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Interventions to Skills Development in the Automotive Manufacturing Sector of South Africa

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Abstract

Competitiveness of the automotive industry is critical to South Africa's economic sustainability. Recent studies have shown that the automotive sector has consistently contributed over 7% to South Africa's annual gross domestic product (GDP) and as such, it is particularly imperative to support this sector, through growth-stimulating measures. Economic growth of any nation has long been attributed to the availability of resources, both tangible and intangible. Human capital is thus far the greatest intangible asset recorded in history and it is the key element upon which the success of all sectors is predicated. The availability of foreign direct investment (FDI) has largely been credited to the level of skilled and proficient human resources within an economy. This chapter highlights the strategic position of the South Africa automotive industry, by discussing various skills development interventions recorded within this sector from a domestic standpoint and from an international perspective. It comparatively analyses the approach applied locally with those implemented in other countries, through a historical review of skills development measures within the automotive manufacturing sector. The chapter identifies the major stakeholders, their roles and recognized contributions toward establishing a sustainable automotive sector. The skills development frameworks discussed in this chapter will serve as bases for informed decision to other industries interested in adapting and replicating some of the plausible actions applied in the automotive sector for their own growth.

Keywords: skills, South Africa, automotive, interventions, skill development, automobile, manufacturing

1. Introduction

The automotive sector has witnessed significant improvement in terms of innovation within the past decade. Notably, material, skills and process improvement have taken

the center stage, with availability of skilled labor emerging a major component for global competitiveness ranking in this dynamic industry. A roadmap to achieve the Automotive Production Development Programme (APDP) growth targets in South Africa's automotive industrial space is currently in place and skill development is a key to achieving these goals. There have been significant investments over the past decade channeled toward filling skill gaps in this sector. Incubation and learning centers, supplier parks and specialized skills development institutions have been setup in a bid to stimulate skill development that will effectively satisfy current and future growth projections, toward achieving the year 2020 automotive industry production target of one million vehicles annually. As such, structures were set up to promote institution-industry collaborations, and synergies were encouraged, established and maintained for the purpose of sustainability. Recognized Technical and Vocational Educational Training Colleges (TVET colleges) and Further Education and Training Colleges (FET colleges) have been engaged, and specialized centers have been set up in higher educational institutions through the Sector Education and Training Authorities (SETA) skills development framework. Through these measures, the wide gap that once existed between South Africa automotive manufacturing industries and post-secondary educational institutions have significantly thinned out. Notwithstanding, opportunities abound for more co-funded projects which should be directed toward localizing skills development in the Research and Development (R&D) space.

The South African automotive industry is conceivably struggling to keep pace with global competition as inferred from key performance indicators derived from statistical report on the overall production volumes and export volumes of vehicles, comparative to international counterparts. The employee skill base of this sector is one of the indicators for testing its health, and its potential of satisfying production and international regulatory demands. Furthermore, the actualization of the automotive sector's targets within the 2030 national development plan of South Africa is largely hinged on the availability of skilled workforce that are continuously keeping pace with changing global skill demand. The review in this chapter reveals skills transfer interventions in the South Africa automotive industry, based on the collective effort of the government and key stakeholders. The approach to the study is from an industrial and educational standpoint, because of the author's affiliation to a higher institution and to the Manufacturing engineering and related services SETA (MerSETA).

Some of the interventions and current framework for skills development within the South Africa automotive sector were informed by research findings on critical skills need and skilled employee gaps identified within the sector. More of the studies have explored how industry needs are being met by exploring the knowledge areas of the interventions, their mode of delivery and the focus group of people within the enterprises who undergo such capacity development programs. The objective of this chapter is to discuss various skills development interventions recorded within the automotive manufacturing sector from a domestic standpoint and from an international perspective. Historical review of skills development measures within the automotive manufacturing sector identifies some of the

lapses and strength of various programs and initiatives toward realizing an industry-wide competence development. The chapter identifies the major stakeholders, their roles and recognized contributions toward establishing a sustainable automotive sector. Lessons learnt from the skills development frameworks discussed in this chapter will guide other industries who may be interested in establishing similar workforce skills transfer initiatives. Part of what is being shared are relevant case study findings that emerged from practical productivity improvement programs carried out in the South African automotive manufacturing sector. The details herein were acquired through group discussions, practical intervention results and literature review from published works. Training officers and knowledge base managers within the automotive industry learning centers were interviewed and qualitative and quantitative data were obtained. Industry stakeholders verified the information obtained during the study, and extensive cross-referencing formed part of the validation.

1.1. The automotive sector

The automotive assembly and component manufacturing industry represents an important sector in South Africa's economy. According to the Automotive Supply Chain Competitiveness Initiative [1], the sector accounted for a third of total manufacturing output in 2015 and employed over 110,000 individuals. The local production was 615,658 vehicles in 2015, mandated to rise to a million units by 2020. This topic will be incomplete without a summarized discussion on the distinction between various categories of enterprises operating within the automotive manufacturing sector. Automotive manufacturers are generally categorized according to their size (number of employees), their position in the supply chain and the product variant. Depending on the classification, the regulatory standard differs. These include variation in Technical Specification (TS) and International Organization for Standardization (ISO) protocols enforced by the regulatory agencies. Original Equipment Manufacturers (OEMs) are at the top of the automotive value chain, and these are the vehicle brands: BMW, Mercedes Benz, Toyota, Nissan, Ford, Hyundai, Volkswagen and other makes. The second layer on the pyramid is the module suppliers which build the final component that goes into the vehicles. They are usually referred to as Tier1 automotive manufacturers and are direct suppliers of modular components to the OEMs. Enterprises within this category supply component such as complete exhaust assembly, windscreen/windshield assembly, electronic control systems, chassis, coupled seats, coupled mirror assemblies, lighting assembly, complete dash, complete gear system and interior and exterior parts. These are very large enterprises and are often quite similar to the OEMs in their production operations. Enterprises within this category source their components from approved Tier2 automotive component producers. Tier2 producers are significant within the automotive value chain because they produce the mini components that Tier1 enterprises utilize. Enterprises within this category produce brake pads, brake disks, vehicle seat frames/foam, fasteners, mirror, cooling fans and similar micro components. Because of the thin difference between the Tier1 and Tier2 firms, some companies operate both as Tier1 and Tier2 suppliers having met the requirements to operate in both industry spheres. As an example, consider Kayaba

(KYB) industry corporation, one of the world's largest vehicle shock absorber producer; the company fall within the Tier1 category, based on their supply to OEMs, and may inappropriately be considered as a Tier2 enterprise due to their supply of vehicle replacement parts to automotive aftermarket value chain. The distinguishing factor will simply be the number of employees because it is a major determinant for categorizing the manufactures within the automotive sector. Tier3 suppliers are those Small and Medium scale Enterprises (SMEs) that provide the raw materials to Tier2 components producers. Companies within this category supply chemical reagents, adhesives, fasteners, raw materials and final body finish.

The automotive industry is extremely robust and skilled employees are essential through the value chain. Ideally, prioritization of Research and Development (R&D) is imperative at all levels. However, findings from industry engagement in a large number of automotive suppliers within South Africa is that Tier3 suppliers depend absolutely on the demand made by Tier2 suppliers and little or no R&D take place at this level. The Tier1 suppliers and OEMs execute the bulk of R&D and advanced R&D is simply outside trusted R&D providers outside the continent. Based on this reality, a holistic approach to skills development is essential in order to meet the changing demand at all levels. OEMs and Tier1s have had to depend on foreign import in South Africa amidst the tight import regulations due to skill gaps that sometimes encountered. Past programs and current skill development initiatives within the automotive sector form the crust of the discussion, aimed at identifying best practices that have been applied and found effective.

2. A critical review of skilled employee training needs, training approach and employee retention in the automotive industry

Historically, skills transfer occurs as critical need for it arises within an industry. The industrial revolution that transformed the course of man's history reckoned with this philosophy because new disciplines evolved and skills emerged during that period. Over the years, this has changes because industries now have to be ahead of the competition in a dynamic and fast changing industrial environment where technology and innovation dictates the pace at which human capacity get upgraded. According to a study undertaken by Skinner et al. [2], differences in perception of what is needed and how feasible it is to apply same determines what skills are acquired. From the educators' perspective, the study revealed that institutions and vocational education and training colleges simply respond to the demand received from the automotive industry for certain skill set.

Petersen et al. [3] carried out a research on methods of bridging skills demand and supply in South Africa. From the study, Petersen et al. [3] concluded that demand-led skills development requires linkages and coordination between firms, education and training institutions, which may be quite challenging simply because each of these entities represents a self-interested unit. He further expressed the need for collaborative projects involving major stakeholders across the board. The need for a pragmatic transition toward systemic thinking, which facilitates the bridge of public and private objectives, came out strong from the study.

Furthermore, also acknowledged were the roles of private intermediaries' in shaping policies. Other authors have also shared the similar views regarding demand-led skills development. According to Petersen et al. [3], the South African government is promoting a demand-led approach to skills development, to improve alignment between the qualifications and skills produced by education and training systems and labor market demand.

Public-private intermediaries play crucial role of coordination, which has the potential of contributing largely to systemic functioning [3]. Kraak [4] elaborated on the role of intermediaries in skills development. The focus has been on the role of public intermediaries such as the Sector Education and Training Authorities (SETAs) in facilitating bilateral relations, and linking the state and employers. The categorization of intermediaries is according to the intermediaries' structures and the mode of facilitating linkages. Of significant importance are the public research institutions, intergovernmental and technical aid support agencies, government agencies and private intermediaries. Intarakumnerd and Chaoroenporn [5, 6] equally stressed the need to better understand the roles of public and private intermediaries in skills development, to improve alignment between skills demand-side and supply-side actors. The building of linkages is a major step in the right direction for addressing skill needs. These linkages may be between firms; government and firms; educational institutions and firms; international accredited support agencies and unions, among other possibilities.

Employee retention is critical to the successful operation of any business unit. In human resource context, the turnover of employees must be at the barest minimum to remain competitive. Manufacturing firms cannot achieve desired goals without a system that retains consistent skilled employees. Many companies within the South Africa automotive industry have witnessed severe operational glitches that emanates from sudden departure of trained employees. Low retention of scarce skills has been an issue affecting optimal operation of industries. More challenging is the recruitment of scarce skilled personnel which has become an expensive undertaking for industries and has prompted unsatisfactory shift in standards, which invariably have negative competitiveness implications for the South African automotive components industry.

Dufficy [7] recognized the role of training for employee retention. Based on his research on recruitment and retention, he identified the role of training to business success in the current world. "At a time of growing skills shortages across a wide range of sectors, disciplines and geographies plays a central role in finding and keeping staff. With many companies moving toward flatter, team-based structures, there is an implicit need for greater multi-skilling, the whole concept of the learning organization and learning for life is focused on acquisition of additional skills and competencies" [7]. These skills development opportunities aid retention because of the job satisfaction derived by employees because of competence improvement deliberately facilitated by the organization. Skills development in specific area of competence also raises the marketability and financial reward that comes with positions with expected set skills. Employees show more level of comfort, confidence and focus when there is continuous improvement in their competence level, which shows in their ability to satisfy the expected work outcome.

Barnes [8] undertook a research on scarce and critical skills need in the South Africa's automotive sector based on an earlier study carried out by the Department of Labor. Recruitment lead times,

Category	MerSETA study	DOL study	HSRC report
Engineering professional	Electrical, mechanical, industrial and metallurgical engineering	Product designers, industrial, mechanical, mechatronics, industrial/product development technologists	Electrical, mechanical and industrial engineers
Trade skills	<ul style="list-style-type: none">• Mechanical, fabrication, electrical and automation. In terms of operators:• Manufacturing and engineering production operators and stationary plant operators.	Engineering technicians: electrical, mechanical, mechatronics, robotics and tool design <ul style="list-style-type: none">• Electricians• Electronics trades workers: (electronics/electronic equipment's)• Fabrication engineering trade workers: sheet metals, structural steel welding, metal fabricators.• Vehicle body builders and trimmers.• Vehicle painters• Mechanical engineering trade workers: metal fitters/machine tool setters, millwright, mechatronics	Artisan skills: electricians, fitters and turners, millwrights, electronics, tool jig and die
Management	Engineering and operations middle management		Supervisor and production managers

Table 1. Comparative analysis of scarce and critical skills need in the automotive sector [8].

industry skill demand profile and skills shortages, formed the bases of the study. According to the firm-level findings from the research, all engineering qualifications, but most notably industrial and mechanical engineering, emerged as the key need areas within the industry [8].

Table 1 illustrates a comparative identification of the scarce skills needs according to the study carried. It describes the findings from the 2006 MerSETA skills need assessment, the Department of Labor (DOL) assessment and the study report documented in the Human Sciences Research Council (HSRC) Automotive Industry Research Report [8].

3. Automotive skills development: lessons from South Africa and from global industries

The approach to skills development has been an issue of discussion in various sectors. What works for employee within mid management level will not necessarily be applicable on the shop floor. Various skills transfer and capacity development methods have been proposed and there are no set rules which govern this training opportunities. Each organization and industry adopt what suites their needs; consequently, variety of short and long learning programs have been developed in this regard. Lean management is an approach adopted

by top-class enterprises because of the value addition that comes through lean management principles. Toyota as an example has been able to integrate lean into every facet of its operations right from top management to shop floor. The training methodology, course contents, appraisal methods, learning outcomes and impact assessment methods of skills development interventions differ across programs. Organizations now focus more on broader areas of competence than isolated proficiency. According to Dufficy [7], training is increasingly focused on the acquisition of broad competencies which include change orientation, leadership and problem solving skills; rather than functional skills, which has reduced dependence on top-down prescriptive teaching in an era where employees recognize the significance of taking full responsibility for their skills upgrade.

Trainings have gone beyond conventional sessions in classrooms and client site, to virtual learning. Blended approach to training is currently a common norm, and with the increasing digitization of manufacturing environment, the role of online real time hands-on training will not be contestable. The learning curve is fast changing and this awareness is imperative in order to be up-to-date with the twenty-first century manufacturing skill demands. According to a research conducted by Dong-Min and Choi [9], Hyundai Motor Company has adopted highly innovative blended learning programs as far back as 2003, for developing its potential managers. This and similar case studies shall be discussed to fulfill the chapters' objective of sharing experiences from global perspectives.

3.1. South African perspective: national approach to automotive manufacturing skills development

There is a long skills development history in the South Africa automotive sector largely linked to government initiatives, local intermediaries and international actors. Kraak [4] in his study on the National Skills Development Strategy (NSDS) in South Africa highlighted the success and challenges facing skills development in South Africa. The highlight emanated from an evaluation of the impact of the first phase of the NSDS, between the first quarter of 2001 and the first quarter of 2005. The most significant limitations recorded in the skills development strategy were the lack of political will to ensure the success of the integrated approach to education and training after 1994, severe governance challenges involving management of Sector Education and Training Authorities (SETAs), financial misappropriation and myriad of operational problems. Because of the numerous setbacks, programs by other intermediaries emerged and previously existing once gained prominence [4].

Automotive Supply Chain Competitiveness Initiative (ASCCI): The Automotive Supply Chain Competitiveness Initiative (ASCCI) was established in 2013 with the mandate of coordinating supply chain developing activities within the South African automotive industry [1]. ASCCI is a collaborative initiative between suppliers, Original Equipment Manufacturers (OEMs), government and labor unions. It was established as a "not for profit" organization and the main mandate of ASCCI is to build a successful and sustainable local automotive industry by actively developing supply chain competitiveness at a national level.

Thus far, ASCCI has made progress in relation to the implementation of its three-year strategy that is intended to increase supplier Manufacturing Value Added (MVA) in support of

growing local vehicle production output, increasing employment, enabling local supply chain capabilities, increasing local content and advancing transformation. ASCCI is a stakeholder driven initiative, drawing on the leadership and expertise of individuals from government, OEMs, suppliers and labor. The initiative has a small but well represented executive committee that takes responsibility for overseeing the implementation of associated projects and interventions. The objective of ASCCI's skills program is to establish skills development programs for shop floor and scarce skills that have sustainable funding and meet the support the industry's skills development needs [1].

ASCCI undertook a comprehensive research to unveil the industry's skills requirements, determine how they are being addressed, and define steps that will ensure training programs align with industry needs. ASCCI's current focus include establishing skills development committees that align best-in-class training institutions with the industry's skills development needs to optimize the availability and quality of skills. It also plans to establish a South Africa automotive industry skills development portal to align the industry with a set of quality skills development standards and resources. ASCCI is also considering creating a platform for aligning suppliers with global industry trends and competitiveness imperatives. Furthermore, through the development of a modularized management development program, it intends to provide enterprises with a mechanism to transform and upskill management to the level where they will independently operate an excellent manufacturing plant.

Motor Industry Development Programme (MIDP): The MIDP was a voluntary incentive scheme established in 1994, designed to save money for the participant, in the form of a reduction in import duties through incentives and rebates given to the MIDP. Government, business and labor unions jointly developed the program; and according to Barnes and Black [10], it was one of the most significant industrial policy interventions since 1994, both because of the powerful incentive structure it established and because of the sheer size of the industry it affected. The objective of the MIDP is to Improve International Competitiveness; thus aiming to produce more affordable motor vehicles for the local market, and increase production of these models for export. One of its core mandates is to encourage job creation and retention through learning and competence development opportunities. However, the benefits desired from this program in terms of skills development significantly eroded, because of the emergence of other agencies such as the Automotive Industry Development Centre (AIDC) and partly due to MIDP's focus, which tended more toward local production economics, manufacturing incentives and import matters. The skills development portfolio was still work in progress until it was dissolved. The Automotive Production and Development Programme (APDP) replaced the Motor Industry Development Programme (MIDP) in 2013. The APDP consists of four pillars, which include import duty, vehicle assembly allowance (VAA), production incentive (PI) and automotive investment scheme (AIS). Lessons learnt from the previous MIDP informed some of the pillars. The training/skills development component was expunged from the pillars because other organizations were meeting that need. One of the lessons learnt from MIDP regime is the need to prioritize skills development within a mandate because human capacity is the greatest intangible asset.

According to ASCCI [1], increasing customer demands will put added pressure on the industry to deepen and widen its employee skills base. From an export perspective, South Africa Original Equipment Manufacturers (OEMs) and component manufacturers will meet the increased export quality demands, which is a clear indication of the much-needed skills across the automotive value chain. The skill need of the automotive industry is largely tied to the employment composition of the industry. To effectively analyze the skills demand in South Africa's automotive industry, HSRC from its automotive industry research report outlined the aggregated number of graduates in engineering, science, business management and technology from South Africa's tertiary education institutions [8]. Similarly, the National Association of Automotive Component and Allied Manufacturers (NAACAM) 2005 survey report on the labor composition of the automotive manufacturing sector explored the skill distribution of the components manufacturers based on employment composition [1]. The automotive components industry's composition report as prepared by B&M Analysts [8] summarizes the workforce distribution as at 2005. This is a good starting point for projecting skills development programs for an industry. However, little to none was explored regarding the skills deficit within each of the levels.

The Automotive Industry Development Centre (AIDC): AIDC is an established support center focused on addressing skills deficit challenges and skills transfer needs in the automotive industry. The Government established it in October 2000 at the request of the industry and it became operational by 2001. AIDC came to be through a partnership between Blue IQ and the Council for Scientific and Industrial Research of South Africa. It is currently an implementation agency of provincial government and has trained a large number of artisans, and supervisors within the automotive manufacturing sector. It has extensively collaborated with higher institutions in a bid to fulfill its mandate.

As part of Gauteng Provincial Government's commitment to skills development, AIDC and Nissan South Africa (NSA) launched the Gauteng Automotive Learning Centre in June 2014. The learning center is part of the Nissan SA investment support program. Under the terms of the collaboration, NSA provided the land and buildings at zero cost to AIDC and the collaboration agreement transferred the cost of utilities water and electricity to NSA. The funding for the construction of the new building and purchase of all equipment required for training purposes came from AIDC. The training program in the learning center is expected to address technical skill shortage experienced in the sector. The learning center has received full training provider (FTP) accreditation from MerSETA for the further education training certificate on National Qualification Framework (NQF) Level 4. Based on this accreditation, the learning center can train on the following general skills programs: passenger vehicle sales, commercial vehicle sales, vehicle servicing, motorcycle sales and part sales.

Furthermore, the learning center currently has accreditation to take technical courses in the following core programs: hydraulics (basic to advanced), pneumatics (basic to advanced), mechatronics systems and PLC & Codesys. Other technical programs to be offered are in CNC (5 axis machinery suitable for tooling), machining: fitting & turning, welding (simulated & practical) and basic hand skills. **Table 2** presents accredited courses and their qualifications level at the learning center.

Qualifications, learning and skills program	NQF level
National Certificate: Autotronics	Level 2–4
National Certificate: Mechatronics	Level 2–4
National Certificate: CNC Production Machining	Level 2–4
National Certificate: Diesel Electric and Electric Fitting	Level 2
National Certificate: Fitting and turning	Level 3
National Certificate: Diesel Electric and Electric Fitting	Level 3
National Certificate: Mechanical Engineering: Fitting	Level 3
Certificate: Fitting and Turning	Level 4
National Certificate: Automotive Spray Painting	Level 2
National Certificate: Automotive Body Repair	Level 2
National Certificate: Automotive Repair and Maintenance	Level 2
National Certificate: Automotive Components: Manufacturing and Assembly	Level 2–4
Further Education and Training Certificate: Automotive Sales and Support Services	Level 4
National Certificate: Welding Application and Practice	Level 2–4
Diesel Mechanic	Level 2–4
Auto Electrician	Level 2–4

Table 2. Courses and qualification levels at the learning center.

The learning center has an overall capacity that can accommodate approximately 1000 learners annually on a variety of training programs applicable to the needs of the automotive industry, for short- and long-term training programs. It is currently equipped with laboratories and technical workshops designed for hands-on learning and simulation of most operations obtainable in most shop floors. Currently, the learning center has collaborated with higher institutions with accredited mid-level managerial training courses. The learning center has thus far adopted the UNIDO Tirisano training module, which is a well-recognized training model utilized within industries in many nations. **Table 3** describes the modules and exit outcomes of the trainings.

Automotive Supplier Park (ASP): Automotive Supplier Park (ASP) is a Gauteng Provincial Government initiative and an international benchmark project that has contributed significantly to the global competitiveness of the South Africa automotive industry. It is aimed at stimulating economic growth and job creation in the automotive industry through large-scale investment in strategic economic infrastructure. The initiative enjoys strong support from the local, provincial and national government. There is equally significant support from the automotive industry and its service providers.

The South Africa’s Automotive Supplier Park is modeled as a replica of existing supplier parks in the United States, Japan and Germany. ASP is strategically located in close proximity to major OEM plants including BMW (3.3 km), Nissan/Renault (1.3 km), TATA (0.5 km) and

Skills program name	Exit outcomes (Award type: National Certificate)
1. Introduction to Change Management	<p>Apply knowledge of self & team in order to develop a plan to enhance team performance</p> <p>Investigate & explain the structure of a selected workplace or organization</p> <p>Identify internal and external stakeholders</p>
2. Problem Solving—PDCA	<p>Recognize areas in need of change, make recommendations & implement change in the team, department or division</p> <p>Set, monitor & measure the achievement of goals & objectives for a team, department or division within an organization</p> <p>Build teams to achieve goals & objectives</p> <p>Optimize manufacturing & production processes</p> <p>Prepare & communicate a productivity improvement plan for a functional unit</p>
3. Quality Management	<p>Recognize areas in need of change, make recommendations and implement change in the team, department or division</p> <p>Set, monitor and measure the achievement of goals and objectives for a team, department or division within an organization</p> <p>Build teams to achieve goals and objectives</p> <p>Apply & continuously improve company policies & procedures</p> <p>Improve the effectiveness & efficiency of qty. mgnt. system</p> <p>Create, maintain & update record keeping systems</p> <p>Monitor, assess & manage risk</p> <p>Manage customer requirements/needs & implement action plans</p> <p>Manage & improve communication processes in a function</p>
4. Total Productive Maintenance (TPM)/Lean Manufacturing National Certificate	<p>Recognize areas in need of change, make recommendations and implement change in the team, department or division</p> <p>Set, monitor and measure the achievement of goals and objectives for a team, department or division within an organization</p> <p>Build teams to achieve goals and objectives</p> <p>Optimize manufacturing and production processes</p> <p>Evaluate current practices against best practice</p> <p>Prepare & communicate a productivity improvement plan for a functional unit</p>
5. Introduction to TPM and Quality Further Education and Training Certificate	<p>Explain the contribution made by own area of responsibility to the overall organizational strategy</p> <p>Discuss Just in Time (JIT) and Lean Manufacturing</p> <p>Maintain records for a team</p> <p>Monitor and control quality control practices in a manufacturing/ engineering environment</p> <p>Participate in a task team in a process environment</p>

Skills program name	Exit outcomes (Award type: National Certificate)
6. Introduction to Cleaner Production Further Education and Training Certificate	Explain the contribution made by own area of responsibility to the overall organizational strategy Employ a systematic approach to achieving objectives Demonstrate an understanding of manufacturing, principles, methodologies and processes

Table 3. Training curriculum (abridged), Tirisano productivity development program.

Ford/Mazda (35 km). Thus far, this is the only supplier park in the world to have more than one OEM in close proximity and this makes it significantly special. ASP clusters automotive component manufacturers, suppliers and service providers in one location to achieve synergies and cost savings.

AIDC is saddled with the responsibility of managing the facility under the Gauteng Growth and Development Agency. AIDC develops factories to lessee requirements on a long-term lease basis. Furthermore, when fully in operation, it intends to offer shared mini-factories for smaller operations and offices for automotive service providers. Tenants under the ASP will benefit immensely because of the benefits that come with shared infrastructure and services. The facility is expected to contain all the relevant training equipment to support specialized training programs relevant to OEMs, automotive component manufacturers, aftersales support centers, dealerships, informal vehicle maintenance sector and unskilled individuals out of school, but interested in specialized skills.

ASP training program focuses on key areas where competence is currently lacking. These include mechatronics, autotronics, programmable logic controllers (PLC), computer numeric controllers (CNC), welding, spray painting, vehicle aftermarket service and maintenance and a variety of training programs to be delivered through the classroom, specialized workshops and PC training. The training model through blended learning approach makes it unique and gives it an edge over conventional approach. Some of the unique features include a Learner Management System (LMS), start-of-the-art simulator for welding and spraying and a vehicle assembly line which will be a typical replica of the actual vehicle assembly process.

AIDC has signed agreements with numerous higher education institutions to develop programs in areas with significant industry demand. The Manufacturing, Engineering and Related Services Sector Education and Training Authority (MerSETA) in conjunction with other institutions, have developed full range of accredited programs to upscale skill level in the automotive industry [8].

AIDC has also collaborated with Ford in developing multiple incubation centers within the Ford facility in Gauteng Province of South Africa, and the managers of these facilities develop top leadership skills within the incubation years. The incubation centers serve as an ideal grooming center for both new employees and older once because there is full conformance to

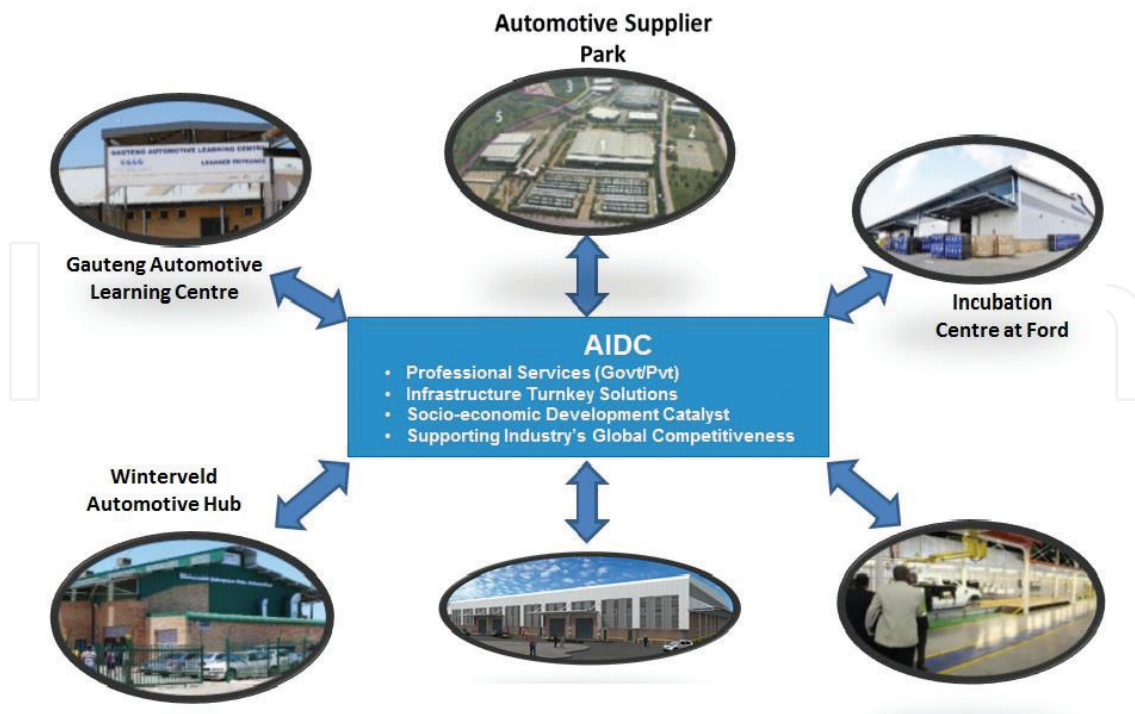


Figure 1. AIDC's footprint in South Africa.

ideal manufacturing conditions, safety procedures, world class processes and manufacturing principles. **Figure 1** shows the footprint of AIDC.

Education and training providers have become increasingly under pressure to improve their programs and to respond to the needs of various employers and learners. As such, AIDC gained a full status as an Employment and Skills Development Lead Employer (ESDLE) in 2004, according to the provisions of the Department of Labor. Furthermore, AIDC has developed training units to establish linkages between industries and specific accredited FET colleges in South Africa.

3.2. International Labor Organization (ILO)/United Nations Industrial Development Organization (UNIDO)

Tier2 suppliers in the South Africa automotive supply chain are generally assumed to be less competitive than Tier1 companies and their global counterparts. Many productivity and competitiveness programs have predominantly focused on Tier1 companies and to a less extent of Tier2 and lower suppliers. There is a distinct gap between Tier1 and Tier2 and lower suppliers with regards to productivity and competitiveness. Resulting from these, in 2015, the United Nations Industrial Development Organization (UNIDO) in conjunction with the International Labor Organization (ILO) collaborated on a study that assessed the competitiveness within the South Africa automotive supply sector with the intent of using the outcomes for strategic planning to help strengthen the sector to enable it achieve a globally competitive position [11].

The aim of this first phase was to establish a supplier needs assessment framework with regards to productivity improvement, resource efficiency, process and technology upgrading, skills, employee engagement and safety in production. The results from this needs assessment informed a baseline survey which eventually inform the joint ILO and UNIDO supplier development approach.

The findings from the study exposed the predominant gaps such as employee engagement, problem solving, adherence to health and safety and strategic training needs. Selection of the companies was done by the guideline received from Automotive Supplier Chain Competitiveness Initiative (ASCCI), which was used by ILO and UNIDO experts to preselect companies to be assessed. Pilot needs assessments were undertaken in four companies in Gauteng jointly by UNIDO and ILO experts in order to test the assessment methodology, perceive responsiveness of firms and align UNIDO's and ILO's assessment frameworks.

The study utilized separate structured questionnaires for UNIDO and ILO. The ILO questionnaire covered the following focal areas: productivity, labor relations and compliance, communication, performance measurement using Key Performance Index (KPI), Research and Development (R&D), product development, Health Safety and Environment (HSE) compliance and competitiveness. The UNIDO questionnaire covered the following focus areas: company policy management, daily management of the production process, process improvement, quality management system, maintenance management and safety, health and environment (HSE) management.

Based on the combined assessments, a joint methodology was developed which was based on the ILO-SCORE training model and the UNIDO-TIRISANO training model. The developed training structure is expected to address skill gaps at the lower tier enterprises when eventually rolled out, because of its multifaceted curriculum.

3.3. Hyundai approach: case study on automotive skills development in Korea

According to Dong-Min and Choi [9], Hyundai Motor Company (HMC) Korea, adopted an innovative blended learning program in 2003 for successfully developing its high-potential managers. HMC introduced an education program (Future Global Leader Program). Future Global Leaders Program was designed to stimulate and groom high-performing junior managers to emerge future skillful leaders. HMC had worked in partnership with Educasia to integrate instructor-led online learning into a program that was previously conducted entirely in the classroom. As a result, Hyundai was able to deliver an expanded learning curriculum in a more efficient and engaging way [9].

Based on Don-Min and Choi [9], HMC focused on developing specialized expertise in five distinct fields namely: human resources (HR), finance and accounting, marketing, operations management and technology management. The program commenced in 2002, and it consisted of five specialized tracks focused on strategic fields identified by HMC.

The Future Global Leaders Program consisted of weekend classes (Friday and Saturday) for 10 months, conducted at local universities within Korea. For each of the specialized fields, the courses were delivered through lectures and discussion groups. The survey conducted upon completion of the course identified the need for a common foundation skills curriculum

because of the varying backgrounds and job differences among the participants. The challenge associated with work-learning balance was also evident. The difficulty in balancing work and learning schedules placed a heavy burden on the course participants because of the 2 days they always need to be off work weekly. This resulted in the call for more flexible schedule, more practical experiences and less theoretical-oriented program. Furthermore, the participants wanted an improved learning experience with opportunities to interact with other companies during the program [9].

The feedback received from the first year program informed the considerations adopted in the second year of the program. There was a transition to blended learning in the second year and the program improved by integrated a common business foundation' curriculum at the beginning of the program. As such, registered participants were first taken through common curriculum before advancing to specialized knowledge areas. The program was phased and the first 6 weeks of training were exclusively through online classes on general management principles, followed by a day physical contact at HMC, in which half day went to lectures and the other half was dedicated to testing the knowledge of participants from previous classes. Subsequent class sessions remained well spread-out for strategic learning using the blended approach [9].

3.4. Opel approach: case study of automotive skills development in Greece

Brinia and Pefanis [12] investigated the views of the employees of GM Hellas, a subsidiary of Opel car manufacturer in Greece, concerning the training they receive from their employer. More specifically, the research sought to examine two types of training aspects; those related to the principles of adult education and those related to the business goals of the company. Opel provides in-house training programs to all staff levels and job positions (sales marketing, consultants, technical, service advisors and other departments). The in-house training is often made compulsory because employees are trained on various subject themes. Due to the mandatory training structure, employees are left with little or no choice to participate in the trainings because they are bound by their employment contracts and need to be in full alignment with the managements' training decisions.

The ultimate goal of the training given to employees of GM Hellas is to transfer the philosophy of the organization to its workforce. Based on significant changes recorded by the management upon completion of the training program, the company believes its training helps participants progress, so as to achieve optimal personal development. The trainings are perceived to help Opel manufacture, distribute and support top quality vehicles [12]. Opel maintains a robust training department within GM Hellas, called GM Academy, and each Opel dealer employs a training manager [12]. Within GM Hellas, there are three levels of training namely: bronze (lower level), silver (medium level) and gold (high level). At least 25% of all job holders in each type of post (car sales, spare-part sales, technical advisors, technicians and others), need to have acquired the gold level, whereas the rest should have acquired, at least the bronze level [12].

"The program has three types of training: Training with a trainer (IBT), which was the most common type of training representing 79% of total Opel training sessions in year 2010, web-based training (WBT, 10%) and training in a virtual classrooms (VCT, 11%). All GM

Hellas employees are obliged to participate in training. However, there are several differences, regarding training opportunities among various jobholders: technicians and sales representatives are more likely to receive training (37% of trainees were technicians and 21% of trainees were sales people), rather than directors of all departments (8%) or technical consultants (18%)” [12].

3.5. The India case study

Rishikesha and Jha [13] in their research explored the importance of industry–academia collaboration to build a strong innovation system for economic beneficiation. The India case study under review is an excerpt from the study carried out [13]. The study examined the nature of collaboration between industry and academia in the Indian automotive sector. Based on the study findings, the most prevalent form of collaboration between industries and the academia is competency development and training, while the second most dominant collaboration involves research services such as material testing, product testing and analytical services [13].

The establishment of industry-institution collaboration was seen to be influenced by many factors at the firm level and institutional level. At the firm level, the factors that positively impact the level of industry-institution collaboration are: research and development passion of the firm, level of research and development currently in place, size of the firm and openness of the firm to collaboration [14].

Collaboration and linkages worth noting exist between the automotive industry and higher institutions/research centers. For example, the Advanced Steel Processing and Products Research Center (ASPPRC) had a close linkage with the Colorado School of Mines. Leading global steel makers and automobile companies like TATA and Mahindra were part of this, because the collaboration afforded them information on current innovation in terms of steel processing which in turn influence their manufacturing processes, material selection and automobile designs.

Automotive Skill Development Council (ASDC) is Indians leading council that promotes collaborative skill development program in the automotive sector. ASDC has taken pioneering steps toward the development of occupational standards within the automotive industry. For this purpose, ASDC has been engaging the entire automotive industry in India in order to make skills development an enabler for the sector’s growth. The councils mandate is to create an enabling environment that ensures availability of required numbers of skilled manpower that meets the quality expectations of the automotive sector. A Memorandum of Understanding (MOU) exist between the government of India, and one of the leading auto manufacturers, Tata Motors, to help promote the skill development centers across its six plants in India. The corporate partnership of Tata Motors with ASDC is a step toward reaping India’s demographic dividend by enhancing employability within India as well as in other countries and also contribute to government’s aggressive plans under the Skill India Mission. The collaboration is expected to promote the ASDC certification that will create career paths for those interested and currently employed in the automotive industry. The training modules cover designing, manufacturing, automobile production, sales and service in various support functions with a focus on quality.

3.6. The Indonesia case study

Indonesia is the largest economy in South East Asia and the automotive sector is one of the largest industries in Indonesia ranking 15th globally in terms of auto sales. The industry has enjoyed steady domestic sales growth, with sales forecast that shows it will continue to grow until the end of the decade. The Indonesian automotive has become prominent among automotive cluster in South East Asia [15]. It is an example of globalization (regional clusters of interdependent firms) and hybrid production (a global initiative that was adapted to customary local conditions) [15]. Japanese multinational enterprises (MNEs) have invested in Indonesia because of its proximity to favorable resources, which is a key lesson from the Indonesian automotive cluster in terms of regional economic development. According to Irawati [15], to develop into a mature cluster, there are four recommendations and lessons that can be learned, but the forth is most important to this study because of its obvious skill development component [15]. The recommendations includes: building clusters in developing countries, exploiting MNEs' own clusters and networks, exploiting geographical proximity for networks and technology and upgrading companies in the Indonesian automotive cluster.

3.7. The Thailand case study

Despite increasing educational attainment across all levels in Thailand, the Ministry of Education's push to increase vocational education, the quality of institutions remain a concern with many firms reporting that these graduates, despite going further in education, are still not well-prepared for the labor market. Individuals, particularly poor and vulnerable populations, may also acquire work-readiness skills through non-formal education. In 2014, The Ministry of Education increased compulsory education to 12 years of schooling. This will allow more students from the lower quintiles to meet firms' minimum education requirements, and trends.

Thailand's "Automotive Industry Master Plan 2012-2016", aimed to administer integrated sustainable automotive human resource development projects emphasizing on training, curriculum development, lecturer development and promoting in-house training centers to accelerate human resource development throughout the industry. Furthermore, the master plan emphasize on creating a collaborative effort with education institute to prepare students for their future careers in the automotive industry.

The aim is to empower human resources in the automotive industry by enhancing their knowledge, skill and ability. Automotive Human Resource Development Project (AHRDP) in collaboration with Japan enabled the transfer of crucial technologies and standard emphasized on developing the body of knowledge which consists of program and expert training in four areas to enable industry-wide development in order to support the growth of Thailand's automotive industry. To achieve desired excellence in human resources development, the emerging guidelines sought to formulate human resource development plan for automotive industry to formulate a long-term plan. It was designed to survey data and design standard academic and continuous professional development (CPD) curriculum with academic cooperation from domestic and oversea institutions together with the private section to develop and improve curriculum in order to satisfy present and future industry demands. Also, it

was planned to develop an automotive human resources development (AHRD) operating work system to develop human resources at all levels, specifically for supervision, testing and research purposes, by integrating all entities involve in automotive human resource development toward sustainable development of the automotive industry. The guideline is expected to add to the body of knowledge for further development.

4. Conclusion

Skills shortage within the automotive industry is not exclusive to the South Africa automotive sector. Other countries have experienced same in various forms across unique lines and need areas. The measure adopted in addressing the knowledge gaps is simply the variance. Retention of skilled manpower is one of the challenges identified in the South Africa automotive sector. This chapter discusses skill shortages relative to the skills development interventions by various stakeholders within and beyond the South Africa automotive industry. From the study, the major solution to remedy low competence is continuous skills transfer through highly structured cross functional skill development programs, which have been widely discussed in this chapter. Social factors which may be part of the reason for poor retention of competent employees was not considered. For further studies, social factors and gratification measures for skilled employees retention is worth considering.

Blended training and virtual teaming [16] have been widely adopted for training purposes. Original Equipment Manufacturers and lower tier suppliers have realized the effectiveness of blended learning approach. Through this methodology, employees have the opportunity of engaging in both hands-on and computer-based learning. Scheduling flexibility is a major advantage this method have other approaches. Based on the study, sufficient evidence confirms the shift and upgrade from conventional training methods to blended learning approach. Blended training is indeed an excellent approach for delivering both short-term and most especially, long-term courses.

In South Africa, specialized courses for the automotive sector have been accredited by the Department of Higher Education and Training (DHET). This was facilitated through the linkage created by the Gauteng Automotive Learning Centre, in collaboration with the Automotive Industry Development Centre (AIDC). These programs are set to create career paths for employees within the automotive industry. Shop floor employees can aspire and work toward skills development in both technical and non-technical areas. This platform is a plausible channel through which employees may grow over time and eventually accomplish their career ambitions. Registered employees will go through series of specialized courses designed to progressively take them through a formal learning path. The courses are expected to be fully available from 2018 academic session, and offered through the University of South Africa (UNISA), the largest distance learning institution within the African continent. Statistics of employee retention and employee turnover over the next few years, will be key indicators to determine how well academic engagement influence labor retention.

Collaboration between industries and intermediaries cannot be overemphasized. This chapter shows that collaboration is essential, and various collaborative efforts employed by various stakeholders within the automotive industries have been discussed. Recognized Technical and Vocational Educational Training Colleges (TVET colleges) and Further Education and Training Colleges (FET colleges) all have a part to play in developing skills for the industry. Due to continuous technological changes and industry innovation, training curriculums need continuous upgrade. Failure to upgrade will result in increasing skills shortages in the industry.

Cross functional training is crucial for flexibility in the workplace [17]. Cross training has been a useful knowledge management tool for creating and transferring technological knowledge within an organization. Organizations adopt cross training, job rotation systems, work flexibility and teams in an attempt to manage process changes due to technological upgrade and market forces [18]. The South Africa automotive industry has long realized this and cross training is promoted by training intermediaries within the industry. Contrarily, smaller industries are yet to come to terms with this and employees end up specializing only in specific areas, hence, limiting their adaptability to other areas where totally different skill sets are required. As such, cross training should be encouraged and recommended for process units within the shop floor and associated functional areas.

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