

# Towards a Competitive South African Tooling Industry

Mncedisi Trinity Dewa, Andre F. Van Der Merwe, Stephen Matope

**Abstract**—Tool, Die and Mould-making (TDM) firms have been known to play a pivotal role in the growth and development of the manufacturing sectors in most economies. Their output contributes significantly to the quality, cost and delivery speed of final manufactured parts. Unfortunately, the South African Tool, Die and Mould-making manufacturers have not been competing on the local or global market in a significant way. This reality has hampered the productivity and growth of the sector thus attracting intervention. The paper explores the shortcomings South African toolmakers have to overcome to restore their competitive position globally. Results from a global benchmarking survey on the tooling sector are used to establish a roadmap of what South African toolmakers can do to become a productive, World Class force on the global market.

**Keywords**—Competitive performance objectives, lead time, toolmakers, world-class manufacturing.

## I. INTRODUCTION

IN the past decades, the South African Tool, Die and Mould-making manufacturers have been struggling to compete on the global market in a significant way. Mkhize [1] highlighted that the local tooling industry only enjoys less than 15% of the global market share as illustrated in Fig. 1. This is due to the fact that World-Class TDM firms from other continents have altered their business strategies by adopting the necessary technology and management philosophies to compete effectively. These firms design, manufacture and deliver their products quickly and reliably to customers thus giving them an edge in terms of lead time and price. This reality has caused most South African companies in the TDM sector to suffer global competition thus hampering their profitability and growth.

In the paper, the success factors employed by world class toolmakers are explored and presented. Results from benchmarking studies of the South African TDM sector are then employed to identify the constraints local toolmakers have to overcome to position them competitively on the global market and restore market share. The structure of the article is as follows: Firstly, an outlook of the current state of the Tooling industry is presented. Secondly, we present the key competitive performance objectives for successful tool-making firms. Finally, results from the South African TDM sector benchmarking survey are employed to identify the constraints local toolmakers need to address to become World-class organizations.

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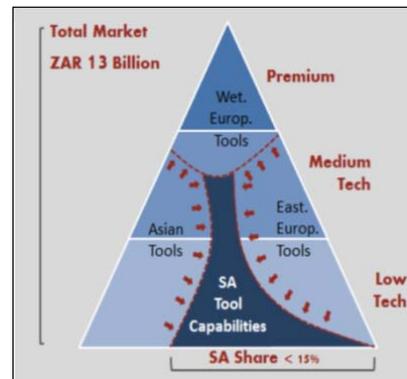


Fig. 1 South African TDM global market share [1]

## II. STATE OF SOUTH AFRICAN TOOLING SECTOR

Though the South African toolmakers are meant to support the Automotive and Plastics manufacturing sectors, records reveal that a majority of local Overall Equipment Manufacturers (OEMs) import most of their tooling equipment from European and Asian firms. Due to demand increase in the South African Automotive sector, the quantity of tools bought by this sector has increased yearly as illustrated in Fig. 2 [2].

In the year 2013 alone, the South African automotive industry spent 4.09 billion ZAR on purchasing tools. However, 72% of this amount was spent on imports from Europe and Asia with the United Kingdom, China and Germany being the main suppliers as illustrated in Fig. 3 [2]. Due to these trends the South African Department of Trade and Industry (DTI) and the Tooling Association of South Africa (TASA) have realized the evident need to resolve the problem. The South African Government initiated the National Tooling Initiative Programme (NTIP) in March 2002. The NTIP under the Department of Trade and Industry was mandated to formulate strategies to revive the TDM sector. Two key programmes namely the Skills Development Programme and the Enterprise Development programme were launched by the NTIP so as to improve the sector's competitiveness.

As part of the work, the NTIP in collaboration with academic institutions of higher learning conducted a benchmarking programme for the TDM industry so as to establish the status of the sector before strategic interventions could be designed and implemented [3]. The goal of the benchmarking study was to identify the key competitive performance objectives for successful firms in the tooling industry and how the South African TDM sector was performing in those areas. As revealed in an Engineering Artisan article [4], the current benchmarking report on the

South African TDM Industry indicates that without interventions, many local companies benchmarked will not survive global competition and will eventually struggle. Some

of the results collected from the benchmarking study motivated the recommendations presented in this article.

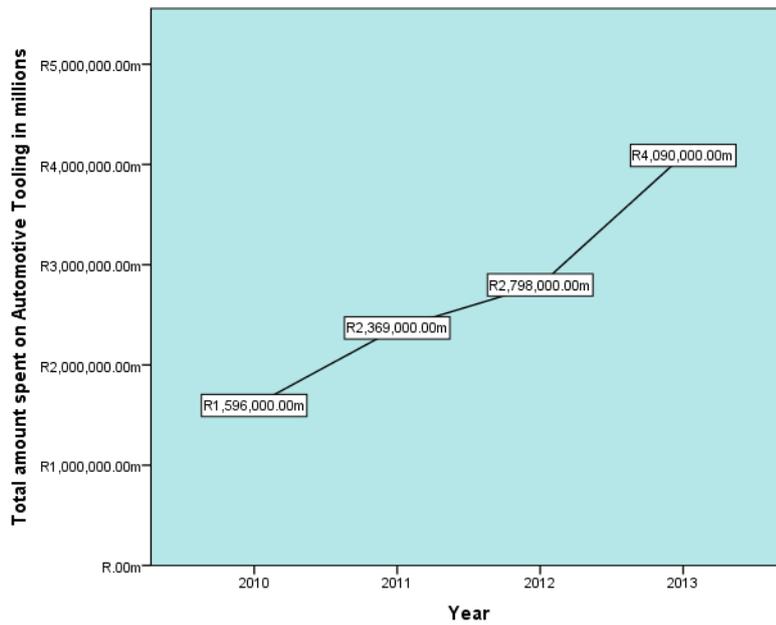


Fig. 2 Growth in demand for tooling equipment in South African Automotive Industry

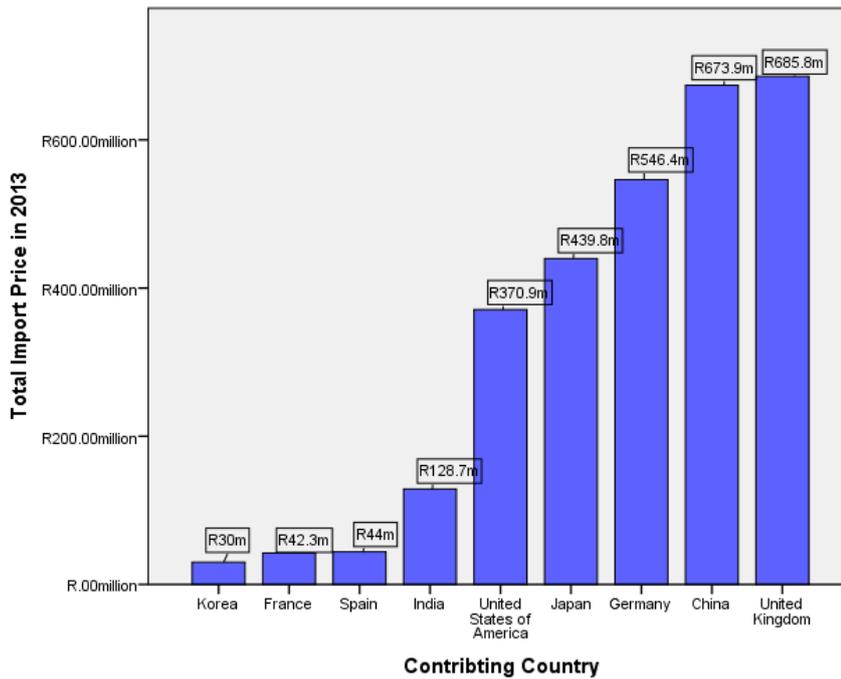


Fig. 3 Where South African Automotive Industry bought tools from in 2013

### III. COMPETITIVE PERFORMANCE OBJECTIVES FOR WORLD-CLASS TOOL-MAKING FIRMS

Schuh et al. [5] and Choi et al. [6] highlighted that tool making companies are measured by their customers against

three key performance indicators which are; product quality, due date reliability and delivery lead time. According to [7], product quality is an order qualifier for clients since it is a prerequisite for all tool making companies to produce goods

which conform to the customer's requirements and defined tolerances. He concluded that due date reliability and lead time to be the order winners which cause some tool and die makers gain market share. Recently, results of a survey in the Western Cape tooling industry by [8] confirmed that product quality and delivery due date performance were critical performance measures as shown in Fig. 4. The product cost was also identified as a key competitive strategy in the study.

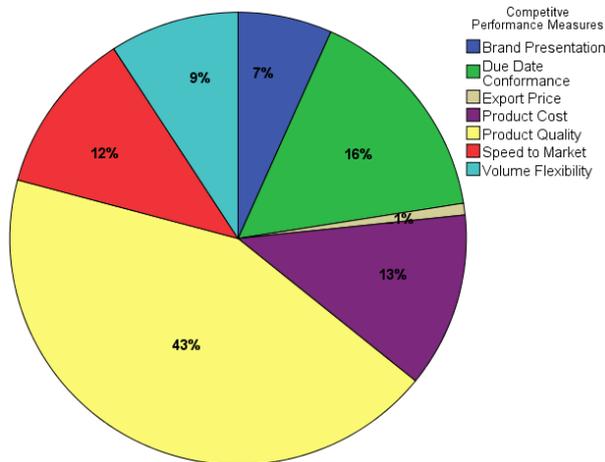


Fig. 4 Key Competitive Performance Objectives in TDM sector [7]

Results of the benchmarking study conducted also indicated that besides producing quality tools, dies and moulds, another key success factor for firms doing well in the TDM sector globally is product time-to-market. South African firms were not competing well in the area of delivery lead times [4].

#### IV. RESEARCH METHODOLOGY

Content analysis of results gathered from the South African tooling benchmarking study was used as the research strategy. Thirty nine (39) firms from different Provinces were selected and visited during the benchmarking survey and were regarded as a representative sample of TDM firms in the nation. A questionnaire was prepared and field visits of the companies were conducted. The respondents were shop-floor managers during the visit. The purpose of the field visits was to compare South African toolmakers to their European counterparts who were leading in the field. The financial welfare, technology, capacity, product capability and manufacturing practices of the firms were observed and compared to those of Asian and European tool-making firms which are doing well on the global market.

#### V. BENCHMARKING SURVEY RESULTS

The benchmarking exercise conducted revealed that a majority of the firms in the South African tooling industry were struggling in the area of production lead times hence not meeting customer due dates. The main constraints causing this

trend were identified and classified as financial, technological, capacity, human resource and global trade related.

##### A. Financial Constraints

The first observation made was that a majority of firms in the South African tooling industry are small with an average of 10-15 employees per firm. According to [9], approximately 90% of the firms in the South African Tool, Die and Mould-making industry are in Small Micro to Medium Enterprises (SMMEs). Current statistics on SMMEs firms reveal that their annual income is less than 10 million ZAR [10]. Eventually the firms lack enough financial muscle thus inhibiting them from investing in the necessary technology required for efficient production and the required design software. As a result, clients perceive the companies as financially unstable entities which cannot work on big projects.

##### B. Technological Constraints

Due to financial constraints discussed earlier, local toolmakers still trail behind their international counterparts when it comes to the required technology. Most South African tool rooms are specialists who focus on their key competences thus delivering a narrow range of products due to their limited outdated technology as shown in Fig. 5.

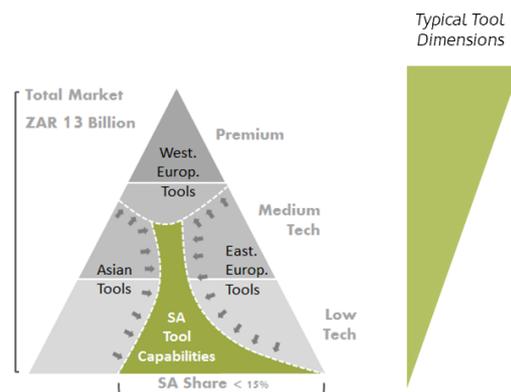


Fig. 5 South African Toolmakers capabilities [13]

The required technology for processes in the tooling sector can be classified at four levels of production which are: design, machining, testing and mould bases. Unfortunately, local toolmakers are still lagging behind on possessing the best technology in all these stages.

##### 1. Design Technology

The main cause of delayed lead times in the observed tool rooms can be attributed to the long order processing times. These delays are a result of lack of a proper design depository for speedy quoting of jobs. Tool making firms in nations like Germany and Taiwan possess design software which allows them to quote jobs in 24 hours or less and make any changes as required by clients. Fig. 6 illustrates the position South African toolmakers take when it comes to design software in comparison to Germany firms.

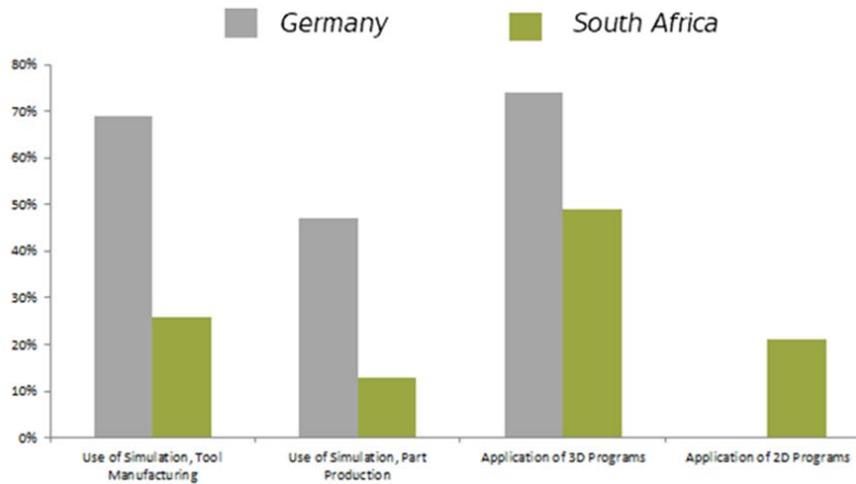


Fig. 6 South African Toolmakers use of software [13]

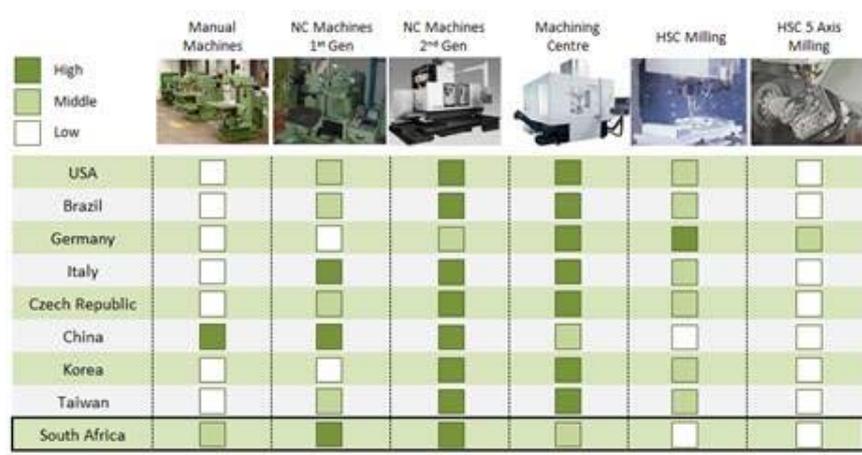


Fig. 7 South African Toolmakers use of machining technology [13]

Most South African Tool and Die manufacturers still lack the required software for simulation, design analysis, failure mode analysis and stress analysis. However, possession of such software has become a prerequisite for OEMs before a contract is awarded.

2. Machining Technology

A majority of South African toolmakers are yet to adopt the latest state of the art machining technology to aid them produce the best finish in their products. Most firms still use old equipment which significantly compromises delivery lead time as illustrated in Fig. 7, lagging behind to most European, American and Asian counterparts.

3. Molding Technology

Globally, a majority of international toolmakers have adopted the strategy of purchasing standard mould bases as a way of reducing production lead times. When clients approach such firms, parts can be processed quickly using this approach. However, most South African toolmakers still machine their

own mould cavities. Though this strategy has cost benefits it significantly compromises the delivery lead times.

4. Testing Technology

It was also observed that a majority of local toolmakers lack the appropriate metrological and measurement equipment for conducting conformance tests on finished tools, moulds and dies. This post-production exercise has become critical in winning contracts within the sector.

C. Capacity Constraints

The South African TDM sector still lacks access to the global market due to their limited resource capacity base. Since a majority of local tool-making firms are small in size, they lack sufficient resources and capacity for voluminous work. Synman [11] revealed that order contracts from the Automotive sector are big with quotes ranging from 10–50 million ZAR per order leaving the local individual toolmakers incapable of meeting such demands due to their limited number of machinery. If a firm is small (with limited resources), a large project will absorb a firm’s entire capacity

for several months rendering it incapable of bidding for more work.

#### D. Human Resource Constraints

Due to a lack of sufficient funds and working capital, South African tool-making firms cannot afford the necessary expertise required to manage big projects. As a result, there is a massive skills shortage problem in the sector at the moment. To deal with this challenge, the Department of Trade and Industry (DTI) initiated a National Skills Fund. In 2013, 650 students across 12 learning institutions were trained to address the skills shortage challenge in the local Tool and Die sector [12]. However, the problem remains overwhelming. According to Bob Williamsom, National Chairman of Instimbi and Tooling Association of South Africa, there are currently 6000 vacant posts in the local Tooling industry [12]. As a result, most firms may have to make do with semi-skilled or few workers resulting in project delays or projects finishing over budget.

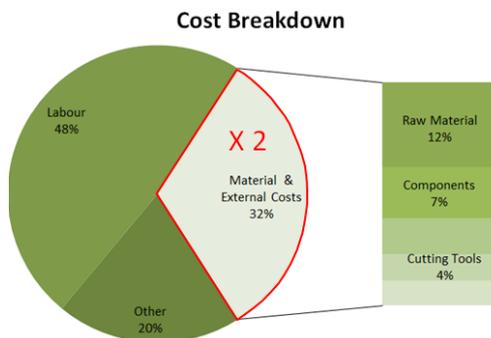


Fig. 8 Material cost breakdown for South African Toolmakers [13]

#### E. Global Trade and Pricing Constraints

The size of South African tool-making firms prohibits them from attaining the necessary purchasing power they need. These local firms pay double the international price for material. South African tool rooms pay double the international standard for tool steel and components which affect their ability to compete on price with their international counterparts as illustrated in Fig. 8. Small local firms pay double the international standard for material and components which makes up 32% of the average tooling project. Furthermore, with the globalization of the tooling industry, local industry advantages related to shipping costs and proximity to market have been degraded by the ability of international companies to generate economies of scale and adopting modern management and manufacturing technology and techniques. This is further exacerbated by the typical small tools produced by local firms not providing a barrier in terms of shipping costs as well as a lack of import duties on tools.

#### VI. RECOMMENDATIONS

In order to overcome the identified constraints and win market share, South African toolmakers need to take the following steps. Firstly, the local TDM sector needs a massive

capital injection so that it can invest on the required technology, expertise and boost up capacity. More benchmarking programs must be continuously run to ensure continuous improvement and growth of the sector.

Secondly, there is an urgent need to strengthen the current educational system for training new toolmakers. More apprentices need to be trained and deployed to the tool shops where they are offered permanent employment for sustainable growth. This will significantly reduce the skill shortages the local sector currently suffers. Furthermore, with sufficient funds, South African tooling firms will be in a position to attract the rightly skilled personnel thus improving the quality of jobs and significantly reducing production lead times.

Finally, it is imperative for South African toolmakers to adopt the right management and business practices. The Managing Director of AfriMold, Mr. Ron MacLarty, was quoted by engineering news online in October 2012 stating that the challenges that tool making companies in SA face are mainly due to weak business practices in contract management, planning, production and project management [14]. Hence, World-Class business practices must be introduced and maintained to realize a competitive South African tooling sector.

#### VII. CONCLUSION

To win a lost market share, South African toolmakers must be prepared to overcome the financial, technological, capacity and human resource constraints cited in the paper. The sector requires great investment and support from various stakeholders.

#### VIII. DECLARATION

This paper was done in partial fulfilment of a Ph.D. study in Industrial Engineering on the Development of a Holonic Control System for the Tool, Die and Mould-making Industry in South Africa conducted by Mncedisi Trinity Dewa.

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#### REFERENCES

- [1] Mkhize, V. 2013. A Paradigm Shift in Tool-making in Gauteng. *Paper presented at Annual General Meeting*. Annual General Meeting 2013/2014.
- [2] Automotive Export Manual South Africa. 2013 publication. *Motor Industry Development Programme (MIDP) Track Record 1995–2012*.
- [3] Malherbe, D.C., 2007. Benchmarking in the South African Tool and Die Manufacturing Sector, *Masters Thesis Report*, SUN.
- [4] The Engineering Artisan, 2012. The State of Benchmarking in the TDM Sector. [http://www.skillsportal.co.za/page/training/training\\_companies/engineering\\_artisan/1192300](http://www.skillsportal.co.za/page/training/training_companies/engineering_artisan/1192300) -The-state-of-benchmarking-in-the-TDM-sector, Date modified: Mon, 05 Mar 2012, Date accessed: 6 Jan 2014.
- [5] Schuh, G., Boos, W., Gaus, F., Schittny, B., 2009. Toolmaking for the Future—A Global Study of Today's Situation and Future Trends in the Tooling Industry, WZL, Aachen.

- [6] Choi, Y., Shin, J., Choi, H., Lee, S., 2010. Quality Management System for Web-Based Collaboration in the Mold and Die Industry. Proceedings of 40th Conference on Computers and Industrial Engineering.
- [7] Schuh, G., Kuhlmann, K., Komorek, N., Schittny, B., 2013. Methodology for Adaptive Management of Internal Value Creation Depth in the Tool and Die Industry. Proceedings of the 13th International Conference on Competitive Manufacturing.
- [8] Dewa M., Matope S., Van der Merwe A. F. and Nyanga L., 2014. An Empirical Analysis of Operational Disturbances and Their Impact on Business Performance in Manufacturing Firms: Case Tooling Industry South Africa. Proceedings of 26th SAIIE Conference, Mulders Drift, South Africa, pp. 1–16.
- [9] Geyer, JJ and Bruwer, R. 2006. Role of Collaboration in the South African Tooling Industry. *Journal for New Generation Sciences*, 4(1), pp. 64–71.
- [10] Mahembe, E. 2011. Literature Review on Small and Medium Enterprises' Access to Credit and Support in South Africa. *National Credit Regulator*, pp. 1 – 92.
- [11] Synmann, H. 2013. South African Tool Making Sector to Get a Boost. *Engineering Online Live News broadcast by F.Taylor*. {Online} Available:<http://www.engineeringnews.co.za/article/sa-tool-making-sector-to-get-boost-2013-05-14>. Date created: 14 May 2013. Date Accessed: 17 November 2014.
- [12] Instimbi National Tooling Initiative. 2013. *Annual Report 2012 – 2013*, pp. 5.
- [13] Boos, W., Pitsch, M., Komorek, N., Kuhlmann, T., and Stark, M. 2014. Tooling in South Africa.
- [14] Taylor, J. Casting. A Spotlight on Opportunities for SA Tool Makers. *Engineering News Online*, (2012).



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