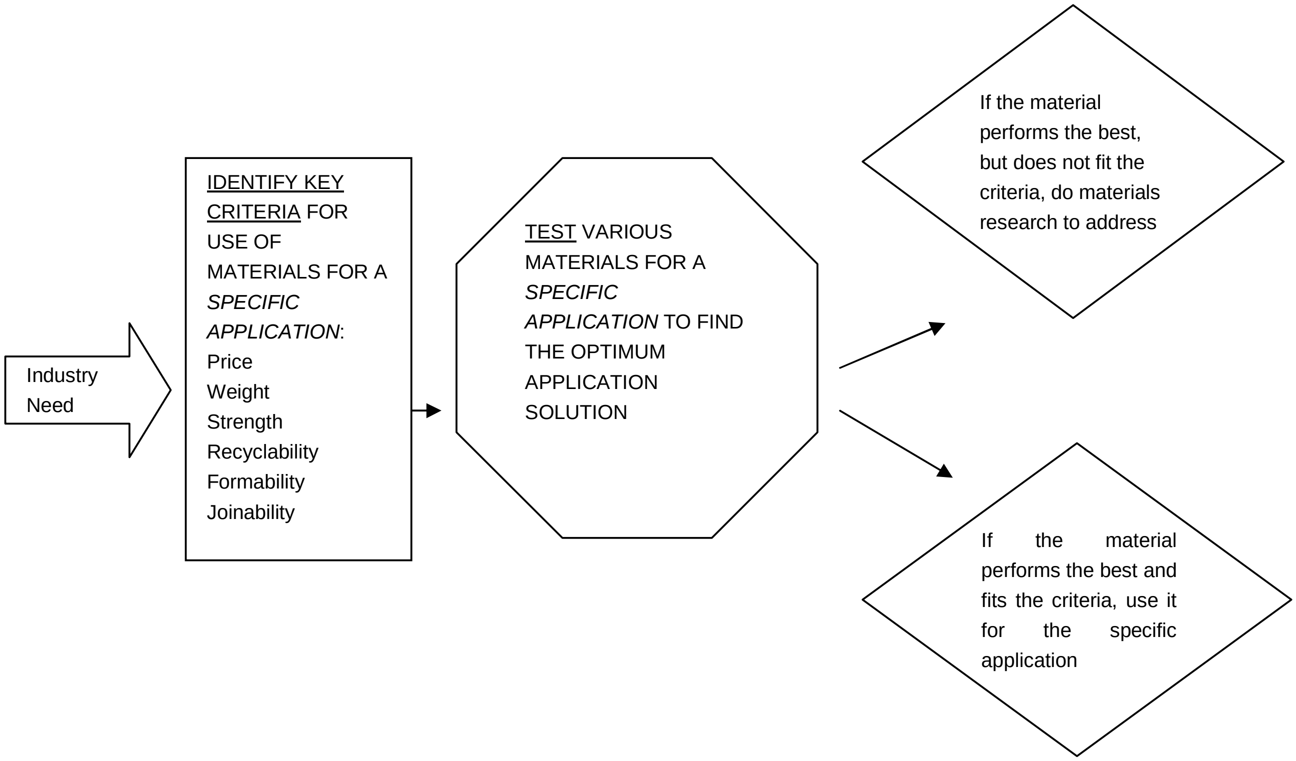
The following skills will be embedded and available to industry:

- Knowledge of material properties.
- Availability of processing techniques.
- Improved product quality.
- Availability of new materials.
- Communication within the industry and amongst industries.

Implementation plan

The CSIR and Mintek have initiated an Advanced Materials Initiative to do joint R&D projects. This initiative could form the foundation to build a world-class materials application research facility in South Africa. It will be imperative to extend the initiative to include other key role-players who could contribute. These would include other science councils, tertiary education institutes and industry associations and industry.

The approach can be shown diagrammatically as follows:



The following support will be available to industry:

- Extend available technology to businesses lacking technical capabilities.
- Help organisations use cleaner production technologies.
- Provide information on available technology.
- Identify problems and use access to technology sources to solve problems.
- Serve as external consultants and assist firms with trouble-shooting.
- Promote cooperation between SMMEs and larger research and cluster initiatives.
- Design new processes and products.
- Train businesses through demonstration, participation and extension.
- Implement new technologies:
  - Import and learn foreign technology
  - Adapt foreign technology to local needs
  - Integrate these technologies into the economy in collaboration with firms

Technology support

The following technology support will be needed:

The application of **advanced materials** in this project will mainly involve nanotechnology in the design of new materials and product development. The application of nanotechnology could result in increased toughness, strength and hardness, higher electrical resistance, improved thermal expansion properties, lower thermal conductivity and improved magnetic properties.

The application of **advanced product technologies** in this project will be in the areas of design and product development and production. The support of advanced product technologies especially in the beneficiation of metals will be used to develop new products from idea to manufacturability, as well as the redesign and re-engineering of existing products.

The following are relevant interventions:

- Design technologies.
- Materials engineering technologies.
- Engineering analysis technologies.
- Tooling technologies.
- Joining technologies. Testing, inspection and validation technologies.

The application of **ICT** in this project will be in the areas of design and product development, production and distribution. ICT supports product development, manufacturing planning, execution and distribution.

The following are relevant interventions:

- Product development software.
- Simulation and modelling software.

The application of Cleaner Production Technologies (CPT) in this project will be in the areas of raw materials, design and product development and production. CPT and compliance to standards are becoming increasingly important in terms of ensuring sustainable exports.

The following are relevant interventions:

- Environmental impact studies.
- Life cycle analysis.
- Design of plants and processes.

- Energy efficiencies and waste management.
- Emission control

Performance measures

- Proportion of projects involving cooperation between partner organisations.
- Proportion of projects involving international linkages.
- Number of post-graduate students involved.
- Number of research outcomes implemented by industry.
- Number of projects in collaboration with industry.
- Number of SMMEs involved in activities.
- Development of industry support services related to material technologies.

5.5. Metal sub-sector: PRECIOUS METALS

Project name

Platinum Beneficiation Initiative

Project description

The annual contribution of the South African platinum sector is R34 bn in foreign exchange earnings, and creates 90 000 jobs. Compared with these figures, a modest R14 m per annum is spent on platinum group metals (PGM) research in South Africa. Platinum producers seem to have little interest in future downstream applications of platinum. The largest current downstream applications are jewellery (51%) and autocats (21%).

Future uses of PGM are seen to be in fuel cells, high-temperature alloys and the extended use of the catalytic properties of PGM. The current technology drivers are:

- Increasing ore complexity
- Cost reduction
- Environmental aspects
- Safety
- Uses of PGMs

During a multi-national platinum workshop held in September 2002 in Pretoria, a Platinum Value Addition Group (PVAG) was formed to facilitate the downstream value addition of PGMs. The group consists of representatives from Mintek, the CSIR, NRF, Germany, Sweden and the University of the North.

This proposal is for the support of this multi-national initiative.

Project impact

This initiative would improve the use of the abundant raw material we possess in South Africa and would ensure that PGMs are not replaced by other materials due to our lack of research and development. Specific projects that have already been identified by the multi-national group are:

- Industrial applications
  - Pt-based super alloy development
  - Pt-modified aluminide coatings on Ni-based super alloys for high-temperature oxidation resistance
  - New developments in the glass industry
  - Electronic applications
  - Catalysis
  - Development of material property databases
  - Process and alloy development in the jewellery industry
  - Medical applications like anti-cancer Pt drugs and Pt-based anti-malarials

Implementation plan

- The PVAG will be consolidated to ensure inclusivity and representation.
- A vision and strategy will be developed with key stakeholders.
- A follow-up workshop will be arranged in Europe to consolidate the network.
- Joint projects will be submitted to various funding agencies.
- Industry will be kept involved through a dedicated communication plan.
- Various proposals made during the South African workshop will be followed up and jointly pursued.

Technology support

The following technology support will be needed:

The application of **advanced materials** in the metals value chain will mainly involve nanotechnology in the design of new materials and product development. The application of nanotechnology could result in increased toughness, strength and hardness, higher electrical resistance, improved thermal expansion properties, lower thermal conductivity and improved magnetic properties.

The application of Advanced Product Technologies in the metals value chain will be in the areas of design and product development and production. The support of Advanced Product Technologies especially in the beneficiation of metals will be used to develop new products from idea to manufacturability, as well as the redesign and re-engineering of existing products.

The following are relevant interventions:

- Design technologies
- Materials engineering technologies
- Engineering analysis technologies
- Tooling technologies
- Joining technologies
- Testing, inspection and validation technologies
-

The application of ICT in the metals value chain will be in the areas of design and product development, production and distribution. ICT supports product development, manufacturing planning, execution and distribution.

The following are relevant interventions:

- Product development software
- Simulation and modelling software

The application of Cleaner Production Technologies (CPT) in the metals value chain will be in the areas of raw materials, design and product development and production. CPT and compliance to standards are becoming increasingly important for ensuring sustainable exports.

The following are relevant interventions:

- Environmental Impact studies
- Life Cycle Analysis
- Design of plants and processes
- Energy efficiencies and waste management
- Emission control

The application of logistics in the metals value chain will be in the areas of raw materials, production and distribution. Logistics is an enabling technology, which plays a major performance improvement role across the value chain.

The following are relevant interventions:

- Industry solutions and best practices.
- Technical simulation models for decision-making.
- SME development through supply chain optimisation

Performance measures

- Establishment of downstream PGM industries in South Africa will be promoted.
- Technical interventions, based on R&D and implemented, will be market driven.
- Opportunities to establish new enterprises will be enhanced.
- New job opportunities will become available in the industry. The value of exports generated will improve. The industry will improve its demographics in terms of SMMEs, BEE and research exposure.

5.6. Metal sub-sector: PRECIOUS METALS

Project name

AuTEK

Project description

The AuTEK project is a collaborative, South African-based research initiative involving gold producers, AngloGold, Gold Fields and Harmony, and the national metallurgical research organisation, Mintek.

The AuTEK project's purpose is to discover, test and develop new applications of gold in the industrial sector. Traditionally, gold has been appreciated for its beauty and acknowledged as a store of value, but the metal has certain distinctive features that hold the promise of its being viewed in another completely different light in years to come. About 85% of the world's gold production is used for jewellery manufacturing, and only approximately 10% for industrial applications, dominated by the electronic industry. Vast scope exists to develop industrial uses of gold.

Gold has many useful technological attributes such as its catalytic properties, which enable it to function at low temperatures and in the presence of moisture; and its great nobility and special electronic structure, which confer special qualities on high-performance alloys and advanced materials. The aspects under investigation by the AuTEK project team include:

- Catalysis
- Metallurgical applications
- Biomedical applications

Most of the R&D is conducted at Mintek, but collaborative work is conducted with local (UP, US, RAU, WITS, UCT) and overseas laboratories (University of Leiden, Netherlands, and Louis Pasteur, France).

Project Impact

The AuTEK project aims to secure the long-term stability of the gold markets by developing a significant new opportunity for gold usage in the industrial sector. The objectives of the project are as follows:

- To create new markets for gold commodities, with a view to ensuring the long-term stability and growth of this vital sector of the South African economy.
- To address pressing world-wide technological issues such as the environment, e.g. reduction of toxic NO_x pollutants and oxidation of CO.

- To foster technological and commercial links between South African and international universities, laboratories and industries.
- To develop a technology platform for fundamental gold research in South Africa.
- To do R&D into processes to produce value-added products locally.

New applications for gold will result in a more stable market. This will not only secure a more reliable foreign income, but also job retention and a stronger society as far as socio-economics is concerned. For example, there is the potential to develop gold-based catalysts and electrodes locally. The catalysts and electrodes could be incorporated into products wholly produced in South Africa with an export potential. This will result in adding value to one of South Africa's most strategic raw materials and increasing job opportunities in various downstream products.

Implementation Plan

To conduct R&D into new/novel applications of gold, thorough literature surveys, market studies and discussions with leaders in the scientific field and potential end-users of the technologies must be done. This will enable R&D to be conducted efficiently, while allowing a focus on specific applications with known targets.

A number of research areas are being investigated by AuTEK and some show potential for scaling up and the possibility of manufacturing in South Africa. The DST has been approached for funding to scale up gold-based catalysts via the Innovation Fund programme. The aim of this proposal to NAMS is to secure funding for conducting pilot plant tests on gold-based electrodes for electrochemical processing of chemical compounds. Attention will be given to the up-scaling of the process, on-line monitoring of the process and production of the electrodes. This approach will allow the entire electrochemical cell to be manufactured locally.

Technology support

The application of advanced materials in this project will mainly involve nanotechnology in the design of new materials and product development.

The application of nanotechnology could result in increased toughness, strength and hardness, higher electrical resistance, improved thermal expansion properties, lower thermal conductivity and improved magnetic properties.

The application of Advanced Product Technologies in this project will be in the areas of design and product development and production. Advanced Product Technologies, especially in the beneficiation of metals, will be used to develop new products from idea to manufacturability, as well as the redesign and re-engineering of existing products.

The following are relevant interventions:

- Design technologies
- Materials engineering technologies
- Engineering analysis technologies
- Tooling technologies
- Joining technologies
- Testing, inspection and validation technologies
- Product packaging technologies

Performance Measures

Summarised progress reports will be submitted every four months that will give feedback on progress and deviation from the schedule, and give an interim financial report. A full progress report will be submitted once a year

Milestones	Duration
Scale up electrodes and electrochemical cell in order to conduct (2). Electrochemical laboratory investigations on a larger scale in order to obtain parameters required for pilot plant design (e.g. electrolyte concentration, flow rate, temperature). Investigate different electrode types (e.g. composition, production methods). Market feasibility study with parameters obtained.	Year 1
If (4) proves economically viable, continue with Year 2 pilot plant design and production. Investigate electrode design and electrode production for pilot plant scale. Optimise electrochemical production process on pilot plant scale.	Year 2
Continue with optimisation of electrochemical production process on pilot plant scale. Install on-line monitoring system of electrochemical cell. Optimise production of electrodes.	Year 3