

PART 1 – EXECUTIVE SUMMARY

3 RECOMMENDATIONS

This section explores the strategic interventions that can be made to foster the growth of an Aroma and Fine Chemical value chain in South Africa and remove the constraints impeding its creation. Recommendations are therefore made for each individual value chain.

Since synthetically and naturally derived Aroma and Fine Chemicals feed into similar downstream industries, there are several recommendations that relate to each of the above value chains. These are referred to as “cross-cutting” recommendations. These relate to the creation of a more sophisticated enabling environment, which will ensure that South Africa develops and maintains a position from which it can compete in the international market for Aroma and Fine Chemicals.

3.1 Aroma Chemicals derived from effluent from the Paper and Pulp Industry

Strategic Intervention: To motivate a detailed feasibility study to establish a viable SME Terpene aroma chemicals manufacturing business based on processing a guaranteed minimum supply of crude sulphonated turpentine and a defined technology.

Specific strategic recommendations

1. Hold discussions with potential crude sulphonated turpentine suppliers to ascertain the potential of a guaranteed supply of crude sulphonated turpentine.
2. Initiate technology development to generate more detailed process chemistry and establish process performance & technical data in order to develop a more accurate techno-economic model.

3.2 Aroma Chemicals Derived from Petrochemical Feed stocks

Strategic Intervention: To motivate the establishment of an Aroma and Fine Chemicals platform based on a mixed cresols feedstock, deploying the CSIR and Mbuyu Biotech suite of technologies to produce the portfolio of products identified in this FRIDGE study, comprising the pHB-intermediate, technical and flavour grade pAA, menthol and OMC as the first phase.

Specific strategic recommendations

1. Develop a strategy to elicit interest from prospective investment parties that have the capacity of completing a detailed business feasibility study into launching the Aroma and Fine Chemical platform and developing a detailed implementation strategy. The

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investment partner must therefore have the capacity of ensuring that the following are achieved:

- Identify and secure a source of mixed cresol feedstock at a price equivalent to a pure cresol price of no more than \$ 1,250 – 1,458/ton.
 - Secure the key enabling technologies for the portfolio of products and ensure that all process development is completed and ready for implementation.
 - Secure an internationally competitive technology in respect of OMC.
 - Define the detailed utility and service requirements for the envisaged complex.
 - Identify and select a potential site capable of providing the utility and services requirements at competitive input costs. The site should have the potential for expansion.
 - Develop a strategic plan to attract international strategic alliance partners for menthol and OMC by leveraging the fact that the global competitiveness of the technologies and the potential business can be demonstrated.
2. Facilitate the provision of a world-class site; a secure competitive feedstock; well-trained professional staff, thereby increasing the prospect that an international strategic alliance partner/s can be secured by the prospective investment partner.

Strategic Intervention: To motivate the incubation of the smaller volume aroma chemicals as a second phase investment by SMEs by South African downstream processing incubators.

Specific strategic recommendations

1. Develop a strategy for the smaller volume high value aroma chemicals not included in the Aroma and Fine Chemicals platform project as the second phase of investment in expanding the value chain. Use could be made of the relevant sectoral incubators.

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3.3 Aroma Chemicals Derived from Essential Oils

The essential oils value chain traverses a couple of industry sectors. The agricultural aspect of the value chain is the primary production platform for essential oils. Therefore, in order to do justice to the whole value chain, recommendations regarding the agricultural component are also presented.

Strategic Intervention: To motivate that the Government adopt a uniform and coordinated approach towards the development and financing of the essential oil industry, including the creation of a joint forum in which to formulate policy and strategy.

Specific strategic recommendations: Agricultural Issues

1. Clarify the role of Governmental Departments (for example, Department of Trade and Industry, Department of Science and Technology and National Department of Agriculture) with respect to their roles in the development and support of the essential oil industry.
2. Clarify the role of Governmental research institutions (for example, the National Botanical Institute, the Agricultural Research Council and the CSIR), with respect to essential oils and determine the manner in which the outputs of their research may be made available to the South African public.
3. Prepare an inventory of all information, relevant to essential oils, housed within government institutions including information relating to indigenous plant materials and their extracts.
4. Create a central database that allows South Africa to manage its knowledge base with regards to essential oils (and other potential non-food crop types) including information relating to the selection of plant material, results of growing trials, studies relating to the economics of essential oil production, chemical composition of plants and their extracts, etc.
5. Consider the development and support of regional producer centres, which will promote a multi-disciplinary approach to essential oil production. These should take advantage of the synergies afforded by the presence of tertiary institutions (producing graduates in agriculture, botany or chemistry and having laboratory facilities), the presence of suitable growing conditions and the presence of committed producers.
6. Consolidate any initiative regarding essential oils into a broader rural industries development strategy. Reference should be made to the experience of other

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countries, such as Australia's Rural Industries Research and Development Corporation.

7. Ensure publicly funded research is conducted with a view to determining and setting standards with regards to such factors as (1) the correct geno-types, (2) the correct growing conditions, (3) the correct harvesting and post-harvesting procedures (4) best practice with regards to distillation. Research could be conducted on the basis of public private partnerships where producers become "crop champions" for public research purposes. The results of such research should be publicly available to allow for the expansion of the industry and to promote international confidence in the South African industry. It should also form the basis for the development of skills training and development materials.
8. Establish a national or regional system of plant material banks to ensure that quality plant material is available for local production. This responsibility could be allocated to agricultural colleges and Agricultural Research Council divisions, probably part of the regional producer centres.
9. Develop courses in Good Agricultural Practices, particularly for previously disadvantaged communities, and particularly with regards to good harvesting and post harvesting practices, which can have significant impact on the yields received and the economic viability of the enterprise.

Specific strategic recommendations: Primary Beneficiation

1. Provide technical assistance and training in respect of the operation of distilling equipment, particularly with regards to quality control.
2. Support research into new extraction processes such as super critical fluid extraction with a view of developing a new extraction enabling technology.
3. Conduct research and development work in respect of cost effective "in-field" chemical analysis techniques.

Specific strategic recommendations: Secondary Beneficiation

1. Develop a national system of standards (corresponding to the ISO standards, but adapted where necessary) or a voluntary industry standard, which will promote the production of good quality oils. Standards should relate to the oils themselves and to the testing procedures. This could also include a voluntary certification process.
2. Create a national database for oil profiles and GC "fingerprints". This would be particularly useful in respect of indigenous plant extracts. This should go hand in

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hand with the generation of research that would support the registration of products with international regulatory bodies. South Africa could perhaps partner with a large trading partner like the European Union in the development of this competency.

Specific strategic recommendations: Marketing and customer relations

1. Consideration should be given to how best to prepare and publish essential oil production and trade statistics.
2. Develop an appropriate national marketing strategy for the industry.

Specific strategic recommendations: Commercial issues

1. Consult potential funding sources (such as the Landbank and the IDC) in the formulation of policy and strategy for the development of the essential oil industry.
2. Review the existing community projects, supported by government, in order to document the lessons learned and to assess their long-term viability.
3. Consider applying co-operative structures to the development of the essential oils industry, particularly as a vehicle for rural development initiatives as they combined individual initiative with communal support and co-operation.
4. Identify businesses involved in the secondary beneficiation stage for support in regional incubators. These could include businesses involved in the production of both synthetic and naturally derived chemicals.

3.4 Cross-cutting Recommendations

3.4.1 Skills Development

The limited availability of skills has been cited as a constraint to growth in the chemical industry.

Strategic Intervention: To target training interventions by assessing the skills development requirements of existing Aroma Chemical, Essential Oil and Plant Extracts, and Flavour and Fragrance industries.

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Specific strategic recommendations

1. Develop learnership programmes with the qualification of specific skills in technical formulation and olfactory related subjects. Olfactory related subjects should also be taught by the higher education institutions at post-graduate level.
2. Encourage learnerships within a 'new' qualification of technical sales, in support of the fine and speciality chemicals sub-sector.
3. Develop a strategic plan whereby existing research organisations and fine chemicals companies could play a pivotal role in the training of technical skills. Technologist exchange programs with the new aroma and fine chemical business could be implemented to train and hone operational skills (by the trainee working on pilot or existing manufacturing plants) and scientific skills (through supplementing technical resource requirements on development projects).
4. Develop training programmes at higher education institutions aimed at furnishing post-graduates with skills targeted at the downstream chemical manufacturing industry. Courses should include aspects of fundamental chemical training, such as industrial chemical synthesis, batch processing, small plant operation, and product formulation. Post-graduate skills with respect to the successful transfer of laboratory procedures into commercially viable production processes should also be taught. These programmes should furthermore include a strong entrepreneurial and business development component, including modules in accounting, business economics, marketing, strategy, management of operations, quality and project management. This will promote the training of numerate graduates with the unique combination of technical as well as management skills.
5. Promote industry-led programmes and networks leading to collaborative efforts between academia and industry. An example is the United Kingdom's BRITEST™ programme. This programme's specific objective is for private companies to participate and provide leadership for projects designed to enhance the industrial relevance of university research and make it more broadly available to industry. The programme focuses on early stages of chemical processes where chemists' ideas are converted into process applications at industrial scale. The outcome of the programme is the innovative development of better approaches for scaling up from test-tube to production plant in the downstream manufacturing industries, thereby improving economic competitiveness. The programme promotes access to creative development in science, engineering and technology, as well as ensuring a continued supply of well-trained scientists and engineers. This interaction will furthermore serve to increase awareness about the skills required and used in the chemical industry.

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3.4.2 Development of a Pipeline of Aroma and Fine Chemicals

Aroma and fine chemicals companies are dependant on their ability to create innovative products in order to grow sales, create markets and add value to existing products.

Strategic Intervention: To develop a balanced portfolio of a future pipeline of products.

Specific strategic recommendations

1. Hold discussions with the South African Flavour and Fragrance houses (both local and international) to explore the potential for integration of the nascent aroma and fine chemical industry into their activities. These discussions should identify further opportunities for the manufacture of a pipeline of Aroma Chemicals specifically selected as being relevant for the regional market.
2. Identify technology partner/s for the research and development of a future pipeline of Aroma and Fine Chemicals to this value chain. The partner/s should be research organizations/institutions with specific experience in the field of Aroma and Fine Chemical research and innovation.
3. Consider the promotion of the use of existing pilot plant and small-scale toll manufacture infrastructure to reduce the risk of full-scale dedicated investments by allowing technology testing, scale-up and early market penetration for the Aroma and Fine Chemical business. Such infrastructure will have to comply with current Good Manufacturing Practice. The manufacture of small pilot scale quantities would allow early assessment of the product's ability to meet market needs, and will promote direct customer interaction at an early stage. Furthermore, new products or changes to existing product specifications could rapidly be implemented and tested within the customer's flavour and fragrance formulation or product. The Aroma and Fine Chemical business can therefore meet the requirement of customer responsiveness before a full-scale investment in new capacity is required.
4. Develop a funding programme for research and development into the value adding beneficiation processes of natural products in order to develop niche or value-added products. For example, this could involve research into the process of "splitting" (fractioning) the natural product into its chemical components thereby isolating the pure natural aroma chemical.
5. Fund research into the application of South African indigenous materials in the areas of flavour and fragrances and the complementary areas of cosmetics and

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nutraceuticals. The focus should be on identifying the “active ingredients” and determining the general safety of the chemicals for human (and other) use.

6. Develop a strategic plan to incubate the smaller volume aroma chemicals identified and proposed as a second phase investment by the South African Downstream Processing incubators. This process will increase the success rate of the start-up companies and provide some of the skills needs, both business and technical, identified as being critically required by the South African chemical industry.

3.4.3 Support of the innovation cycle

An innovation chasm in the phase between research and development and the commercialisation of viable products has been identified. Overcoming these constraints is critical to ensuring the longer-term sustainability of this industry.

Strategic Intervention: To bridge the innovation chasm between research and development and the commercialisation of viable products.

Specific strategic recommendations

- 1 Review the funding process for the latter phase of technology innovation i.e. scale-up, product introduction, process engineering, and new plant trials, before projects meet the criteria for private sector investment. This could have a direct impact on stimulating industry demand for research.
- 2 Involve potential funding sources in the formulation of policy and strategy for the development of the industry. These agencies need to be informed of the dynamics of the industry so that they can properly develop funding packages to meet the needs of the industry. Furthermore, the industry needs to determine what factors need to be in place in order to make the industry more attractive to these institutions.

3.4.4 Integration into the downstream Flavour and Fragrance Industry

Consideration should be given to the development of complementary value chains in the fields of flavour and fragrance formulation, cosmetics and nutraceuticals. These draw heavily on the same skills and experience base.

Strategic Intervention: To begin the process of integrating the Aroma and Fine Chemical value chain into the next stage of the Flavour and Fragrance Industry (Step 2).

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Specific strategic recommendations

- 1 Promote education and skills development in the downstream flavour and fragrance industry and the complementary industries of cosmetics and nutraceuticals. South African tertiary institutions should therefore provide courses in cosmetics and flavour and fragrance formulation.
- 2 Develop at least one regional centre of excellence in each of the areas of flavour and fragrances, cosmetics and nutraceuticals. These should take advantage of the synergies afforded by the presence of tertiary institutions (producing graduates in agriculture, botany, chemistry, pharmacology and having laboratory facilities etc.)