Preliminary Feasibility Study and Business Plan on Establishing a Foundry Industry Training Centre in Gauteng

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1. INTRODUCTION

1.1 Background

The National Foundry Technology Network (NFTN) has been established to bring together the key stakeholders from industry, government, science and technology, and tertiary education in order to devise and implement support programmes and projects to overcome the key issues faced by the industry. One major focus area is skills development, and the NFTN together with the SAIF has developed a career path framework for the foundry industry, and the organizations are currently engaged in the roll-out of a comprehensive and focused training programme.

In 2009, the Tshumisano Trust, through the GTZ, commissioned a study into the establishment of a specialist, green foundry training centre in the Western Cape. This study, conducted by LHA, indicated a substantial need for such a practical training facility, as well as strong industry support for the centre. Based on these outcomes and the business plan developed as part of the study, a foundry training centre has now been established in the Western Cape, and was successfully launched at the end of May 2011.

The training centre in the Western Cape represented the first phase in the establishment of at least three regional foundry training centres in South Africa. In view of the success achieved so far, the Gauteng Provincial Government has requested the NFTN to initiate the development of a similar training centre in Gauteng. As a first step in this process, the NFTN has accordingly commissioned this feasibility study

1.2 Purpose and Objectives

The core ***purpose*** of this study was to conduct a feasibility study on the establishment of a Green Foundry Training Centre in the Gauteng Province. The study should focus on establishing the current foundry industry training needs within Gauteng, stakeholder buy-in, and the infrastructure that is required and available. Ultimately, the objective was to compile a business plan for the establishment of an appropriate Training Centre, consolidating all the findings into one document.

1.3 Approach and Methodology

A combination of desktop research and personal interviews with key industry players and stakeholders was applied. An online electronic survey of the foundry industry in the Gauteng region was conducted (the survey is attached in Annexure A for information).

This was supplemented with personal meetings and interviews with a number of key foundries in the region. These foundries were selected to collectively represent more than 65% of the total foundry-related employment in Gauteng. The following stakeholders were consulted:

Personal meetings and interviews (22)

Industry:

- South African Institute of Foundrymen (SAIF)
- National Foundry Technology Network (NFTN)
- National Tooling Initiative Programme (NTIP)
- Arcelor Mittal
- Scaw Metals
- Guestro Castings and Machining
- Prima Industrial
- Thomas Foundry
- RelyIntracast
- Crown Cast
- MIS
- Auto Industrial
- Elmacast
- Hi Duty Castings
- Malleable Castings
- PCS Foundry
- Concorde
- Hi Alloy Castings

Training Institutions (4):

- University of Johannesburg and the Metal Casting Technology Station (MCTS)
- Vaal University of Technology
- SAJ Competency Training Centre
- Ekurhuleni East FET College

These interviews served to gather views and information on factors such as:

- Existing / current supply and demand for training of foundry workers in Gauteng;
- Skills deficiencies and employment gaps;
- Need for training in terms of type, frequency, focus, etc.;
- Estimate of actual and latent training demand in terms of numbers of students;
- Interest and support for a Gauteng Foundry Training Centre and the nature of possible support;
- Potential support and role of tertiary education institutions in Gauteng;
- Views on the training centre structure, funding, and management;
- General inputs into past successes, failures, potential location, and any other issues to be considered.

Based on this information, a business plan was developed, as outlined in this document. Several follow-up meetings and consultations were held with key stakeholders in the development of the plan, notably University of Johannesburg and MCTS, as well as Ekurhuleni East College for FET.

1.4 Acknowledgements

We would like to express our appreciation to the many stakeholders, role players and interested parties who have given freely of their time, expertise, information, and advice to contribute to and inform this study. In particular, we acknowledge the positive cooperation of the NFTN, SAIF, Training Institutions, and key industry players.

2. SITUATIONAL ANALYSIS

2.1 Industry Structure

2.1.1 Number of foundries

The South African foundry industry is one of the cornerstones of the manufacturing sector. The most recent comprehensive information available is the 2011 Castings Directory, published by Castings SA. From the data contained in this directory, the total number of foundries in 2011 is estimated at 184, which is some 13% down on the 211 foundries in 2003.

The industry structure in terms of foundry types is shown in Table 2.1 below (note that many foundries cover two or more categories, hence the total number of foundries in the different categories is larger than the number of foundries in SA). The table illustrates that the number of foundries was rather stable between 2003 and 2007, which suggests that the bulk of the decline in foundry numbers may be related to the effects of the financial crisis and difficult economic conditions prevailing during 2008 to 2010. It should be noted, however, that the decline cannot be exclusively attributed to foundry closures, since a number of mergers and consolidations have also occurred since 2007.

Table 2.1: Industry structure by foundry type [SAIF, 2003; Castings Directory, 2007, 2011;].

Foundry Type	No. of Foundries 2003	No. of Foundries 2007	No. of Foundries 2011	2011 vs. 2007 Change (%)
Ferrous (Iron & Steel)	110	110	67	-39%
Non-Ferrous (Aluminium, Brass, Zinc)	117	119	70	-41%
High Pressure Die Casters	36	32	32	0%
Mixed Metal	35	35	34	-3%
Investment Casting	7	4	4	0%
Art Foundries	13	12	12	0%
Total number of foundries	**213**	**211**	**184**	**-13%**

The data indicates that the industry has experienced substantial declines in the number of ferrous and non-ferrous foundries. This can be partially attributed to consolidation in the industry through mergers and acquisitions.

2.1.2 Production Volumes and Employment

In the mid-2000's the SAIF estimated that the industry produced around 500,000 tons of castings annually. As shown in Table 2.2, the total foundry production volume increased by some 30% between 2003 and 2007, but has since declined by some 13%. Nevertheless, it is interesting to note that despite the difficult economic conditions and a decline in the number of foundries, the actual tonnage produced in 2011 remains some 13% higher than in 2003 (Figure 2.1). Taking into account the loss of some high profile foundries since 2007, particularly in the aluminium sector (e.g. Tiger Wheels and Kolbenco), this suggests that the industry has shown significant resilience.

Table 2.2: Estimated annual production by metal type [SAIF, 2003; Castings Directory 2007, 2011;].

Metal Type	Estimated Annual Production 2003 (tons)	Estimated Annual Production 2007 (tons)	Estimated Annual Production 2011 (tons)	Growth 2011 vs. 2007 (%)
Non-Ferrous	**84,000**	**97,800**	**91,400**	**-7%**
Aluminium	66,000	77,800	74,600	-4%
Bronze	9,000	8,200	8,400	2%
Brass	6,000	7,600	5,700	-25%
Zinc	3,000	4,200	2,700	-36%
Ferrous	**422,000**	**562,600**	**479,950**	**-15%**
Grey Iron	110,000	147,000	170,200	16%
Ductile Iron	100,000	86,000	123,800	44%
Other Cast Irons	85,000	145,600	61,250	-58%
Steel	123,000	179,100	118,000	-34%
Stainless Steel	4,000	4,900	6,700	37%
Total Annual Production	**506,000**	**660,400**	**571,350**	**-13%**

The industry is highly concentrated – in the ferrous sector, the top 11 foundries account for some 63%. The non-ferrous sector is even more concentrated, with the top 3 foundries accounting for 67% of production. This makes the sector somewhat vulnerable, particularly since the major non-ferrous foundries are all linked to the automotive sector and its exports.

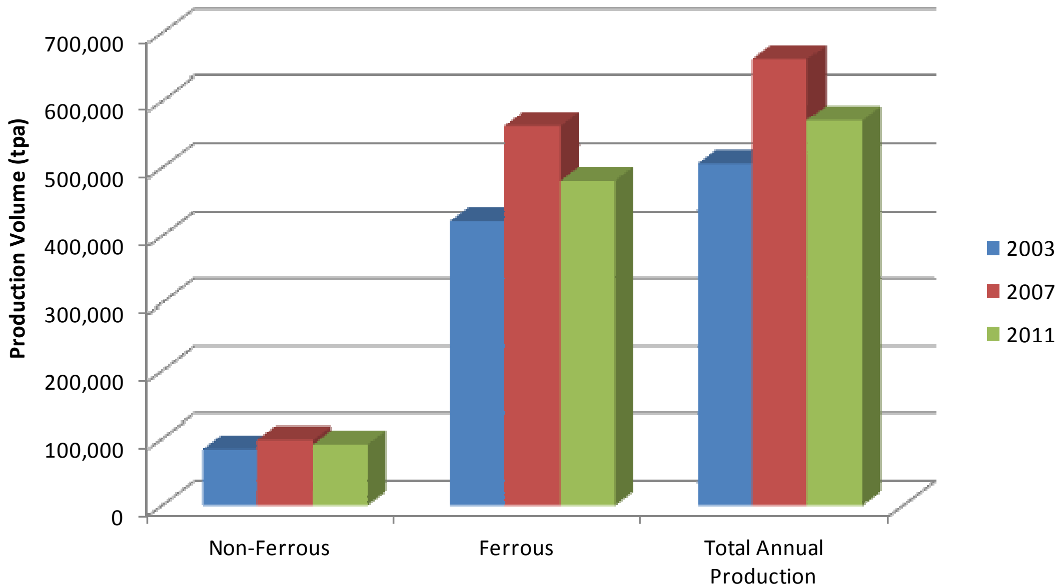


Figure 2.1: Evolution of foundry production volumes in South Africa 2003 – 2011.

An important feature of the industry is the fact that the value added is significantly higher in jobbing foundries than in production foundries. It was estimated that jobbing foundries accounted for over 28% of the total turnover of the foundry industry of R10.3 billion in 2003, which implies that the value add in jobbing foundries is almost double that of production foundries. From a socio-economic and employment perspective, the smaller jobbing foundries are therefore at least as important as production foundries, if not more so.

It is estimated that around 11,600 people are directly employed in the industry in 2011, of which 80% are previously disadvantaged individuals employed on shop floor level. Assuming a multiplier of around 0.3, a further 4,000 job opportunities are linked to the foundry industry through the 180 – 200 supplier companies to the industry. It is estimated that the total direct employment in the foundry industry has decreased by some 10 – 12% since 2003, as companies have focused on increasing efficiencies and competitiveness.

2.1.3 Geographical distribution

The geographical distribution of foundries in South Africa as determined in 2011 is shown in Table 2.3 and Figure 2.2.

Table 2.3: Geographical location of foundries in South Africa [SAIF, 2003; Castings Directory 2007, 2011].

Province	No. of Foundries 2003	No. of Foundries 2007	No. of Foundries 2011	Percent of Total 2011
Gauteng	110	108	97	54%
Western Cape	26	16	15	8%
Kwa-Zulu Natal	20	26	24	13%
Eastern Cape	16	10	10	6%
Free State	10	7	6	3%
North-West	10	9	5	3%
Northern Cape	6	3	3	2%
Other	15	15	18	10%

It is perhaps unsurprising to note that more than half the foundries in South Africa are located in Gauteng, which is the manufacturing and economic centre of the country. Other notably industry nodes are found in KwaZulu-Natal (13%) and the Vereeniging area (around 9%).

The large concentration of foundries in the Gauteng region provides a powerful motivator for the envisaged training centre.

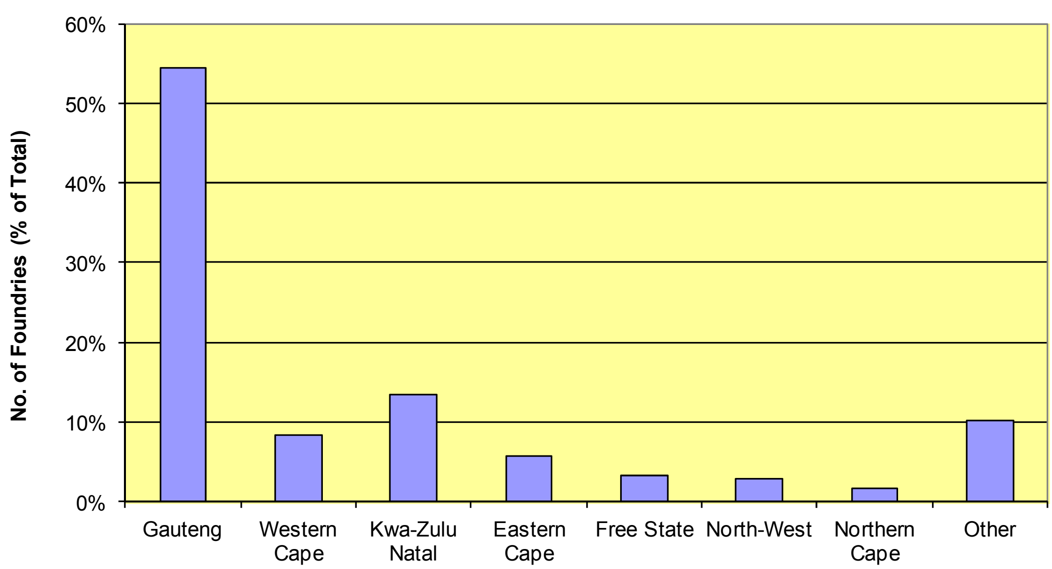


Figure 2.2: Geographical distribution of foundries in South Africa.

2.1.4 Process type

The type of process or technology used in a foundry to produce castings has an important bearing on skills training and practical training infrastructure requirements. Consideration of this parameter is therefore very relevant in determining the equipment and infrastructure requirements for the proposed training centre.

Most companies limit themselves to one of the major process types, i.e. sand, permanent mould or investment casting, with only 16% of foundries using multiple processes. Sand casting is the dominant technology by far, and is used by 65% of foundries in South Africa, followed by permanent mould casting at 24%. These process types can be categorized further into specific process types, as shown in Table 2.4.

Table 2.4: Main casting processes used in South African foundries (SAIF, 2003).

Process Type	No. of Foundries using the Process (%)
Sand	
Bonded sand	44%
Green sand	34%
Shell	14%
Permanent Mould	
Gravity	21%
Low Pressure	5%
High Pressure Die Casting	7%
Other	3%

In Gauteng, the foundry industry is quite diverse and all major foundry categories are represented, in terms of materials of production, process type, and scale of production. As shown in Table 2.5, most of the foundries in Gauteng are jobbing foundries (52%), while 24% are production oriented (i.e. specialized in higher volume production of a limited number of products). Some 25% of foundries offer castings both production and jobbing castings.

Table 2.5: Gauteng foundries by type [Castings Directory 2011].

Foundry Type	No. of Foundries	No. of Foundries (%)
Production	23	24%
Jobbing	50	52%
Production & Jobbing	24	25%

The majority of jobbing foundries in Gauteng use chemically bonded sand processes, with some green sand casting in evidence as well, particularly in the cast iron production foundries. Cores for sand casting are typically produced in chemically bonded sand, using a core blowing machine. Gauteng is also home to numerous gravity and high pressure die casting foundries, specializing mainly in aluminium, as well as two investment foundries.

Given this industry structure, the practical training aspects of proposed foundry training centre should focus primarily on bonded and green sand casting for cast iron, steel and aluminium, as well as gravity die casting of aluminium. This would ensure relevance of the centre infrastructure and offerings to the industry in Gauteng.

High pressure die casting is highly specialised and requires access to costly infrastructure, i.e. high pressure die casting machines. It is therefore considered impractical to make provision for high pressure die casting in a new training facility. However, an excellent high pressure die casting facility is located at the CSIR, and this could be made available for specialized training of staff.

2.2 Challenges and Opportunities

2.2.1 Overview of recent trends

It is apparent that the industry is facing a number of important challenges for its survival and growth. Perhaps most important is the increased competition from abroad in the form of imports, in the wake of the liberalization of the South African economy after 1994. Significant consolidation has been experienced in the industry in an effort to improve economies of scale and competitiveness, with the number of foundries reducing from around 400 in 1988 to around 210 in 2003 and down to around 180 today. This is indicative of the severe competitive pressures experienced in the automotive industry in particular, where high volumes and low cost production as well as the need to invest in costly new technologies are key drivers.

In response to these challenges, the industry has invested heavily into new equipment and technology over the past 5 years. Mergers and acquisitions have resulted in a smaller number of foundries, while total employment in the industry has declined by 10 – 12% since 2003. These measures have resulted in improved competitiveness and economies of scale.

It has to be said that the foundry industry suffered substantial declines in business during the height of the economic downturn in 2008 – 2010. Foundries interviewed during 2009 indicated that many were operating on short time and some of the smaller foundries had experienced declines in production volumes of up to 30 – 50%, with similar reductions in staff numbers. Fortunately, the staff numbers in the larger foundries had remained less affected. Data from 2011 suggests that the industry as a whole has managed to recover fairly well since 2010 – although 2001 production volumes are some 13% down on 2007 figures, they are some 13% higher compared to 2003.

A key concern is the rapidly increasing cost of energy, which is impacting negatively on the competitiveness of the industry. Several foundries have already closed down in 2011, citing electricity tariff increases as the main cause. Together with the NFTN and the SAIF, the industry is taking concerted action to improve energy efficiencies in foundry operations.

In light of the severe current challenges, it is interesting and meaningful to note that the foundries generally displayed a positive attitude towards upskilling their staff, since this is seen as an important enabling factor in ensuring commercial competitiveness and growth.

2.2.2 Challenges and constraints

The fundamental challenge for the local foundry industry is to develop and maintain its commercial competitiveness relative to not only the local industry, but particularly relative to international suppliers. In many cases, such suppliers have the advantage of large production runs, which facilitate automation and lower the unit production costs.

In South Africa, the low cost of energy as well as relatively low labour and space (rental) costs have historically been seen as major advantages, which have enabled the industry to compete. However, the industry is currently undergoing some structural changes in this regard which will change the competitive landscape going forward.

Some of the key challenges for maintaining competitiveness are:

- ***Rapidly rising energy costs*** – most local foundries are energy inefficient relative to international benchmarks;
- ***Labour costs*** – although unit labour costs are still relatively low compared to developed countries, this is offset by comparatively low labour efficiencies and low levels of mechanization;

- ***Environmental regulations*** – much more stringent environmental legislation is in preparation which will substantially tighten the emissions and health and safety requirements in foundries. The foundry industry is generally not well prepared to deal with these requirements – one particular issue of concern at present is the disposal of spent foundry sand;
- ***Transport and logistics costs*** – logistics costs within South Africa are relatively high and this raises costs and hampers export competitiveness in particular;
- ***Access to capital*** – many smaller foundries find it difficult to access sufficient financial resources to invest in modern equipment and technologies.

Constraints in the industry which limit competitiveness include:

- ***Lack of market intelligence*** – formal market research is lacking in most medium to small size foundries, which typically have a small number of clients, usually long-term business acquaintances. This makes these foundries vulnerable to changes in market dynamics;
- ***Lack of lean manufacturing principles and knowledge*** – technology transfer in this regard is not a priority in the industry and few attempts have been made to link with relevant specialists in consultancies, science councils or universities;
- ***Relatively low levels of technical competence and capacity*** – both on the shop floor and in key supplier industries such as patternmaking and the tool and die industry. This leads to process chain inefficiencies as well as an inability to develop and adopt modern technologies and techniques.

It will be realized that an important common element underpinning many of these challenges and constraints is the issue of skills. Shop floor workers are generally un- or semi-skilled, with very limited schooling. Foundry respondents in Gauteng indicated high levels of functional illiteracy amongst the workforce (up to 95% in one instance), and that the bulk of worker training is on-the-job training. This is clearly not optimal and results in workers being less efficient and effective, and also less able to proactively improve processes and adopt modern techniques.

The transfer of more advanced know-how is made more difficult by the prevailing low schooling levels. For example, core making involves the use of chemically bonded sands and therefore requires significant knowledge of chemistry. Core making is reportedly one of the less popular courses in the SAIF training programme, since the students appear to be somewhat intimidated as a result of their low levels of schooling in the natural sciences.

It has to be said, however, that there are also gaps with regard to higher level skills, including management, metallurgists, tool and die makers, and foundry engineers. While this is primarily the domain of FET colleges and universities, suitable short term interventions in the form of short courses and international expert training programmes could well contribute to uplifting such skills. This is an important potential role for the proposed training centre.

Further constraints with regard to skills training include:

- the lack of a suitable apprenticeship programme (it is currently not possible to train as a foundryman apprentice in South Africa);
- a lack of a coordinated training framework for the industry;
- industry finds it difficult to attract new young talent since it is perceived as a "dirty" and unsophisticated industry;
- lack of physical facilities for practical training outside a production environment. Foundries generally have very limited discretionary resources and the resultant lack of sustainable funding has prevented the development of a more permanent and formal training structure. For the same reason, equipment for practical training is very rudimentary and relies on access to equipment within the production foundries, which is not ideal for effective training. The practical aspects of foundry training are thus poorly catered for.

2.2.3 Opportunities

Industry Growth

There are several factors which suggest that the foundry industry has significant growth potential, which include

- Availability of raw materials;
- Relatively competitive input costs such as rental, energy, labour (although these have been increasing and are somewhat offset by lower efficiencies);
- Pockets of excellence in terms of manufacturing quality;
- A high level of flexibility and engineering versatility, i.e. small production runs, mixed process and mixed metal production;
- Spare production capacity – the foundry industry on average operates at utilization rates of 70% or less, based on a single shift scenario. This implies that there is as much as 50% theoretical spare capacity that could be utilized.

In terms of market sectors, the automotive industry has traditionally been seen as a particular growth sector for the foundry industry. Indeed it is estimated that 30 - 40% of the foundry output in South Africa is directed at this industry. Despite challenges with regard to production costs and technology requirements, the automotive sector continues to offer growth opportunities, particularly as this sector also enjoys the active support of government, as a priority industry sector.

The mining industry remains a substantial growth opportunity, particularly with regards to exports into Africa and the Americas. A number of South African foundries are highly successful in this domain, producing both original equipment and consumables (mainly wear parts).

The large procurement programmes by State-Owned Enterprises (SOEs) like Transnet and Eskom represent a further opportunity for the foundry industry. Indeed, the foundry sector has been identified as a lead sector for the Competitive Supplier Development Programme (CSDP) led by the Department of Public Enterprises and the dti. Substantial efforts have been made in the areas of supplier development, benchmarking, and matchmaking, with the NFTN taking a leadership role, to position the industry to take advantage of localization opportunities.

Skills Development

A significant attempt to address the skills training deficiencies has been made over the years by the Western Cape branch of the South African Institute of Foundrymen (SAIF), through the provision of a programme of training courses for foundrymen. These efforts have been broadly successful and the SAIF courses are well respected in the industry, as evidenced by the positive responses received in the foundry interviews.

Moreover, in recognition of the substantial challenges outlined above as well as the fact that the foundry industry is a priority sector identified by government, the Department of Trade and Industry has taken the initiative and provided seed funding for the establishment of a National Foundry Technology Network (NFTN). The NFTN brings together the key stakeholders from industry, government, science and technology, and tertiary education in order to devise and implement support programmes and projects to overcome the key issues faced by the industry. One major focus area is skills development, which was highlighted as a major deficiency during a RALIS exercise in the foundry industry in February/March 2008. This exercise was initiated by the Metal Casting Technology Station (MCTS) at the University of Johannesburg and supported by GTZ.

The concept a National Career Path Framework (NCPF) emanated from the finings of that exercise, and as a result the NFTN in collaboration with industry, UJ, and GTZ have successfully developed a NCPF for the foundry industry. This was followed by the development of Profiles, Curricula, Qualifications, and Training Materials for the three key foundry occupations of Melter, Moulder, and Patternmaker. These will for the first time allow the training of people in foundry specific occupations, from NQF levels 2 to 4, in a structured manner. Some 16 trainees are currently involved in a pilot training programme based on the new materials.

Further support systems exist in the form of the Technology Stations Programme (TSP) of the Department of Science and Technology which provides technology support services targeted at SME enterprises in selected industry sectors. At least one of the TSPs is targeted specifically at the foundry sector, i.e. the Metal Casting Technology Station (MCTS) at the University of

Johannesburg. With a mandate to engage in technology transfer and skills training for industry, the MCTS could provide a convenient node in Gauteng around which to anchor practical and theoretical foundry specific training in the province. To realise this potential, however, the equipment infrastructure at the MCTS would need to be upgraded and the utilization of the facility improved substantially.

The initiatives outlined above represent substantial opportunities for the foundry industry to improve its human resource capacity and thereby contribute towards higher levels of international competitiveness. The proposed foundry training centre in Gauteng could make a valuable contribution towards training in the region. A particular positive impact would be the facilitation of practical training in a well-equipped training foundry and under training rather than production conditions. This would not only meet the relevant Merseta requirements for practical training, but also enable the transfer of state-of-the-art knowledge.

3. MARKET PERSPECTIVE FOR TRAINING CENTRE

3.1 Current Training Offerings

SAIF "Diploma" in Foundry Technology

The main training programme directed at the foundry industry in Gauteng is the SAIF Foundry Trainig Programme, in collaboration with the NFTN. This is based on two main training programmes, i.e. the SAIF Operator Programme and the so-called "Diploma" Course which have been offered on a smaller scale, particularly in the Western Cape, since 1994 (Figure 3.1).

An unskilled worker would typically be exposed first to the operator programme and, following a selection process, could enter the "diploma" course. It is intended to register this programme as a skills training programme with Merseta, to allow learners to achieve a recognized qualification. The training courses are delivered by trainers who are experienced in foundry operations and technology.

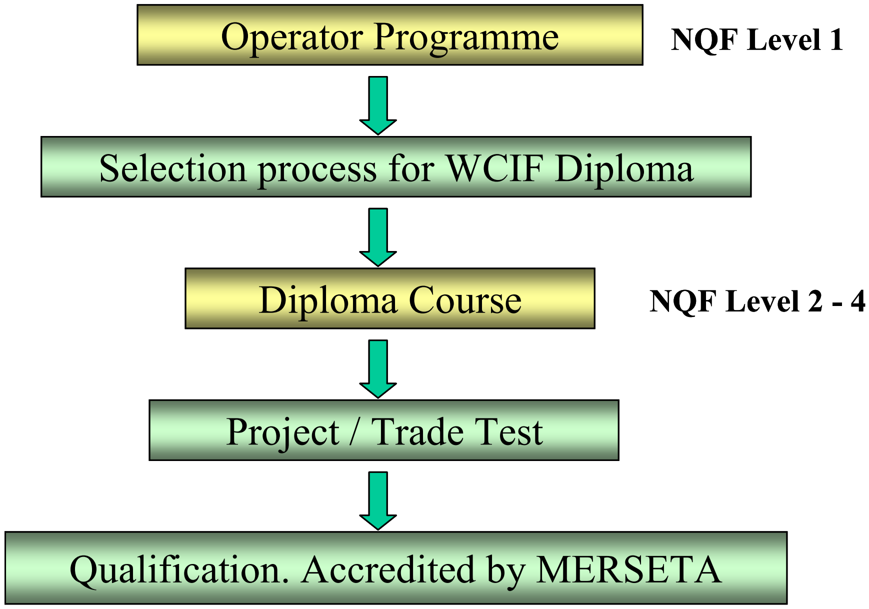


Figure 3.1: SAIF Foundryman Development Programme (SAIF, 2009).

The ***Operator Programme*** comprises the following elements:

- Melting & Metallurgy;
- Cores & Coremaking;
- Moulding & Moulding Sands;
- Filtration Methods & Casting Defects;
- Fettling & Fettling Techniques;
- Quality Control in the Foundry;
- Productivity & Production Planning;
- Supervisory Management.

The course is aimed at NQF Level 1 and serves as an introduction to these topics to lay the foundation for more in-depth and higher level training offered through the diploma course. The operator programme is presented in-house at foundries and comprises eight 4-hour presentations. Written tests follow after each programme and a 50% pass mark is required for each module attended. An operator certificate is awarded on the successful completion of all eight written tests.

The ***"Diploma Programme"*** consists of 8 modules, i.e.:

- Module 1: Metallurgy;
- Module 2: Cores & Core Making;
- Module 3: Moulding & Moulding Sands;
- Module 4: Tooling & Casting Processes;
- Module 5: Fettling & Fettling Operations;
- Module 6: Quality Control;
- Module 7: Productivity & Production Planning;
- Module 8: Supervisory Management.

This is a much more in-depth training programme and is aimed at NQF Levels 2 - 4. Each module requires around 32 – 36 hours of contact time with the trainer, delivered on Saturday mornings over an 8 – 9 week period. With three modules being presented per year, completion of the full eight modules therefore requires around 2.5 years. Self-study and self-test materials are given every week, and a written test must be completed after each module, with a 50% pass mark. A certificate is awarded after successful completion of each module.

Following completion of all eight modules, a practical test is required after which the "Diploma" in Foundry Technology is achieved. It should be noted that learners can elect to complete only particular, individual modules rather than the entire course programme. From historical data obtained from the WCIF, it is inferred that the average number of modules completed is three per learner. Historically, only about 25% of all learners completed six or more modules up to Diploma level.

University of Johannesburg (UJ)

The University of Johannesburg (UJ) offers higher level education for a BTech in metallurgy with a foundry major. Students have the opportunity to also study further to MTech and DTech level. Within the context of a career path within the foundry industry, these offerings could potentially link to the NQF Level 2 – 4 courses of the WCIF Foundry Technology Diploma progamme, whereby a learner could progress from the WCIF programme to the higher level education.

The UJ also hosts the Metal Casting Technology Station (MCTS) funded largely by the Technology Innovation Agency (TIA). The MCTS seeks to support and develop small and medium foundries by improving their product, process and human resource capabilities. The MCTS is equipped with a small scale sand foundry infrastructure which enables it to offer experiential learning and skills transfer to foundry staff. Key equipment include a 250kg aluminium melting furnace, a small 30kg induction melting furnace for ferrous materials, green sand moulding facilities, a core blowing machine as well as supporting laboratories for sand and materials analysis.

Through the MCTS, UJ also offers short courses in foundry technology, including:

- Foundry Technology;
- Aluminium Foundry Technology;
- Sand Technology;
- Principles of Heat Treatment;
- Methoding and Simulation for Sand Casting;
- Introduction to Corrosion and Basic Corrosion;
- Introductory Practical Course; and
- Die-Casting Aluminium for Foremen, Operators and Technicians.

This structure is considered to be analogous to the proposed Gauteng Training Centre, in that it can provide NQF Level 1 – 4 training, practical foundry training, as well as short courses and seminars. UJ is also closely involved with the SAIF in the delivery of SAIF training courses. Furthermore, the university is currently engaged in a process to register the MCTS as a training institution for NQF levels 2 – 4; this is expected to be completed by the end of 2011.

However, it must be noted in this context that the mandate of the University of Johannesburg is determined by government, and more specifically the Department of Higher Education. In terms of this mandate, the university is required to focus on training for NQF level 5 upwards. UJ is therefore not able to confer qualifications for lower NQF levels, but only certificates of attendance. In order to offer such lower level training as anticipated for the proposed foundry training centre, UJ would therefore need to collaborate with a suitable FET College, mandated to offer NQF level 2 – 4 training.

Vaal University of Technology (VUT)

The Vaal triangle represents one of the foundry industry nodes in Gauteng. The area is dominated by Arcelor Mittal, with about 14 other, smaller foundries located in the area. Vaal University of Technology (VUT) is located in close proximity to the area, and has historically been closely linked to ArcelorMittal in particular.

VUT offers training in metallurgical engineering, as part of which some foundry related topics are addressed. During a recent internal “RALIS” review, conducted to identify potential innovation opportunities, the topic of foundry technology and industry support emerged as an important natural strategic focus area. Accordingly, VUT intends to increase its focus on foundry industry support, and is engaged in upgrading its metallurgical laboratories to incorporate foundry technologies.

Currently, VUT faces the same constraint as UJ, however, namely that it is an institution with the mandate to provide training for NQF level 5 and upwards qualifications, and an inability to grant qualifications for lower NFQ levels. Nevertheless, training for lower level NQF levels does form part of the VUT agenda, through the Enterprise Development Unit (EDU) within the Technology Transfer and Innovation function.

VUT has also registered an interest in potentially hosting a foundry training centre. This could form part of a plan to revitalize the EduCity campus premises adjacent to the university, which are to be re-developed into a Science Park. This comprises 180ha of land and numerous buildings and facilities, including a resource centre (library). As a semi-industrial site, this could offer a potential location for the proposed Gauteng foundry training centre.

There is a further interesting synergy between the rapid prototyping and product development capabilities located at VUT and the foundry industry for the rapid production of patterns and core tooling for castings. This would support the innovation capabilities of the industry.

Independent Service Providers

A number of independent service providers offer specialised training to the foundry industry. Examples include presentations and consulting on computational process modeling as well as specialized in-house training targeted at particular needs within individual foundries. It is anticipated that the proposed training centre could function as a regional hub for the presentation of such specialized courses.

Industry (Scaw Metals, ArcelorMittal)

Several large companies such as ArcelorMittal and Scaw Metals Group have established particular training programmes to address their own needs. For example, the following training initiatives are undertaken by **ArcelorMittal**:

- In-house training for metals production workers, which begins with a 1-year basic traininig programme that address the relevant unit standards for “Select, Use and care for Engineering Hand Tools”, “Power Tools, Measuring Equipment”, and “Routine Maintenance”. Some 600 new recruits per annum undergo this training.
- Artisan learners are sent to trade schools where possible.
- In-house learnerships are offered in Fitting & Machining (including Welding), as well as Operator/Maintenance Operator.
- For foundry specific training, ArcelorMittal conducts in-house training for melters and moulders, and makes use of the training facilities at Scaw Metals for patternmakers.

- The company also offers work experience positions for learners from outside companies (capacity for some 20 learners per annum, in addition to some 10 learners per annum to meet their own requirements).
- ArcelorMittal is a participant in the current foundry learnership pilot project, involving some 16 learners in the areas of melter, moulder, and patternmaker.

It is interesting to note that the minimum entry requirements set by ArcelorMittal for learners include a Matric certificate with a minimum D-symbol in mathematics and science. This is required due to the technical nature of the work at the company.

Scaw Metals is presently the only accredited trade test facility for patternmakers in South Africa. The company also maintains an in-house patternmaking training facility, which is linked to the main Scaw Metals pattern shop. This can accommodate about 10 – 12 learners at a given time, which mainly caters for the company's own requirements. Additional training facilities would be required to increase the annual number of patternmaking learners.

Scaw is a registered training facility for the Foundry learnerships, i.e. melting, moulding, patternmaking. In-house training is provided to some 40 learners per annum (existing employees) in the field of moulding. For melter training, the Iron & Steel Learnership is currently used. This was developed in the early 2000's by a training committee comprising representation from Scaw Metals, ArcelorMittal, Highveld Steel, and Columbus Stainless. This learnership was successfully piloted around 2005 by Scaw Metals and Highveld Steel, with 15 learners. The third group of learners is currently undergoing training, with good success.

3.2 Training Needs

A two-pronged approach was followed to assess training needs and the demand for training in the industry, i.e. an electronic survey supplemented by personal interviews with selected foundries.

The electronic survey could be completed online and was circulated to 77 foundries in the Gauteng region. These excluded the foundries that were interviewed. The survey was repeated twice in an attempt to maximize the response. In the end, 15 completed surveys were received, for an overall response rate of 20%. Although this seems rather low, such response rates are not unusual in similar industry surveys.

The respondents represented some 640 foundry employees, or 9% of the total employment in foundries in Gauteng. The key results from the respondents are summarized in the following paragraphs.

The overwhelming majority of foundries train workers through in-house or on-the-job training while a rather lower proportion also make use of the SAIF courses (Table 3.1). The apparent relative lack of popularity of the SAIF courses may be due to the fact that concerted efforts have only recently commenced to offer these in the Gauteng region.

Table 3.1: Training method used by foundries [LHA survey, 2011].

Training Method	No. of respondents	Proportion (%)
In-house	12	80%
SAIF Training Courses	2	13%
Other training providers	1	7%

The type of training that is required is summarized in Table 3.2.

Table 3.2: Type of training required by Gauteng foundries [LHA survey, 2011].

Range	Responses	Proportion (%)
Moulding/Core Making	12	80%
Melting	10	67%
Metallurgy	6	40%
Machine Operators	4	27%
Pattern Making	3	20%
Apprentices	1	7%

It is clear that **moulding/core making** and **melting** are by far the most urgently required training areas for shop-floor workers. It is interesting to note that a full 40% of respondents also identified **metallurgy** as an important training topic. It would appear that this requirement is typically not for degreed metallurgical engineers, but rather for somewhat lower level training in key principles and practical aspects of foundry metallurgy. Nevertheless, this result also points towards a latent demand for foundry metallurgists at BEng and BSc(Eng) level, as offered by Universities and Universities of Technology

Pattern making only rated 5th in the scale of training requirements – this may be due to the fact that most foundries outsource their pattern making, and only handle routine pattern maintenance and modifications in-house. Consequently, such foundries do not have a need for fully qualified pattern makers on site.

Finally, only one respondent explicitly identified a need for apprentices, i.e. artisan level training.

These results are consistent with the findings from individual foundry interviews. Foundries interviewed indicated that they typically recruited new shop floor workers without specialist foundry training or skills, and then trained them through on-the-job training as well as the SAIF training courses. The most immediate requirement identified was for the training of existing employees and particularly shop floor workers, rather than new entrants. Upskilling is required in the main areas of melting and moulding as well as patternmaking and supervisory skills. The level of training that is required is typically below artisan level, i.e. at NQF levels 1 – 3, although several foundries also recognized the need for artisan level training in moulding and patternmaking. Interestingly, several foundries identified a need for training in **fettling**, since this represents a labour intensive part of the operation with a substantial impact on foundry throughput.

In summary, the key skills and training needs highlighted by foundries are the following:

- moulders, core makers, machine operators, NQF Levels 1 – 2, emphasis on practical training;
- production melters;
- foundry metallurgy;
- fettling;
- supervisor / foreman (in larger foundries);

Most foundries agreed that multiskilling is important. Other training needs that were noted include:

- patternmaking, artisan training;
- business training at introductory and higher level (not part of current SAIF programme); and
- specialist courses directed at other foundry processes such as gravity and high pressure die casting, which are inadequately covered in the SAIF courses at present.

It was emphasized that the training of shop floor workers typically needs to be very practical and thus requires access to foundry infrastructure. Currently this type of training is done through on-the-job training which is foundry specific and not standardized. The establishment of a training foundry in the proposed training centre would allow more standardized, generic training of foundry workers, within the context of a national accredited skills development framework.

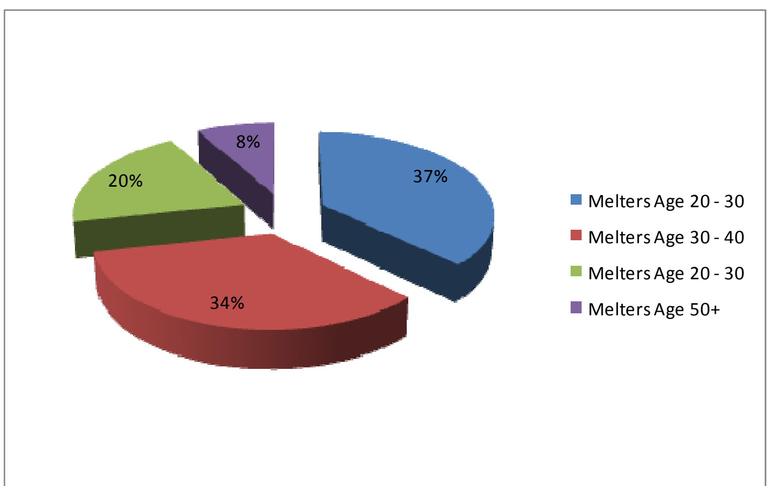
The SAIF courses were generally well received in the industry. The payback on training investments is typically not quantified, but foundries indicated that in their experience trained staff were more confident and motivated and worked more effectively. Interestingly, foundries also noted that trained staff tended to pass on their new knowledge to other staff; thus the training has a positive multiplier effect.

Foundries agreed that the time taken to achieve the SAIF Diploma could be reduced substantially from the current 2.5 years. This should be one important objective of the proposed training centre, i.e. to introduce a diploma training course that will allow the completion of the diploma within a year.

Specialist foundries using permanent mould casting (gravity, low pressure or high pressure) indicated that they would welcome courses on these processes, which are currently not available.

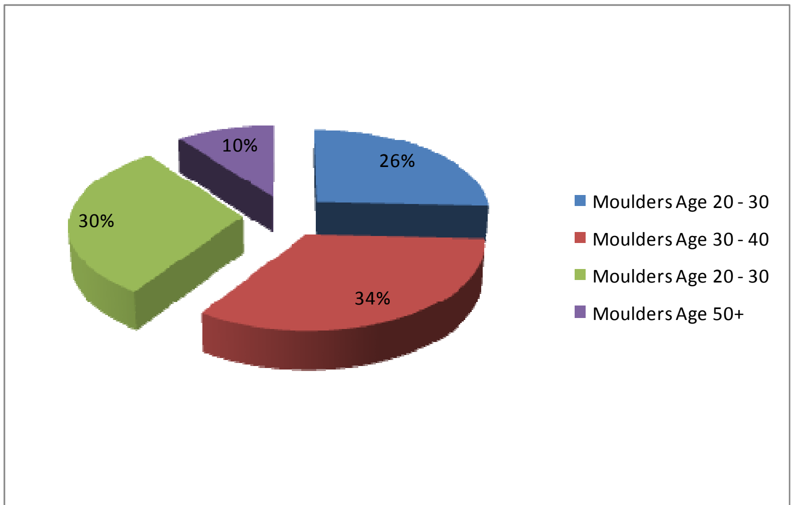
Demand for short courses offered by UJ is reported to be very low at present. Possible reasons for this include the current tight economic climate as well as the pricing of these courses, which is substantially higher than that of the WCIF courses (R750 per module for the WCIF course). Appropriate pricing will thus be an important element in ensuring the success and sustainability of the proposed training centre.

Although most foundries focused on upskilling of existing employees as a key need and few foundries explicitly identified a need for artisan level training, the development of new entrants up to artisan level is believed to represent a further key requirement for the foundry industry. The NFTN recently conducted a survey of the employment profile in the industry and uncovered some important trends. In particular, the average age of foundry workers appears to increase significantly with increasing skills levels. Considering the key occupations of melter, moulder and pattern maker (Figures 3.2 – 3.4), it is apparent that only 28% of melters are older than 40 years, compared to 40% of moulders and 64% of pattern makers. Even more concerning is that fact that some 30% of pattern makers are older than 50 years and therefore relatively close to retirement age.



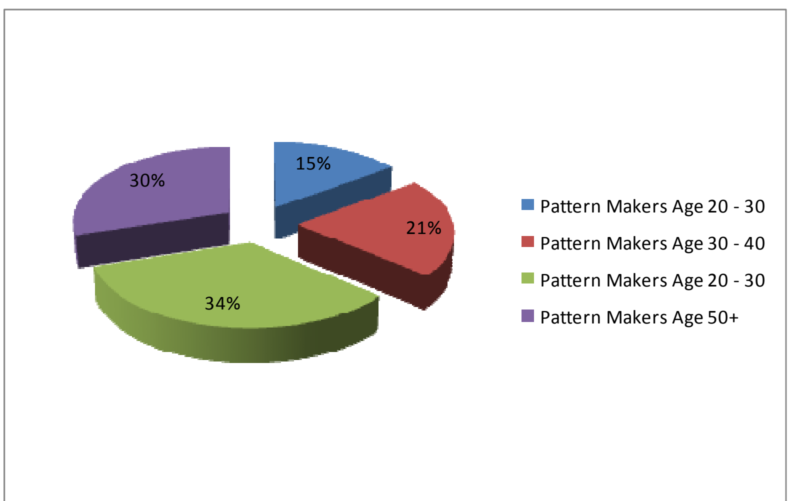
Melters				
Age 20 - 30	Age 30 - 40	Age 40 - 50	Age 50+	Total
55	51	30	12	**148**

Figure 3.2: Age profile of melters in foundries [NFTN, 2011].



Moulders				
Age 20 - 30	Age 30 - 40	Age 40 - 50	Age 50+	Total
50	65	59	20	**194**

Figure 3.3: Age profile of moulders in foundries [NFTN, 2011].



Pattern Makers				
Age 20 - 30	Age 30 - 40	Age 40 - 50	Age 50+	Total
7	10	16	14	**47**

Figure 3.4: Age profile of pattern makers in foundries [NFTN, 2011].

It is clear, therefore, that a significant skills gap is developing in the moulder and pattern maker skills areas in particular. The training of new entrants to replace these older workers must therefore represent another key focus area for the proposed training centre in Gauteng.

3.3 Market Demand

It has to be emphasized at the outset that there appears to be overwhelming industry support for the proposed training centre. A full 93% of survey respondents and 100% of foundries that were interviewed personally indicated that they would support and make use of such a centre.

In order to assess the appropriate scale and scope of the centre, the potential market demand has been estimated. The training demand falls into two main categories – new entrants, and training of existing foundry employees.

3.3.1 New entrants

From an analysis of the foundries in the region, the number of **direct employees** in the Gauteng foundry industry is estimated at **7,200 people**, the majority of whom are shop floor workers.

Staff turnover on the shop floor was found to be low among the foundries interviewed, and is estimated at typically 3% per annum. Assuming that half of the staff turnover is due to staff movements within the industry, the **requirement for new foundry workers** is estimated at **80 – 100 people per annum**. Given the employment profile of the industry as discussed in the previous section, it is estimated that some 50 – 60% of these of these replacement workers required would be **moulders and pattern makers**, i.e. **40 – 60** trainees **per annum**.

3.3.2 Existing employees

The demand for training of existing foundry staff as estimated from our research is summarized in Table 3.3 below. It will be seen that the foundries involved in the research represented some 72% of all employment in the foundry industry in Gauteng, and therefore the derived training demand estimates are considered to be representative for the region.

Table 3.3: Estimated training demand for existing foundry employees [LHA research, 2011].

Source	Foundry Employees	Proportion of Total Emloyment in Gauteng	Training Demand (Students p.a.)	Proportion of foundry employees (%)
Industry Survey	640	9%	60 - 90	9 - 14%
Interviews	4,500	63%	160 - 210	4 - 5%
Totals	**5,140**	**72%**	**220 - 300**	**4 - 6%**

The training demand is estimated at between 220 and 300 employees per annum, which represents some 4 – 6% of foundry employees. (The higher proportion found in the industry survey was due to two foundries with a particularly high propensity for training).

3.3.3 Aggregate training demand

The overall demand for training in the Gauteng foundry industry was estimated by combining the two estimates above. As illustrated in Figure 3.5, it is estimated that a proportion of existing employees will progress to higher level training such as learnerships. Due to constraints related in particular to the time available for studies, it is estimated that less than 10% of existing employees will be able to take advantage of such opportunities.

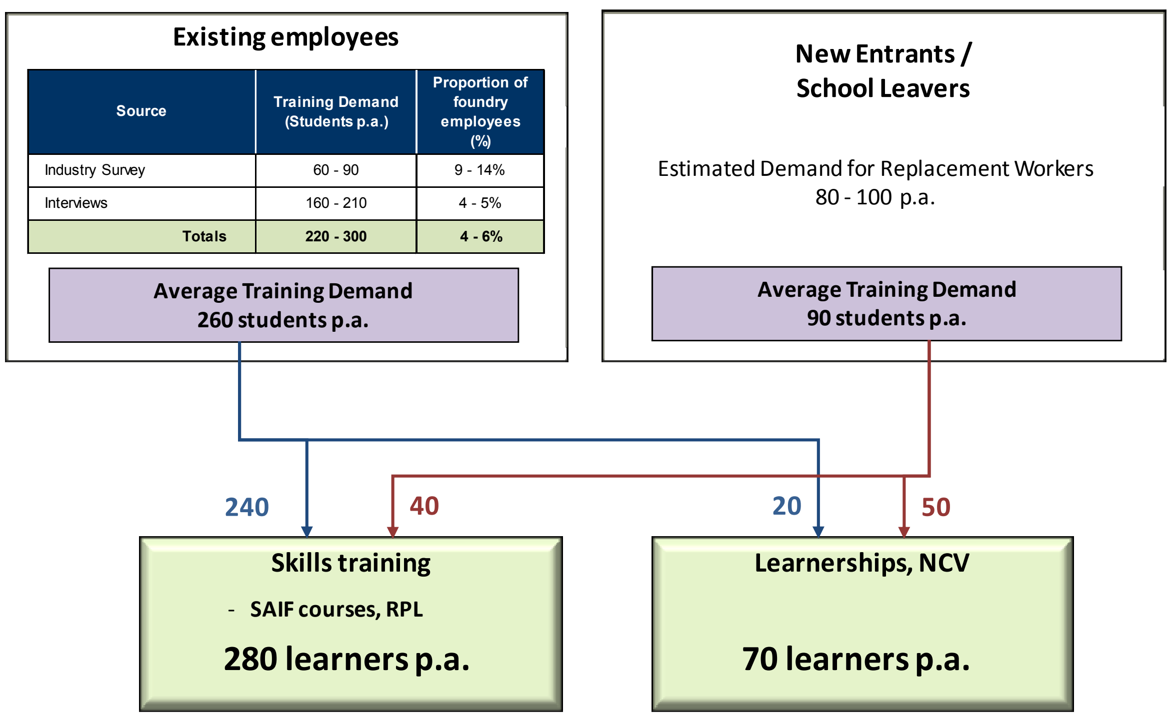


Figure 3.5: Estimated average aggregate training demand in the Gauteng foundry industry [LHA, 2011].

The demand for new entrants for the occupations of melter, moulder and pattern maker is estimated at around 50 learners per annum. The remaining new entrants would focus on targeted theoretical and practical occupational skills training. These projections are considered realistic, bearing in mind that there are currently 60 learners undergoing artisan training in the industry, at various levels of completion. The majority of these are current employees at larger foundries such as Scaw Metals, Joseph Grievson, and Umgeni Iron Works. Some 60% of these learners are patternmakers, while the remaining 40% are moulder artisan trainees.

The total aggregate training demand is estimated at some 350 learners per annum, which represents some **5% of the total number of foundry employees** in Gauteng. This ratio compares with those found internationally. For example, the Australian foundry industry employs some 2,000 staff directly and currently trains some 120 apprentices annually in a national training facility, which represents about 6% of the national employment figure. Similarly, in Finland the foundry industry employs 2,700 people directly and trains between 50 and 150 students per annum. Note, however, that most of the students trained in the international examples are in fact artisans whereas in South Africa the primary emphasis is still on upskilling shop floor workers. This suggests that the above training demand estimates may well be conservative, as South Africa has a significant backlog in terms of not only the quantity but also the quality or level of training. In other words, there may well be significant potential to increase the local student numbers with effective marketing and as the proposed training centre gains momentum.

3.3 Stakeholder Support

3.3.1 Industry

The overwhelming majority of foundries interviewed expressed strong support for the proposed training centre. All the foundries interviewed and 93% of foundry respondents to the electronic survey indicated that they see a need for and would make use of such a centre.

Location of the training centre is an important issue due to the availability and cost of transport. Most respondents agreed that a distance of around 20km would be preferred. This implies that the training centre should be located in the Ekurhuleni region, bearing in mind that most foundries in Gauteng are located in this area.

Specialist permanent mould foundries expressed overall support but also noted that the SAIF training programme does not address their needs effectively. To gain the interest of these foundries, the offerings of the proposed training centre and the SAIF should be expanded to include relevant courses on permanent mould gravity and pressure die casting of aluminium.

3.3.2 Gauteng provincial government

The Gauteng government's Department of Economic Development (DED) has indicated a strong interest in the proposed training centre, expressed in its commitment towards partnering with the

NFTN and initiating the present feasibility study and development process. Although the foundry industry was historically not seen as a priority sector for development, the provincial government more recently identified the Metals and Engineering sector as a new development focus area. Within this, the foundry industry is seen to offer growth opportunities, particularly through the SOE procurement programmes and its link with national development efforts such as the CSDP (Competitive Supplier Development Programme) of the DPE, the CSP (Customised Sector Programme) of the dti, and the various development programmes facilitated through the NFTN.

The Gauteng DED's interest in the training centre is guided by its mandate, which is "…to lead, facilitate and promote economic growth and economic development in Gauteng, with a targeted commitment to focus on enhancing the inclusivity of the Gauteng economy, whilst enhancing the competitiveness of the Gauteng economy". Inherent in this mandate is a focus on strategic programmes to enhance job creation and greening the economy.

The proposed training centre has the potential to impact positively on a number of these strategic focus areas. First and foremost the centre is of course directed at skills development, but it will also enhance the competitiveness of industry through its potential use as a hub for technology transfer, process development, and product prototyping, using the training foundry infrastructure. By also focusing on the training and mentoring of small and emerging foundries, the centre will also contribute towards enterprise development. The centre is therefore well aligned with the provincial government priorities.

The Department also indicated its willingness to consider a substantial financial contribution to the establishment of the centre. This would take the form of seed funding, which would be on the basis of shared risk and shared investment, i.e. funding must also be leveraged from other sources.

3.3.3 SAIF

As noted earlier, the SAIF, through its Western Cape branch, has driven the foundry training process in the Western Cape for some time with the strong support of Atlantis Foundries, and has established foundry courses and training schedules. SAIF as the foundry industry umbrella organization has recently been awarded a large contract from the NFTN to establish and implement a national training framework for the foundry industry. The proposed training centre is expected to be integrated into this national initiative, and thereby also access additional funding for expanding its activities. Discussions with the SAIF Executive confirmed that SAIF as the representative body of the organized foundry industry is fully supportive of the proposed centre. Tangible support could come not only in the form of participating in the governance of the centre on behalf of the industry, but also by way of financial contributions or subsidies for the training of students. This forms part of the larger training programme funded by the NFTN.

3.3.4 NFTN

The NFTN support is mainly through the funding provided to the SAIF industry training programme and by integrating the proposed training centre into the overall foundry career path and training framework which is being developed at present. Further support may well be forthcoming through co-investment into the initial establishment of the centre.

3.3.5 Tertiary education institutions

The University of Johannesburg has been working closely with the NFTN in the development of the career path framework, training curricula, and training materials. UJ is also working closely with the SAIF in the delivery of training courses for the industry in Gauteng. Discussions with senior staff in UJ have confirmed that the Faculty of Engineering and the Built Environment (FEBE) views the Technology Station model and associated offerings as an integral part of the faculty's business strategy. This includes a mandate to offer technology transfer and skills training, through the Technology Station vehicle, to industry. UJ therefore has expressed a strong interest and desire to participate in and even to host the envisaged training centre, through its Metal Casting Technology Station (MCTS).

The Vaal University of Technology (VUT) has expressed a strategic intent to increase its focus foundry industry support, and is engaged in upgrading its metallurgical laboratories to incorporate foundry technologies, with a view to offering technology support. VUT also offers rapid prototyping and product development training and services, which offers interesting synergies with the foundry industry for the rapid production of patterns and core tooling for castings. This would support the innovation capabilities of the industry. The Vaal foundry industry node is too small and geographically distant from the centre of gravity of the Gauteng foundry industry for VUT to be a viable location for the proposed training centre. However, VUT could well function as a regional node for the training centre, offering specialist theoretical training for the foundry industry.

Ekurhuleni East College (EEC) for FET has also indicated a strong interest and willingness to participate in the proposed training centre. The college is located on 5 campuses, i.e. Benoni, Springs, Brakpan, Kwa Thema and Daveyton, and offers National Certificate (Vocational) or NCV training in engineering and other disciplines. The college has experience in collaborating with industry sectors for the provision of specialized training. Examples include the paper industry, for which the college offers NCV training in paper technology, and the tooling industry, for which the college offers toolmaking learnerships. It must be noted that the college receives generous subsidies from the Department of Higher Education and Training, but these are only accessible for NCV training programmes. Learnerships are offered on a full cost recovery basis, i.e. in the case of the toolmaking learnerships, the respective companies or the Tooling Initiative cover the training costs. Of course the Merseta contribution towards learnerships could be accessed in this case, which

3.4 SWOT Analysis

3.4.1 Strengths

- Established and accredited SAIF training courses which are well accepted in the industry.
- Established learnerships for the qualifications of Melter, Moulder and Patternmaker, up to NQF Level 4.
- Availability of suitable trainers to offer the courses.
- Strong support from the Gauteng foundry industry at large, as well as other key stakeholders such as provincial government, tertiary education institutions, SAIF, and the NFTN.

3.4.2 Weaknesses

- The market and need for training is substantial, but the industry does not have a culture of utilizing external training facilities. Significant marketing and collaboration with industry will be required to penetrate the market.
- Smaller foundries in particular have very limited discretionary funds available for training.
- Lack of adequate full-time human resources – there are few independent trainers with the required practical and industrial foundry experience required; hence it will be a challenge to source the appropriate staff for the proposed centre.

3.4.3 Opportunities

- Establishment of the centre as a training hub for the foundry industry in the greater Gauteng region.
- Integration of the centre into the national foundry training programme led by SAIF and the NFTN, with concomitant access to funding support for training.
- Established infrastructure and expertise in foundry technology at the University of Johannesburg, which could serve as a platform for the development of the proposed training centre.
- Linkage to Ekurhuleni East College for FET to provide institutional capacity and access to institutional funding support for learnerships/apprenticeships.
- Use of the training foundry facilities for technology transfer, process development, and product development / prototyping, in collaboration with industry and universities.

3.4.4 Threats

- Lack of funding for infrastructure establishment and renewal.
- Relatively small local market for higher level training of school leavers (learnerships, NCV), which limits the initial turnover potential of the centre.

4. BUSINESS PLAN

4.1 Vision and Objectives

The vision for the proposed Gauteng (GFTC) is to create a hub for foundry related skills training and technology transfer in the greater Gauteng region, offering facilities and infrastructure for both theoretical and appropriate practical training.

The fundamental objective of the proposed foundry training centre is to increase the scope and impact of foundry training in Gauteng by expanding the current training offerings of the SAIF in the following two key ways:

i. by offering practical foundry skills training in a training environment rather than a production environment, using appropriate modern equipment and techniques;

ii. by offering an intensive version of the SAIF Foundry Technology "Diploma" course to condense the time required for completion of the course from 2.5 years to less than one year.

iii. by offering learnerships/artisan training for Melter, Moulder and Patternmaker qualifications, including the required practical training component.

4.2 Scope and Service Offerings

The proposed scope of the training centre is guided by the requirements of the local foundry industry and will therefore encompass the following four key pillars:

1. **Skills Training** – this would be based primarily on the SAIF training modules, and focused on upskilling existing foundry employees;
2. **Learnerships** – for Melter, Moulder, Patternmaker qualifications, focused on new entrants and school leavers;

3. **Recognition of Prior Learning (RPL)** – here the skills and experience of existing foundry employees would be assessed with a view to identifying gaps and addressing these through targeted training interventions;
4. **Non-technical training** – selected specialized training offerings which could include Adult Basic Education and Training (ABET) to improve literacy among foundry staff, basic business skills, and basic supervisory training courses.

Given the structure of the industry in Gauteng, the training centre would focus on sand casting using both chemically bonded and green sand as well as permanent mould gravity die casting. Casting materials are initially limited to grey cast iron and aluminium, with the possible inclusion of nodular graphite or SG cast iron.

The training foundry equipment will be largely manual but of sufficient scale to allow for training that is meaningful in an industrial context, i.e. the aim is for a small-scale industrial foundry infrastructure rather than laboratory scale facilities. There is a need to offer specialist training in high pressure die casting, and in this regard it is proposed that the high pressure die casting facilities at the CSIR be accessed to offer such training.

The training centre should also function as the regional hub for other foundry related training including short courses, management training courses offered through the NFTN and the IDC, and technical presentations.

The training foundry infrastructure should also be used in collaboration with industry and universities for the development and prototyping of casting processes and products.

To illustrate the positioning of the training centre and its service offerings, it is useful to consider a map for foundry specific occupations (Figure 4.1). This was developed by a GTZ consultant together with the MCTS, NFTN, and industry and is based on the occupational framework of the Department of Labour.

It will be seen that the core services of the proposed Gauteng Foundry Training Centre are targeted at NQF levels 1 – 4, which is equivalent to shop floor workers such as process and machine operators, production staff, and patternmakers. Within the context of the broader career path framework for the foundry industry, this training will also offer the opportunity for foundry staff to move on to higher levels of education and training, including formal diplomas and degrees. Such relevant training is offered by universities and technical training colleges. Examples include UJ which offers a BTech in metallurgy with a foundry major, as well as Wits University and Pretoria University which offer degrees in physical metallurgy. It is envisaged that the transition through the various NQF training levels will eventually be fairly seamless.

MANAGEMENT CONSULTANTS

Universities, TEIs — NQF 5 - 7

133502
Production/Operations Manager (Manufacturing)

Plans, organises, directs, controls and coordinates the manufacturig activities of an organisation including physical and human resources

- Fettling Foreman
- Melting Manager
- Foundry Foreman

314104
Metal Manufacturing Technician

Provides technical support and services in the development of manufacturing methods, facilities and systems, and in the planning, estimating, measuring and scheduling of all aspects of the metal manufacturing process.

- Foundry Metallurgist
- Casting Estimator
- Foundry Technician
- Metallurgical Lab. Assistant
- QA / QC
- Methods Engineer

WC Foundry Training Centre

NQF 4

322104
Metal Casting Trade Worker

Forms sand moulds and cores for the production of metal castings.

- Melter
- Moulder / Core Maker
- Foundry Patternmaker

NQF 2 – 3

712301
Engineering Production Systems Worker

Performs a range of production process tasks to refine and treat metals and mineral ore, fire ceramics, and operate lant to produce and finish metal products such as rods, tubing and structural shapes, and moulds for casting.

- Production Moulder/Coremaker
- Heat Treatment Operator
- Ladle Operator
- NDT Operator

NQF 1 – 2

839101
Metal Engineering Process Worker

Performs routine tasks in manufacturing metal products.

- Fettler
- Moulder Helper
- Scrap Yard Attendant
- Shakeout Operator

Figure 4.1: Draft occupational map for foundry occupations (NFTN, 2009).

The occupational map illustrates that the proposed training centre will serve to fill a key void at the lower NQF training levels, and may therefore make a substantial positive contribution to the formal training of foundry staff. Moreover, within the context of the new national training framework and the Quality Council for Trades and Occupations (QCTO), it is anticipated that the higher education levels of 5 – 7 will not be limited to the formal higher education stream only, but could also be achieved through an occupational training route. This would open up further opportunities for the training centre.

In terms of delivery of the core training courses, it is envisaged to offer training as follows:

Skills Training – SAIF Foundry Technology Diploma

It is envisaged to offer three complete diploma courses per annum, each on a full-time basis over a 12 – 14 week period. The training would cover all training modules and include theoretical training, i.e. lectures, combined with extensive practical training related to the various training modules (the content of the various SAIF training modules was discussed previously in Section 3.1). The maximum number of students would be 12 – 14 per course, due to the practical training aspects.

These diploma courses would require a substantial commitment from both the student and the foundries, since students would be required to give full-time attention to their studies over the 12 – 14 week period. Many of the foundries interviewed felt that they could release their staff for a maximum of one week at a time. However, the larger foundries (e.g. ArcelorMittal) indicated that they would in principle consider releasing their trainees for significant block times. Nonetheless, the courses may need to be scheduled to spread the block times over the year, i.e. run the three diploma programmes concurrently.

Skills Training - SAIF Foundry Training Modules – Part-Time

It is also envisaged to offer the SAIF training modules on Saturday mornings, as per established practice. This would typically involve the presentation of three modules per annum, i.e. three groups of students. To augment the theoretical training, additional practical training could also be offered on two Fridays per month – the foundries interviewed indicated that they would be prepared to release workers for 2 – 4 days per month for particular training. Students would still be able to complete the diploma in 2.5 years as before.

Learnerships – Melter, Moulder, Patternmaker

The learnerships developed for these qualifications would be offered through the proposed training centre. These involve essentially full-time training for a period of 3 years, whereby successful learners progress through NQF Levels 2 – 4. On successful completion of the final modules, learners can write a trade test to obtain their trade qualification.

The learnerships are based on roughly 1/3 theory, 1/3 practical training (offered through the training foundry infrastructure of the proposed centre), and 1/3 workplace experience, which would be offered through participating foundries. Large companies such as ArcelorMittal have indicated that they are able to offer workplace experience for up to 20 foundry learners per annum.

4.3 Facilities and Infrastructure

4.3.1 Proposed facilities

In considering the equipment selection and design of the proposed training foundry, it is relevant to consider some international examples of similar foundry industry training initiatives:

Australia

In Australia, Skills Tech Australia in 2008 inaugurated an integrated foundry and patternmaking training centre, established at a cost of AUD 7,5 million (approximately R48.9 million). The facility contains state-of-the-art training rooms as well as a flexible workshop area and laboratories equipped with modern patternmaking and foundry equipment. Located in Brisbane, the centre is part of the Queensland government training system (Technical and Further Education, TAFE) and was designed and is operated in cooperation with the Australian Foundry Institute (AFI). The cooperative research centre CAST is currently working with the AFI and the training centre to develop nationally accredited training course in metallurgy. It is important to note that the centre is seen as a national facility, with the intention of attracting students from around the country to complete practical training. (Interestingly, much of the theoretical training is planned to be delivered on-line).

The foundry industry in Australia employs some 2,000 staff directly and produces some 94,000 tons of iron and steel castings per annum, with a value of about AUD600 million. Note that this production output represents roughly 25% of South Africa's ferrous foundry production, while the employment figure represents only around 15% of South African foundry employees. This illustrates the much higher labour efficiency of the Australian industry.

In the previous training centre, only 22 apprentices were enrolled in training. The new facility has resulted in an increase in enrolment to a current 120 apprentices with an expected growth of 15 – 20% over the coming 5 years. This is a relatively high proportion compared to the industry employment numbers, and illustrates the commitment of the industry and the training institute to skills training.

Sweden

In Sweden, the Swedish Foundry Association is responsible for operating the ***Scandinavian Foundry School*** which serves the training needs of the foundry industries in Sweden, Denmark and Norway. The school is equipped with a wide range of up-to-date equipment, including:

- Wagner Sinto moulding machine;
- Disamatic moulding machine;
- Italpresse high pressure die casting machine;
- ABB robot;
- Light emission spectrometer; and
- Computer aided casting process simulation facilities.

Since 1994, students have been able to undergo technical and apprenticeship training in the facility, and some 100 students have since received their journeyman's certificate.

Finland

In Finland, the ***Foundry Institute*** develops and coordinates national foundry education and is involved in international research and product development. The Institute is an associate of Tampere University of Technology, Tampere University of Applied Sciences, and Tampere College. The institute was established in 1998 with start-up funding of 2.69 million Euros (about R30 million today) from the City of Tampere. In terms of sustainability, the Institute to day is funded mainly by Tekes (Finnish Funding Agency for Technology and Innovation), which provides 70% of funding. The remaining 30% are generated from the private sector.

The foundry industry in Finland is small with a total of 100 foundries with a total staff complement of some 2,700. An estimated 30 patternmakers serve the industry. Nevertheless, the volume of students trained at the Foundry Institute is about 50 – 150 per annum. These industry employment and training figures are similar to Australia and again illustrate the commitment from the industry and the impact of the training facility on skills training.

USA

One of the most relied-upon industry training resources for metal casting is the ***Cast Metals Institute (CMI)***, which is the educational arm of the American Foundrymen's Society and is located in Des Plaines, Illinois. CMI is able to meet most of the training needs of the foundry industry and on average trains some 2,500 people per annum. Facilities include a small foundry, sand laboratory, metallurgical testing laboratory, lecture hall and several classrooms. The foundry is of a small industrial scale with 150kg and

250kg induction furnaces, a 120kg non-ferrous aluminium resistance furnace, a 15kg lift-swing non-ferrous furnace, and a gas fired crucible furnace. For moulding and casting, the facility is equipped with a continuous sand mixer, a shell core machine, a squeeze moulding machine, a tilt-pour permanent mould casting machine (for aluminium), as well as a tumble and table shot blast machine. The sand laboratory is equipped with all the common sand testing and non-destructive testing equipment including a dilatometer, a wet tensile machine, a hot distortion tester and a gas evolution tester. The facility is supported by a full metallography laboratory including an x-ray tester, hardness tester, and scanning electron microscope.

As with the other international facilities discussed above, a key perceived advantage of CMI is that it represents a "one-stop-shop" for both practical and theoretical training for a number of common foundry processes, including green sand, chemically bonded sand, permanent mould, and ferrous and non-ferrous casting.

A common feature of all these initiatives is that they all offer small but industrial scale practical foundry training facilities covering the main casting processes of sand casting (green sand and chemically bonded sand), core making, and cast iron as well as aluminium casting. The larger facilities include automatic moulding machines and/or high pressure die casting machines, which is inappropriate for the scale of the Gauteng facility.

The international facilities also offer sand laboratories and at least a basic metallographic laboratory that allows training in materials testing and quality control.

Against this background and taking into consideration the needs of the local industry and the identified scope of the proposed Gauteng training centre, the training foundry should encompass the following main facilities:

- ***Mouldmaking***
  - Green sand moulding facility including a batch mill and moulding table
  - Chemically bonded sand moulding facility based around a continuous sand mixer (1 ton/hour capacity) and vibrating compaction table
  - Core sand mixer (batch) and core blowing machine
  - Mould coating facilities
  - Mould handling unit to limit manual manhandling of the moulds
  - Mould transfer to casting area via roller tracks

- ***Melting and Casting***
    - Medium frequency (MF) induction melting furnace for ferrous materials (mainly cast iron), ~50kg capacity
    - Electric resistance melting furnace for aluminium (crucible type), 100kg capacity min.
    - Argon rotary degassing facility for aluminium
    - Manual casting via hand shank transfer ladles
    - Roller track for mould transfer and casting
    - Mould stripping bay
    - Manual fettling with hand tools and grinders

- ***Heat Treatment***
    - Muffle furnace for basic heat treatment

- ***Sand Laboratory***
    - AFS sieves for sand grading
    - Green sand testing equipment (continuous clay washer)
    - Permeability tester
    - Tensile tester
    - Muffle furnace for sand testing

- ***Metallurgical Laboratory***
    - Sample preparation facilities (cut-off machine, grinding and polishing wheels, sample mounting press)
    - Etching facilities
    - Optical microscope
    - Rockwell hardness tester

- ***Pattern Shop***
    - Facility for producing relatively small patterns using traditional patternmaking techniques (which are similar to woodworking techniques). This would include a small wood lathe, disc/bobbin sander, circular and band saws as well as suitable hand and power tools.

It should be noted that patternmaking for sand casting is a particular technology that is distinct from the toolmaking technology used in the manufacture of permanent metal tooling. For smaller patterns there is an emerging trend towards the use of CNC machining technology to produce the pattern shapes. There is thus a synergy with the toolmaker training programme of the National Tooling Initiative Programme (NTIP), which is offered in Gauteng in partnership with the Ekurhuleni East College for FET. However, larger patterns can typically not be produced by CNC technologies and rely on the skills of the patternmaker. There is thus a need to offer dedicated patternmaker training as part of the proposed training centre.

A typical small scale melting furnace for cast iron and steel are shown in Figure 4.2 – this is the unit installed at the Western Cape Foundry Training Centre. Note the hydraulic tilting mechanism which allows decanting of the molten cast iron into a hand shank transfer ladle for casting. This is a typical arrangement and will also be used in the proposed training centre.

Figure 4.2: Small-scale induction melting furnace for cast iron installed at the Western Cape Foundry Training Centre.

It is important that the training centre has facilities for chemically bonded sand moulding since the associated cold box and no bake moulding techniques are dominant in jobbing foundries in South Africa and internationally. Although such training could also be achieved with small batch sand mixers, it is considered important to equip the facility with a small continuous sand mixer (Figure 4.3 illustrates the mixer installed at the Western Cape Foundry Training Centre). These are becoming the norm in industry and such a facility will allow training in key skills such as optimization of machine parameters (nozzle adjustment etc.) and correct maintenance of the equipment (e.g. servicing and replacing of feed screw). These are essential skills to ensure effective operation of such a sand mixer and to optimize the equipment lifetime.

Figure 4.3: Continuous sand mixer installed at the Western Cape Foundry Training Centre.

A more detailed equipment list with associated capital investment requirements is provided in Section 4.3.5 of this document.

4.3.2 Location

The location of the training foundry infrastructure and the proposed training centre must be guided by practical and operational considerations, which include:

- Close proximity to most foundries to limit travelling requirements (most foundries indicated that a travel radius of around 20km would be preferable);
- Linked to an appropriate training institution to ensure sustainability;
- Aligned with the host institutions mandate and the natural funding streams for training.

It was noted earlier that the Ekurhuleni region would be the most appropriate location, given the fact the most of the Gauteng foundries are located in close proximity to this area. This is supported by the foundries, the overwhelming majority of which indicated that Ekurhuleni and/or the University of Johannesburg (UJ) as the preferred location.

To ensure sustainability of the training centre, it is considered to be very important to institutionalize the training centre. This is best achieved by locating it within a suitable training institution, and to ensure that it is able to access the natural training funding streams. This essentially rules out a private initiative, since funding support for artisan training from the Department of Higher Education and Training is confined to public sector training colleges and institutions.

Location of the training centre at **UJ** has a number of advantages, which include:

- Substantial foundry infrastructure already exists, i.e. melting facilities for iron and steel as well as aluminium, sand testing laboratory, metallographic laboratory, and a spectrometer and chemical analysis facilities. Although the facility will require upgrading (notably the addition of a no-bake / chemically bonded sand moulding facility, as well as larger ferrous melting facilities), capital investment requirements will be substantially lower than for a Greenfield training foundry. This is addressed in more detail in the financial plan section.
- Convenient location close to the Ekurhuleni industrial area and close to major bus and taxi routes.
- Ample facilities for theoretical training in the form of classrooms and training infrastructure.
- Existing experience and expertise in foundry technology, including availability of several lecturers / trainers. UJ has also indicated that it is willing to appoint additional staff for the proposed training centre.
- Support from the university in the form of buildings, services (water, electricity), and infrastructure maintenance, which would significantly reduce the direct operational cost of the facility.
- Established Metal Casting Technology Station (MCTS) which would be an appropriate vehicle to deliver NQF Level 2 – 4 training. In fact, MCTS is already engaged in delivering SAIF foundry training courses as well as specialist short courses in foundry technology. However, MCTS is not an independent legal entity, although its management and financial structures are ringfenced within the Faculty of Engineering and the Built Environment.
- UJ already offers training in metallurgical engineering, i.e. a BTech in metallurgy with a foundry major. Students have the opportunity to also study further to MTech and DTech level. UJ recognizes that the proposed foundry training centre could also provide an opportunity for learners that have progressed through NQF Level 2 – 4 training within the centre to extend their studies to the higher level degrees.

On the other hand, location at UJ is also associated with several challenges, including:

- UJ is not mandated to offer qualifications for NQF levels below 5 (see also Figure 4.1). Therefore, although the MCTS will be a Merseta-accredited training institution for NQF Level 2 – 4 training and could host the training centre, UJ would be unable to issue formal qualifications or certificates.
- For reasons outlined above, UJ/MCTS are also not able to access student subsidies from the Department of Higher Education and Training. These subsidies are offered only to FET colleges, which are mandated by the department to offer NQF Level 2 – 4 training.

Nevertheless, once MCTS is a Merseta-accredited training institution, learners and their employers will be able to claim the normal training funding support from Merseta.

The alternative would be to locate the foundry training centre at an FET college. The most appropriate would be **Ekurhuleni East College (EEC)**, which has several campuses in close proximity to the foundry industry in Ekurhuleni. As noted earlier, the college has experience in collaborating with industry in offering industry-specific learnerships and NCV training programmes (i.e. paper and tooling industries). The advantages of locating the training centre at the college would include:

- Excellent alignment between the objectives of the training centre and the mandate of the college, i.e. NQF level 2 – 4 training;
- Access to financial support from the Department of Higher Education and Training. This varies depending on the details of the course, but typically amounts to some R32,000 – R41,000 per student per year. Additional financial support is available to students in the form of a grant from the department, to make up the shortfall between the subsidy and the actual total cost of the training programme. Typically, this amounts to R8,000 – 9,000 per student per annum.

  It should be noted, however, that these subsidies are available for government approved qualifications only, i.e. NCV qualifications, and not for learnerships. The latter still need to be financed either directly by the student and/or their employer, or through Merseta subsidies.
- Established infrastructure and expertise for Fundamental Subjects (Language, Mathematics, Life Orientation), as well as some appropriate core subjects.

Disadvantages of locating the centre at the Ekurhuleni East College include:

- No established expertise and human resources for foundry-specific training;
- No formal materials or metallurgical engineering related training is offered;
- Hence, no metallurgical engineering and foundry technology infrastructure exists. The proposed training centre would therefore have to be established as a Greenfield operation, with associated higher capital cost and time requirements.
- The college is focused primarily on NCV and, more recently, artisan training, although it also does offer selected skills training programmes as individual projects for industry clients, on a full cost recovery basis. However, skills programmes to upskill existing foundry employees is one of the core functions of the proposed foundry training centre.

In view of the above, two options emerge for locating the Gauteng training centre.

Option 1: Joint venture between UJ and EEC

In this scenario, a potential solution to overcome the challenges associated with locating the centre at UJ would be to establish the delivery of foundry industry training in Gauteng as a collaborative initiative between UJ and the Ekurhuleni East FET College.

In terms of this concept, the relative roles of the organizations would be as follows:

University of Johannesburg

- Host the proposed practical foundry industry training centre at the UJ Doornfontein campus. The centre would be established through the extension and upgrading of the existing MCTS foundry infrastructure and facilities.
- Offer skills programmes and foundry training for existing foundry employees, based on the SAIF training courses. Theoretical training to be augmented by practical skills training using the training foundry.
- For learnerships and/or NCV training programmes, provide specialist theoretical training as well as the practical foundry training component using specialist trainers or service providers;
- Offer selected short courses in foundry technology as well as selected non-technical training in areas such as basic supervisory skills and business skills.

Ekurhuleni East College for FET

The main role of the college would be to support the delivery of foundry learnerships (Melter, Moulder, Patternmaker), which are aimed mainly at new entrants and school leavers.

- Where appropriate, students would be registered through the EEC in order to qualify for government bursaries. As noted earlier, the foundry learnerships would need to be converted to NCV training programmes in order to qualify for student bursaries.
- Provides foundation courses and training as part of the foundry learnerships.
- Issues learnership qualifications at NQF levels 2 – 4 (which UJ is not mandated to do).

This concept has been discussed with both UJ and the EEC and has been support in principle by both organizations.

Option 2: Location of the centre at EEC

In this scenario, the proposed foundry training centre would be established as a greenfields operation at the Ekurhuleni East College for FET. The most appropriate location would be the Kwa-Thema campus, which also houses the head office of the college, thereby ensuring appropriate management support, as well as the toolmaking training facilities, which would offer opportunities to exploit synergies with the patternmaker training requirements.

Apart from the better organizational fit, this solution would also simplify management and administration processes, and ensure appropriate institutionalization of the training centre. A disadvantage is the higher initial setup costs that will be required to establish the foundry infrastructure.

In the remainder of this document, both options are explored in further detail.

4.3.3 Layout

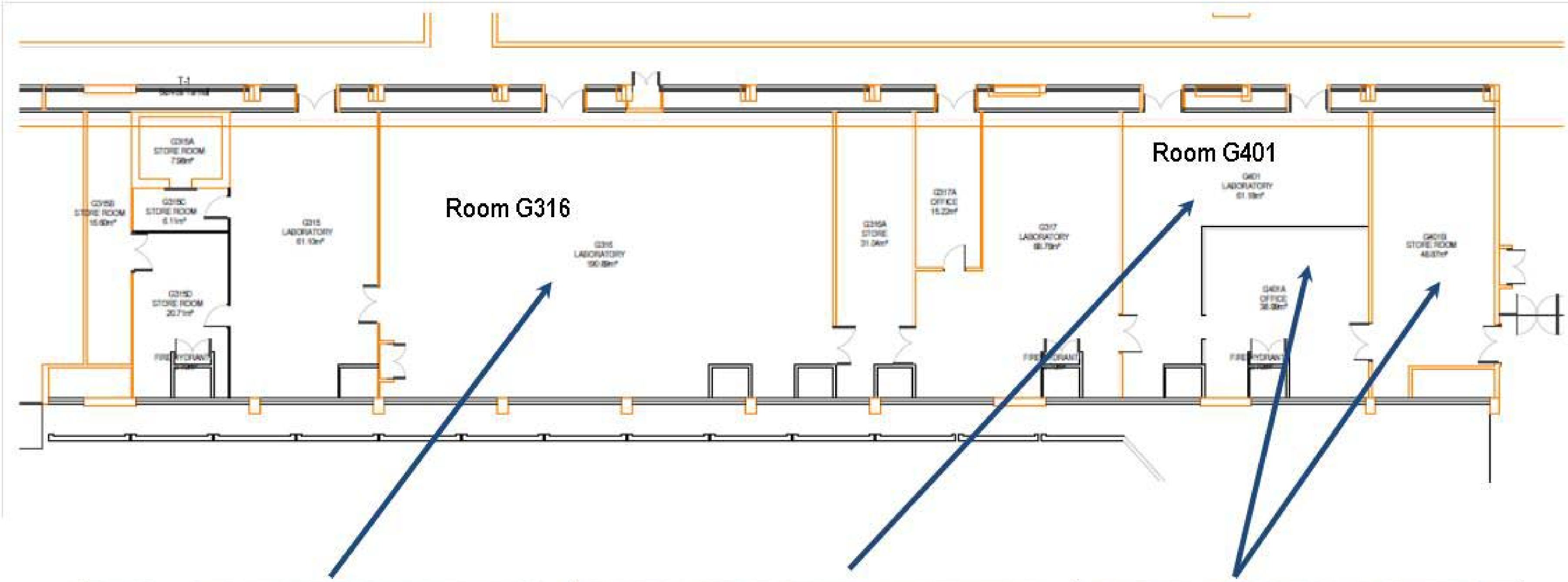
Option 1: Joint venture between UJ and EEC

The existing foundry infrastructure at UJ comprises a small scale foundry as well as a workshop and sand laboratory. Metallurgical laboratory facilities are also on hand as part of the infrastructure of the Department of Metallurgical Engineering. Figure 4.4 shows an overview of the existing foundry facilities.

A typical layout for the proposed training foundry at UJ is provided in Figure 4.5. This incorporates the existing MCTS foundry in the John Orr building, room G316, and augments this facility with a bonded sand plant as well as a new ferrous melting furnace. Clearly the layout is confined to the training foundry only, i.e. excluding other ancillary facilities that are required such as classrooms and ablution facilities, which are available within the same building.

Figure 4.6 shows a concept layout for the proposed pattern shop at UJ, which could be located in the area that is currently occupied by a mechanical workshop. A store room as well as a furnace room containing a range of small hear treatment furnaces is located between the foundry and the proposed pattern shop area.

The sand laboratory is located adjacent to the proposed pattern shop. This is well equipped and does not require any major investments or upgrades at this stage.



Overview of UJ foundry

Workshop – possible location for pattern shop

Sand laboratory

Figure 4.4: Overview of existing foundry facilities at UJ.

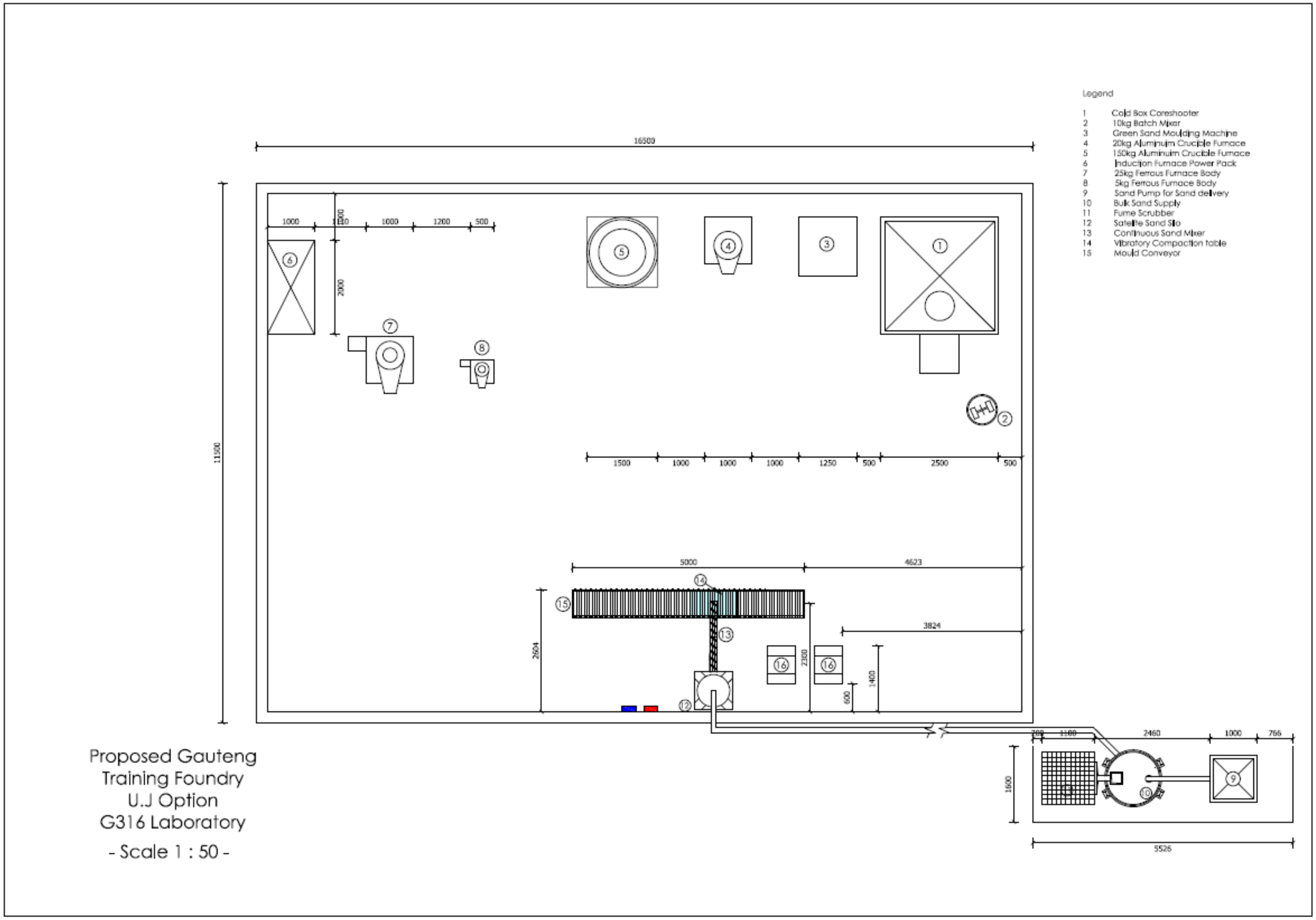


Figure 4.5: Concept layout for proposed training foundry at UJ – John Orr Building, Room G316.

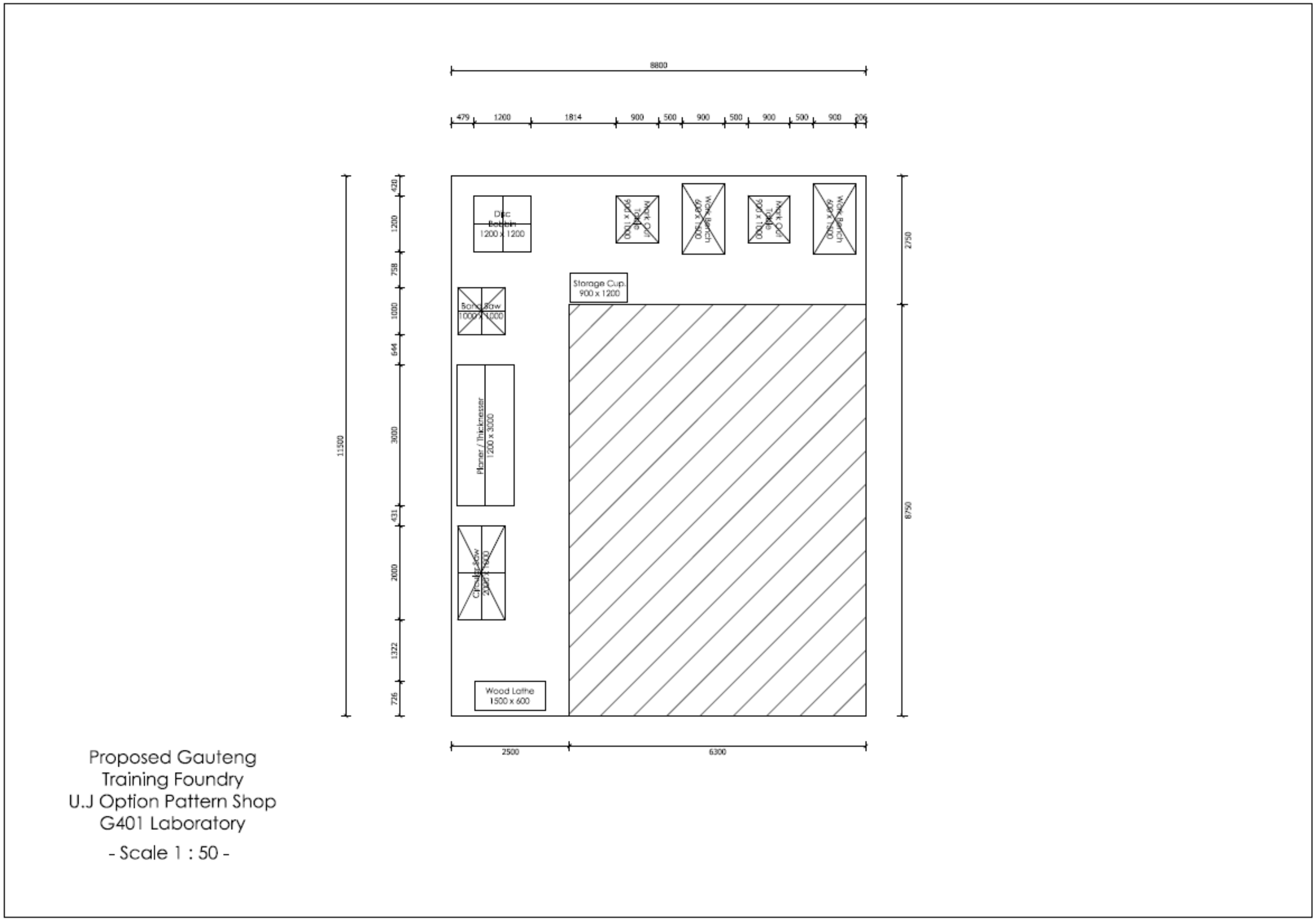


Figure 4.6: Concept layout for proposed pattern shop at UJ – John Orr Building, Room G401.

The facility essentially comprises a new induction melting unit for ferrous materials (cast iron and steel) as well as a resistance melting unit for aluminium (which already exists). The main moulding facility comprises a new no-bake system, utilizing a sand mixer for the preparation of the chemically bonded sand. Provision has also been made for a green sand moulding facility, using the existing green sand muller and moulding table.

Core making facilities comprise a core sand mixer and a core blower. The cores are assembled into the no-bake or green sand moulds on the moulding conveyor or the moulding table, respectively. Casting is done on the casting floor by means of transfer ladles.

Good lighting is important as well as sufficient extraction facilities for fumes and dust. A dedicated fume scrubber will be required for the core blowing unit for the core binder fumes.

Option 2: Location of the centre at EEC

Although EEC does have a number of workshop facilities that could potentially be rearranged to free space for the proposed foundry training centre, a better and more desirable solution will be to construct a new building to the centre. This approach was also followed in the establishment of the toolmaking training facilities at EEC.

Figure 4.7 shows a concept layout for the Greenfield foundry training centre at EEC, assuming a new building. The layout is based on the experience gained in the establishment of the Western Cape foundry training centre.

The melting and moulding facilities are similar to those outlined for Option 1. The facility will also include a new sand and metallurgical laboratory to facilitate training in sand testing as well as basic materials inspection, including hardness testing and microstructure inspection.

This initial layout is designed to enable convenient process flow and to ensure that material flows and people movements always occur in one direction without the need to “double back”. This is important from an ergonomic and safety perspective.

For both options, the detail layout design would be done during the implementation phase of the project, once the equipment has been selected and the detail dimensions are known. Moreover, if Option 1 is selected, the detail location of the sand plant and the core plant fume scrubbers outside this building will need to be confirmed once the equipment details are known, since the existing facility at UJ is a relatively narrow building with the moulding, core making and melting facility to one side and the sand laboratory and other facilities located in adjacent rooms.

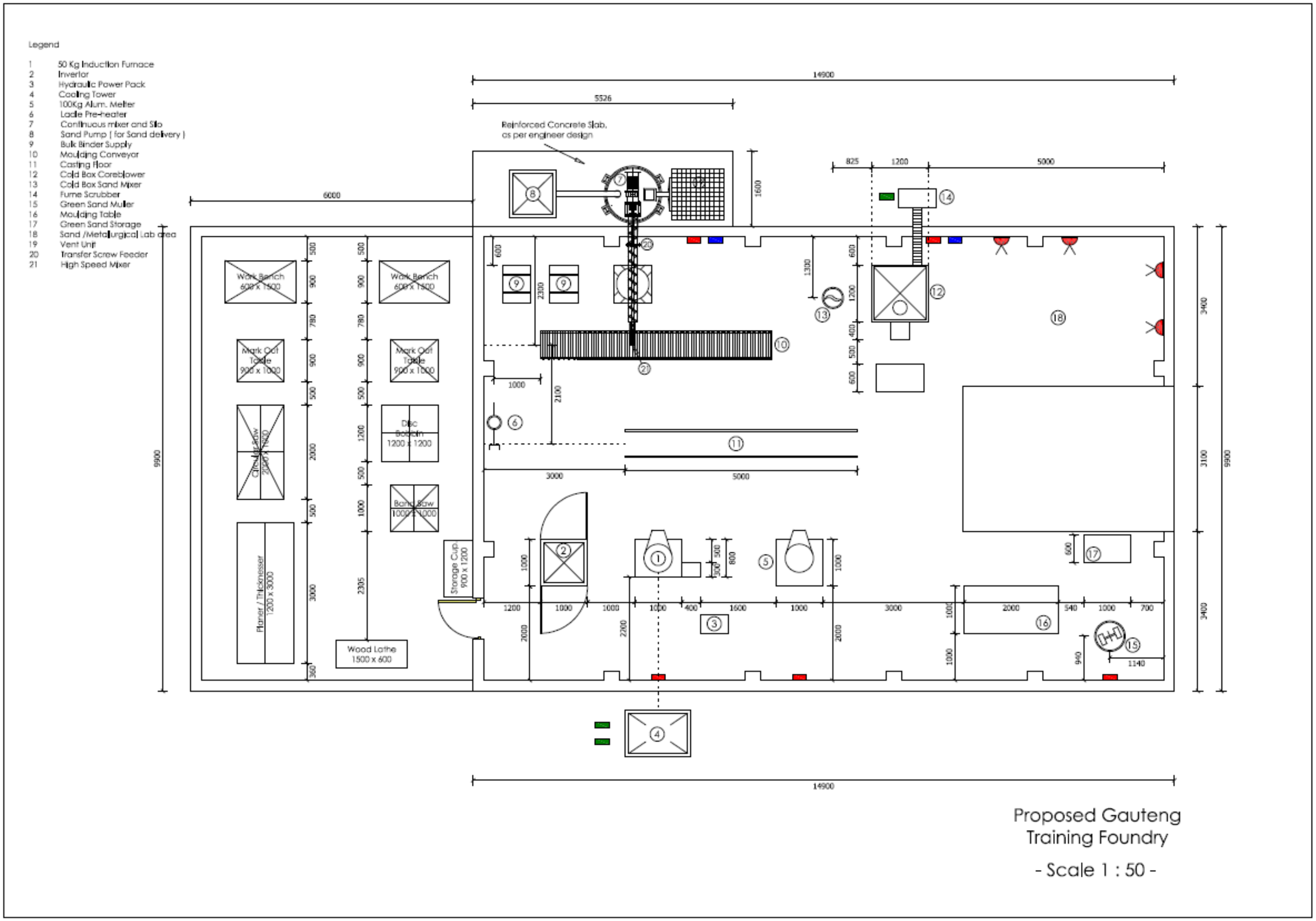


Figure 4.7: Concept layout for proposed foundry training centre at EEC, Kwa-Thema campus.

4.3.4 Supporting infrastructure requirements

The key infrastructure requirements for the proposed training foundry include:

- ***Electrical power:*** Power requirements of melting furnaces depend on the capacity of the furnace (i.e. kg of metal that can be melted) and the melting rate. For example, the proposed MF induction melting furnace of 150kg capacity (for cast iron) requires between 100 and 175kW of electrical power for melting rates between 120 and 320kg/hour. The foundry requires access to 380V 3-phase power with a 190A circuit breaker and a 50mm^2 supply cable. Conventional 22V supply is required for control systems. These facilities are available at both UJ and EEC – the latter is in fact embarking on a project to double the power supply capacity at the Kwa-Thema campus.

- ***Gas installation:*** An LPG gas installation is required for pre-heating of the transfer/casting ladles. Since no pipe gas is available in the vicinity of the training foundry building, it is proposed to use two LPG gas bottles with suitable manifold and regulators. A similar Argon gas facility will be required for rotary degassing of aluminium melts.

- ***Water:*** A water supply is required for various uses, including metallurgical sample grinding and preparation.

- ***Compressed air:*** Compressed air will be required for the mould coating facility, and this will be supplied by a dedicated compressor.

- ***Materials storage:*** The MCTS foundry building at UJ appears to have sufficient space for most materials storage requirements with the possible exception of moulding sand. However, the sand plant will be dimensioned to hold sufficient sand quantities within the sand silo outside the building. The EEC facilities will have ample space in the building to be constructed.

As noted previously, classrooms for theoretical training will be accessed at the existing training facilities of UJ and Ekurhuleni East College. Both institutions have ample training facilities and modern audiovisual training equipment, as well as access to appropriate refreshment and ablution facilities.

4.3.5 Capital investment requirements

The capital investment requirements for the Gauteng Foundry Training Centre are based on relevant research, quotations, and experience gained from the establishment of the Western Cape foundry training centre. The capital investment schedule is summarized in Table 4.1 below, for both implementation options. Please note that the detail amounts exclude VAT, but the total investment amount is inclusive of VAT. The estimated cost for establishing a Greenfield training foundry at EEC (Option 2) excludes the cost of a new building and ancillary infrastructure such as electricity and water. These costs are taken into account in the financial projections in Section 4.6.3.2.

It will be seen that the total capital investment requirement for establishing the centre at UJ is estimated at around R 2.5 million, while the greenfield facility at EEC will require an estimated investment of R4.65 million. Provision should also be made for a contingency of approximately R150,000 to cater for escalations and changes in scope during the detail design phase of the foundry.

Additional investments required include establishment costs to cater for detail facility design, procurement, and project management of the building alterations and equipment installation/commissioning.

Table 4.1: Capital investment requirements for the Gauteng Foundry Training Centre.

	Cost Including Installation (Rand)	
CAPITAL EQUIPMENT - GAUTENG TRAINING FOUNDRY	**Option 1 UJ**	**Option 2 EEC**
Total Capital Investment Requirement (incl. VAT)	**R 2,434,470**	**R 4,637,520**
VAT at 14%	**R 298,970**	**R 569,520**
Totals (excl. VAT)	**R 2,135,500**	**R 4,068,000**
MELTING PLANT	**R 720,000**	**R 870,000**
1. 50kg Induction furnace installation comprising: Power pack Transformer Hydraulically tilted furnace body Hydraulic power pack Cooling tower Interconnecting pipework Water cooled cables Refractory lining	R 550,000	R 550,000
2. 2 x 20kg Iron and 2 x 10kg Aluminium casting ladles including lining material, ladle supports and hand shanks	R 70,000	R 70,000
3. Gas heated ladle drying facility including support stand, gas supply, burner and hood	R 35,000	R 35,000
4. 100kg Aluminium radiant heated furnace, bale out style including crucible and casting spoons		R 150,000
5. Portable immersion thermocouple temperature measuring device	R 35,000	R 35,000
6. Raw material storage bins for scrap, returns, ferro alloys and innoculants	R 30,000	R 30,000

Table 4.1 (cont.):

CHEMICALLY BONDED MOULDING PLANT	**R 860,000**	**R 860,000**
7. Chemically bonded sand moulding facility comprising: Continuous sand mixer 3 tph capacity with PLC controlled binder and catalyst injection with pumps situated in a remote cabinet for ease of access. Automatic calibration system for binders, catalysts and sand, rapid cleaning system, level probes for inlet hopper, binder and catalyst support structure including interconnecting piping 5 Ton capacity dry silica sand silo complete with reverse jet dust extraction, access ladder and inspection lid, level probes, isolation valves at sand outlet, all supporting structure and foundation bolts Pneumatic sand pump system to facilitate the loading of the 5 ton sand silo including a 1 ton receiving hopper for bulk bagged sand delivery complete with weatherproof cover, all electrical, pneumatic controls and interconnecting piping.	R 700,000	R 700,000
8. Vibratory compaction table 600mm x 600mm for compaction of chemically bonded moulds complete with amplitude variation, airbag mould lifting and all controls and interconnecting piping.	R 105,000	R 105,000
9. 2 x 10m lengths heavy duty rollertrack 600mm wide x 600mm high for moulding and curing stations	R 50,000	R 50,000
10. Fabricated assembly for retaining dry silica sand on the casting floor	R 5,000	R 5,000
CORE MAKING PLANT	**R 85,000.00**	**R 545,000.00**
11. 50kg Capacity cold box batch sand mixer		R 80,000
12. 5 litre Cold box coremaking and curing machine complete with side clamps for horizontal and vertical core production, blow head, gassing plate, PLC control. Machine to be fully enclosed in a sheet metal cabinet with allowance for fume extraction. Tetra ethyl amine gas generator for curing and purging of cold box cores		R 380,000
13. Fume scrubber complete with interconnecting ducting and controls for use with the coremaking machine	R 85,000	R 85,000
GREEN SAND MOULDING PLANT	**R 80,000.00**	**R 367,500.00**
14. 50kg Capacity green sand muller complete with muller wheel, scraper, discharge door and safety cover		R 185,000
15. 5 Sets of matching moulding boxes 450mm x 300mm x 150/150		R 50,000
16. Patterns and moulders tools	R 45,000	R 45,000
17. Return and new green sand storage bins		R 15,000
18. Racking shelves for patterns and core box storage		R 18,500
19. Racking shelves for core storage		R 10,000
20. Personal protection clothing and signage	R 35,000	R 35,000
21. Secure lock up cupboard, wheelbarrows and sand waste bin		R 9,000
SAND TESTING LABORATORY	**R 0.00**	**R 650,000.00**
22. Sand testing equipment comprising the following:		R 650,000
Green sand rammer and accessories		
Electronic universal sand strength machine and accessories		
Digital absolute permmeter		
Laboratory sifter complete with sieves and microsplitter		
Methylene blue clay tester		
Test piece blower complete with cold box gassing and purging device		
Green sand lab muller		
Core sand mixer		
Digital balance		
Rapid sand washer		
Muffle furnace		
Drying oven		
Green sand moisture analyser		
Electronic mould hardness tester		
MATERIALS LABORATORY	**R 0.00**	**R 385,000.00**
23. Metallurgical and materials testing equiment including the following:		
Cut-off machine		R 60,000
Sample preparation (grinding and etching)		R 50,000
Sample mounting press (manual)		R 25,000
Optical microscope		R 120,000
Laboratory consumables (initial stock)		R 80,000
Rockwell hardness tester		R 50,000

Table 4.1 (cont.):

PATTERN SHOP	R 240,500.00	R 240,500.00
24. Basic pattern making equipment including the following:		
Small band saw	R 25,000	R 25,000
Small circular saw	R 15,000	R 15,000
Disc/Bobbin sander	R 100,000	R 100,000
Small wood lathe	R 50,000	R 50,000
Planer/Thicknesser	R 30,000	R 30,000
2x work benches with carpenters vice	R 6,000	R 6,000
2x mark-out tables	R 2,000	R 2,000
Power tools	R 6,000	R 6,000
Hand tools	R 4,000	R 4,000
Storage cupboard (lockable)	R 2,500	R 2,500
COMPRESSOR	**R 150,000.00**	**R 150,000.00**
25. 150 CFM fixed base compressor including basic pipe work	R 150,000	R 150,000

4.4 Key Partners and Stakeholders

The key partners / stakeholders and their potential roles are listed below:

- ***University of Johannesburg*** – Option 1: potential host of training centre through the MCTS structure, provision of skills training programmes and specialist courses, higher level training (i.e. continuum beyond SAIF diploma level), provision of serviced infrastructure and administration capacity. In the case of Option 2 being selected, it is envisaged that UJ would still collaborate with SAIF, EEC, and the foundry industry in the provision of specialist technical courses and seminars as well as technical support to the industry.
- ***Ekurhuleni East College for FET*** – Option 1; collaboration with UJ to deliver foundry learnerships: registration of students, provision of foundation training courses, issuing of qualifications. Option 2: host for the foundry training centre and the provision of foundry training, including administration, sourcing of funding, and issuing of qualifications.
- ***SAIF*** – participation in governance of the training centre, liaison with industry and marketing, provision of training materials, funding support subsidizing student training through the SAIF / NFTN training programme.
- ***Gauteng Provincial Government*** – funding support for the initial establishment of the training centre;
- ***NFTN*** – funding support for the establishment of the training centre, integration of the centre into the broader skills training framework for the foundry industry, promotion of the centre and expansion of its activities to include short courses and specialist presentations;
- ***DST/TIA*** – potential funding source for the initial establishment of the centre.
- ***Department of Higher Education & Training/ National Artisan Moderation Body (NAMB)*** – conversion of current foundry learnerships into NCV programmes and/or inclusion of melter/moulder/patternmaker disciplines in approved list of artisan trade occupations that is currently being developed by NAMB.

- ***Merseta*** – funding source for leanerships.

As noted previously, most of these key stakeholders have already indicated their strong support for the proposed centre.

4.5 Option 1: Joint Venture between UJ and EEC

4.5.1 Governance structure and operational model

As outlined earlier, Option 1 proposes that the Gauteng Foundry Training Centre be hosted by the University of Johannesburg, through the Metal Casting Technology Station within the Faculty of Engineering and the Built Environment (FEBE). The proposed governance structure and operational model is illustrated schematically in Figure 4.8.

The training centre will be implemented through the MCTS, since that is the entity that will be accredited by Merseta to offer training at NQF levels 2 – 4, as required for the foundry training centre. The management and financial structure of the centre will be ring fenced within the MCTS, and the centre will be managed by a dedicated manager who will report directly to the Dean of FEBE. This is required to avoid any doubt and potential conflict between the mandates and business orientation of the MCTS and the foundry training centre.

Furthermore, it is proposed to establish an Advisory Committee that will offer guidance to the training centre management on strategic and operational issues, to ensure adequate and optimal delivery of training to the foundry industry. The committee should comprise representatives from the key stakeholdes in the training centre, i.e.:

- SAIF (industry)
- NFTN (industry, potential funder)
- UJ – FEBE and MCTS (host institution and implementing agency)
- Ekurhuleni East College for FET (training partner).

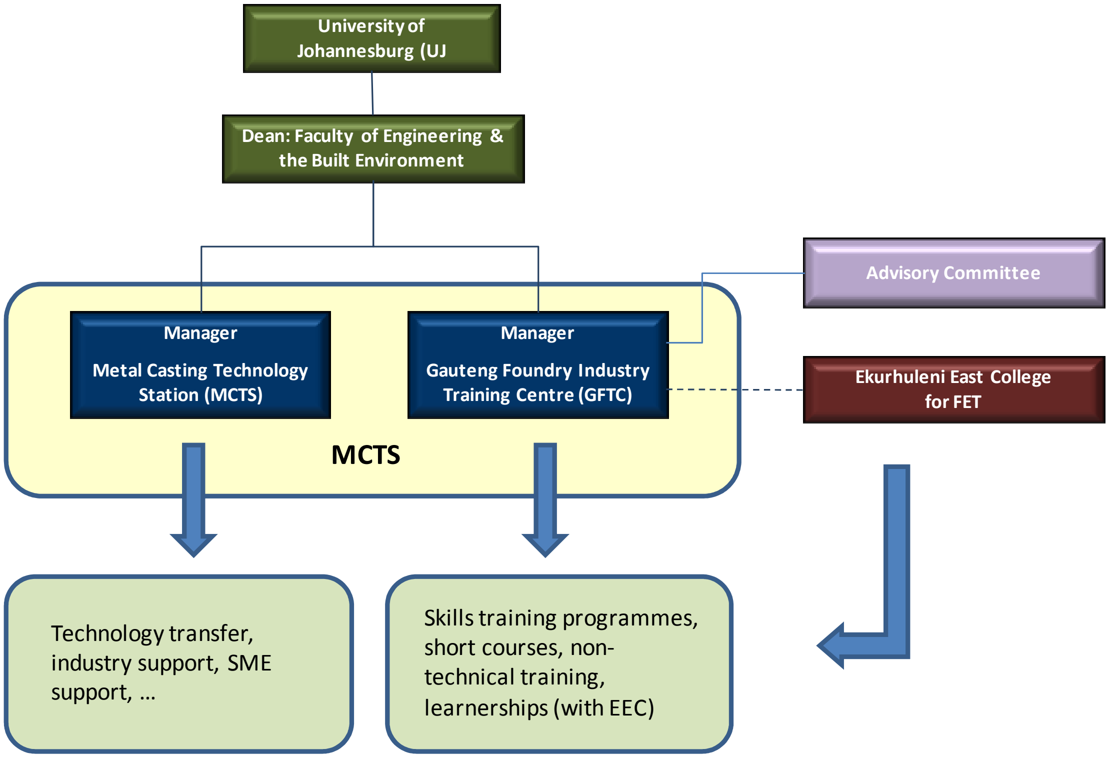


Figure 4.8: Governance structure and operational model – Option 1 [LHA, 2011].

As noted earlier, the training centre will offer skills training for upskilling of existing foundry employees, Recognition of Prior Learning (RPL) assessment and targeted training, non-technical training and short courses, as well as foundry learnerships for new entrants/school leavers. The latter qualifications will be implemented in collaboration with the Ekurhuleni East College for FET. The respective roles of the organizations in this regard have been defined broadly in Section 4.3.2.

4.5.2 Human resource strategy

The effective operation of the centre will require the appointment of a full time manager, who will also act as the lead Trainer, offering the diploma courses. Other training such as the Saturday morning SAIF modules will be presented by trainers on an ad-hoc, contract basis.

Regarding the availability of trainers – three experience trainers are already involved in the present training programmes in the Western Cape. Further training resources exist in UJ as the host institution as well as in the industry and among independent service providers who could be drawn into the programme. However, it is anticipated that additional trainers would need to be appointed at UJ, particularly for the practical training, since this will require particular practical foundry skills and industrial experience.

The management of the training foundry infrastructure will be handled by the existing MCTS resources responsible for the foundry, sand and metallurgical laboratories. Typical responsibilities would include:

- cleanliness of laboratory;
- manage the use of laboratory consumables, including re-ordering of supplies;
- control access to the laboratory;
- relevant maintenance of laboratory equipment.

It is envisaged that UJ will make available required office facilities and administrative resources to support the training centre manager and trainers.

4.5.3 Financial plan

4.5.3.1 Assumptions

The key assumptions in the development of the financial plan relate to the envisaged contributions from UJ in terms of operational costs, i.e.:

- buildings;
- electricity and water;
- infrastructure maintenance;
- office facilities and administration support;
- training facilities such as classrooms and audiovisual equipment.

However, indications from UJ are that the university typically charges a levy of 25% of turnover in respect of significant non-degree training projects. It is assumed that this would also apply to the present foundry training initiative; however, it is assumed that the levy rate can be negotiated to a reduced level of 20%.

The training centre would need to cover its direct costs in terms of human resources (manager, trainers, service providers) and raw materials, i.e. moulding and core sand, metals and alloys, and consumables such as laboratory materials.

Other assumptions include:

- Income from courses:
  - Learnership/NCV R 40,000 per learner per annum
    (total cost R49k, but R9k to be transferred to EEC for foundation training)
  - SAIF "diploma" course R 23,000 per learner per annum
  - SAIF skills programme R 2,200 per learner per module
- Number of learners per annum is ramped up over a period of three years, learner numbers are based on the market analysis presented in Section 3.3.
- foundry running costs are based on an estimated 16 melts per month at R700/melt (calculated from the required consumables such as gas, lining materials, thermocouple tips, etc.), and for a 10 month operating cycle;
- foundry materials are estimated on the basis of a 15% loss on casting. The remaining material is recycled through the foundry.
- maintenance costs are estimated at ~1% of capital cost;
- the cost of printing course material is estimated at R175 per copy and module.
- staff salaries have been benchmarked against Director level in the public sector for the training centre manager, and against typical trainer salary ranges provided by training colleges.
- learner/trainer ratios of 15 – 20 are used; these have been benchmarked against typical ratios applied in colleges for technical training courses. The ratios tend to be lower (around 15 learners per trainer) for practical training and up to 25 – 30 learners for courses with a high theoretical content.

4.5.3.2 Operational costing and financial projections

The projected financials are summarized in Table 4.2 for a period of four years. It is clear that Year 1 represents the establishment phase, which comprises mainly the recruitment of the training centre manager (6 months) and the establishment of the physical training foundry infrastructure.

Operationalisation of the training centre commences in Year 2 with an initial learner complement of 10 learnerships, 5 SAIF "diploma" candidates, and 50 skills programme learners. The number of learners is ramped up over the next two years to reach break-even point in Year 4. A UJ levy rate of 20% is assumed for the purpose of these projections.

Table 4.2: Financial projections for Option 1 – training centre hosted at UJ.

Budget Item	Budget Amounts (R'000, excl. VAT) Year 1	Year 2	Year 3	Year 4	Total Year 1- 4
Operational Income	**0**	**675,000**	**1,956,960**	**4,653,901**	**7,285,861**
Learnerships / Apprenticeships	**0**	**432,000**	**1,399,680**	**3,930,301**	**5,761,981**
SAIF "diploma" course (1-year)	**0**	**124,200**	**248,400**	**248,400**	**621,000**
Skills Training Programme	**0**	**118,800**	**308,880**	**475,200**	**902,880**
Specialist and Short Courses	**0**	**0**	**0**	**0**	**0**
Expenses	**4,470,000**	**2,294,030**	**2,980,541**	**4,592,406**	**14,336,977**
Operations	**1,265,000**	**2,294,030**	**2,980,541**	**4,592,406**	**11,131,977**
Training Centre Manager	**300,000**	**648,000**	**699,840**	**755,827**	**2,403,667**
Administration Officer	**0**	**194,400**	**209,952**	**226,748**	**631,100**
Specialist Trainer(s) - Learnerships	**0**	**270,000**	**583,200**	**1,259,712**	**2,112,912**
Specialist Trainer(s) - SAIF "Diploma" Courses	**0**	**270,000**	**291,600**	**314,928**	**876,528**
Training Service Providers	**0**	**81,000**	**227,448**	**377,914**	**686,362**
Establishment Costs	**890,000**	**200,000**	**0**	**0**	**1,090,000**
- Establishment costs (detail design, project management, construction and commissioning)	440,000	0	0	0	440,000
- Industry workshop, contractual agreements, structures, staff recruitment	350,000	0	0	0	350,000
- Establish administrative and managerial structures and procedures	100,000	200,000	0	0	300,000
Direct Operational Running Costs	**75,000**	**248,292**	**471,744**	**891,876**	**1,686,912**
- Foundry running costs	0	81,648	163,296	317,447	562,391
- Materials and consumables	50,000	59,940	119,880	233,047	462,867
- Foundry maintenance	0	12,960	25,920	50,388	89,268
- Training materials	0	66,744	133,488	259,501	459,733
- Travel (local)	25,000	27,000	29,160	31,493	112,653
Indirect Costs (UJ contribution)	**0**	**382,338**	**496,757**	**765,401**	**1,644,496**
- UJ administrative support	0	382,338	496,757	765,401	1,644,496
Capital Investments	**3,205,000**	**0**	**0**	**0**	**3,205,000**
- Capital Investments (foundry infrastructure)	2,500,000	0	0	0	2,500,000
- Building alterations, equipment installation, etc.	500,000				
- Computer and IT equipment	30,000	0	0	0	30,000
- Furniture	25,000				25,000
- Contingency	150,000				
Surplus / (Shortfall)	**-4,470,000**	**-1,619,030**	**-1,023,581**	**61,495**	**-7,051,116**

	Unit income	Number of learners		
Income	Year 1	Year 2	Year 3	Year 4
Learnerships	40,000	10	30	78
SAIF "diploma"	23,000	5	10	10
Skills training (per module and student)	2,200	50	130	200
Specialist and short courses				

It will be seen that under the given set of assumptions the training centre will require an investment of some R7.1 million over a period of 3 years. Also, note that a total of 78 learnerships per annum will be required to reach breakeven point. While this appears to be higher than the annual market demand as estimated in Section 3.3, it should be realized that the total number of learners in Year 4 will also include the learners from Years 2 and 3 (since a learnership requires 3 years to complete). With the projected student numbers above and not taking into account any dropouts, the total of 78 learners only represents a new intake of 48 learners in Year 4, which is well within the projected market demand range.

4.5.3.3 Funding framework

The required seed funding and proposed funding sources are summarized in Table 4.3.

Table 4.3: Funding plan for Option 1 – training centre hosted at UJ.

	Budget Amounts (R'000, excl. VAT)				
Budget Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total Year 1- 4**
Surplus / (Shortfall)	**-4,470,000**	**-1,619,030**	**-1,023,581**	**61,495**	**-7,051,116**
Seed Funding	**4,470,000**	**1,619,030**	**1,023,581**	**0**	**7,112,611**
Operations	**1,415,000**	**1,619,030**	**1,023,581**	**0**	**4,057,611**
Gauteng Provincial Government	1,415,000	1,219,030	623,581	0	**3,257,611**
NFTN	0	400,000	400,000	0	**800,000**
Capital Investments	**3,055,000**	**0**	**0**	**0**	**3,055,000**
Gauteng Provincial Government	2,055,000	0	0	0	**2,055,000**
NFTN	1,000,000	0	0	0	**1,000,000**

Summary	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total Year 1- 4**
Total Gauteng Provincial Govt.	**3,470,000**	**1,219,030**	**623,581**	**0**	**5,312,611**
Capital Investment	2,055,000	0	0	0	**2,055,000**
Seed Funding - Operations	1,415,000	1,219,030	623,581	0	**3,257,611**
Totan NFTN	**1,000,000**	**400,000**	**400,000**	**0**	**1,800,000**
Capital Investment	1,000,000	0	0	0	**1,000,000**
Seed Funding - Operations	0	400,000	400,000	0	**800,000**

It is proposed that the initial seed funding be contributed by the Gauteng Provincial Government as well as the NFTN. As indicated in Table 4.3, a total amount of **R 5,312k** would be required from GPG and a further **R 1,800k** from the NFTN. This seed funding will cover the required capital investments as well as the anticipated working capital for the operationalisation and ramp-up phase.

Cash Flow

It is envisaged that core and programme funding should be released on a 6-monthly basis, in advance. Financial reporting will take the form of quarterly expenditure reports and an annual financial and narrative report.

4.6 Option 2: Location of the centre at EEC

4.6.1 Governance structure and operational model

As outlined earlier, Option 2 proposes that the Gauteng Foundry Training Centre be located at the Ekurhuleni East College for FET. It would in this case fall under the management and administrative structure of the college. In order to ensure adequate management attention, it is proposed to locate the centre at the Kwa-Thema campus of EEC, which is where the head office of the college is also located.

Given the fact that the NFTN and the SAIF are key stakeholders and funding sources, it is also proposed to establish and advisory committee with representation from EEC, SAIF and NFTN. This committee should guide and oversee the operation of the training centre and ensure that the needs of industry are met.

4.6.2 Human resource strategy

The effective operation of the centre will require the appointment of a full time manager, who will also act as the lead Trainer, offering the diploma courses. Other training such as the Saturday morning SAIF modules will be presented by training service providers on an ad-hoc, contract basis.

As would be the case for Option 1, training service providers will be utilized to present the skills training programme. In this regard, several experienced trainers are already involved in the present training programmes in the Western Cape as well as Gauteng. Further training resources exist in the industry and among independent service providers who could be drawn into the programme. Additional trainers would need to be appointed, particularly for the practical training, since this will require particular practical foundry skills and industrial experience.

The management of the training foundry infrastructure as well as the administration of the learners and related documentation (e.g. Portfolios of Evidence) will be handled by the existing EEC administration structure. It is anticipated that an additional administrative assistance will need to be employed from Year 3 onwards as the number of learners grows.

4.6.3 Financial plan

4.6.3.1 Assumptions

The EEC has indicated that the college would contribute significant resources to the proposed training centre. These include electricity and water, infrastructure maintenance, office facilities and administration support, as well as training facilities such as classrooms and audiovisual equipment. The college in return will charge rent on the utilized buildings and classrooms at a commencing rate of R30/m^2.

The training centre would need to cover its direct costs in terms of human resources (manager, trainers, service providers) and raw materials, i.e. moulding and core sand, metals and alloys, and consumables such as laboratory materials.

Other assumptions include:

- Income from courses:
  - Learnership/NCV R 49,000 per learner per annum
  - SAIF "diploma" course R 23,000 per learner per annum
  - SAIF skills programme R 2,200 per learner per module
- Number of learners per annum is ramped up over a period of three years, learner numbers are based on the market analysis presented in Section 3.3.
- foundry running costs are based on an estimated 16 melts per month at R700/melt (calculated from the required consumables such as gas, lining materials, thermocouple tips, etc.), and for a 10 month operating cycle;
- foundry materials are estimated on the basis of a 15% loss on casting. The remaining material is recycled through the foundry.
- maintenance costs are estimated at ~1% of capital cost;
- the cost of printing course material is estimated at R175 per copy and module.
- staff salaries have been benchmarked against Director level in the public sector for the training centre manager, and against typical trainer salary ranges provided by training colleges.
- learner/trainer ratios of 15 – 20 are used; these have been benchmarked against typical ratios applied in colleges for technical training courses. The ratios tend to be lower (around 15 learners per trainer) for practical training and up to 25 – 30 learners for courses with a high theoretical content.

4.6.3.2 Operational costing and financial projections

Table 4.4: Financial projections for Option 2 – training centre hosted at EEC.

	Budget Amounts (R'000, excl. VAT)				
Budget Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total Year 1- 4**
Operational Income	**0**	**772,200**	**2,197,368**	**4,427,153**	**7,396,721**
Learnerships / Apprenticeships	**0**	**529,200**	**1,714,608**	**3,703,553**	**5,947,361**
SAIF "diploma" course (1-year)	**0**	**124,200**	**173,880**	**248,400**	**546,480**
Skills Training Programme	**0**	**118,800**	**308,880**	**475,200**	**902,880**
Specialist and Short Courses	**0**	**0**	**0**	**0**	**0**
Expenses	**7,320,000**	**1,904,092**	**2,791,948**	**4,385,367**	**16,401,406**
Operations	**1,265,000**	**1,904,092**	**2,791,948**	**4,385,367**	**10,346,406**
Training Centre Manager	**300,000**	**648,000**	**699,840**	**755,827**	**2,403,667**
Administration Officer	**0**	**0**	**174,960**	**188,957**	**363,917**
Specialist Trainer(s) - Learnerships	**0**	**270,000**	**583,200**	**1,259,712**	**2,112,912**
Specialist Trainer(s) - SAIF "Diploma" Courses	**0**	**270,000**	**291,600**	**314,928**	**876,528**
Training Service Providers	**0**	**81,000**	**227,448**	**377,914**	**686,362**
Foundation Training Cost (R5k/learner p.a.)	**0**	**54,000**	**174,960**	**377,914**	**606,874**
Establishment Costs	**890,000**	**200,000**	**0**	**0**	**1,090,000**
- Establishment costs (detail design, project management, construction and commissioning)	440,000	0	0	0	440,000
- Industry workshop, contractual agreements, structures, staff recruitment	350,000	0	0	0	350,000
- Establish administrative and managerial structures and procedures	100,000	200,000	0	0	300,000
Direct Operational Running Costs	**75,000**	**248,292**	**471,744**	**891,876**	**1,686,912**
- Foundry running costs	0	81,648	163,296	317,447	562,391
- Materials and consumables	50,000	59,940	119,880	233,047	462,867
- Foundry maintenance	0	12,960	25,920	50,388	89,268
- Training materials	0	66,744	133,488	259,501	459,733
- Travel (local)	25,000	27,000	29,160	31,493	112,653
Indirect Costs (EEC building rentals)	**0**	**132,800**	**168,196**	**218,239**	**519,235**
- foundry building rental (330m2 @ R30/m2)	0	118,800	128,304	138,568	385,672
- classroom rental (70m2 per 30 students @ R30/m2)	0	14,000	39,892	79,671	
Capital Investments	**6,055,000**	**0**	**0**	**0**	**6,055,000**
- Capital Investments (foundry infrastructure)	4,650,000	0	0	0	4,650,000
- New building, equipment installation, etc.	1,200,000				
- Computer and IT equipment	30,000	0	0	0	30,000
- Furniture	25,000				25,000
- Contingency	150,000				
Surplus / (Shortfall)	**-7,320,000**	**-1,131,892**	**-594,580**	**41,787**	**-9,004,685**

	Unit income	Number of learners		
Income	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Learnerships	49,000	10	30	60
SAIF "diploma"	23,000	5	7	10
Skills training (per module and student)	2,200	50	130	200

The projected financials are summarized in Table 4.4 for a period of four years. As for Option 1, Year 1 represents the establishment phase, which comprises mainly the recruitment of the training centre manager (6 months) and the establishment of the physical training foundry infrastructure.

Operationalisation of the training centre commences in Year 2 with an initial learner complement of 10 learnerships, 5 SAIF "diploma" candidates, and 50 skills programme learners. The number of learners is ramped up over the next two years to reach break-even point in Year 4.

It will be seen that under the given set of assumptions the training centre will require an investment of some **R9.1 million** over a period of 3 years, which is **R2 million higher** than for Option 1. However, note that a total of only 60 learnerships per annum will be required to reach breakeven point, which is 18 fewer learners or 23% less than for Option 1. This indicates that Option 1 is **more robust from an operational perspective**, which would improve the sustainability of the initiative.

4.6.3.3 Funding framework

The required seed funding and proposed funding sources are summarized in Table 4.5.

It is proposed that the initial seed funding be contributed by the Gauteng Provincial Government as well as the NFTN. As indicated in Table 4.3, a total amount of **R 7,250k** would be required from GPG and a further **R 1,800k** from the NFTN. This seed funding will cover the required capital investments as well as the anticipated working capital for the operationalisation and ramp-up phase.

Cash Flow

It is envisaged that core and programme funding should be released on a 6-monthly basis, in advance. Financial reporting will take the form of quarterly expenditure reports and an annual financial and narrative report.

Table 4.5: Funding plan for Option 2 – training centre hosted at EEC.

Budget Item	Budget Amounts (R'000, excl. VAT) Year 1	Year 2	Year 3	Year 4	Total Year 1- 4
Surplus / (Shortfall)	**-7,320,000**	**-1,131,892**	**-594,580**	**41,787**	**-9,004,685**
Seed Funding	**7,320,000**	**1,131,892**	**594,580**	**0**	**9,046,472**
Operations	**4,265,000**	**1,131,892**	**594,580**	**0**	**5,991,472**
Gauteng Provincial Government	4,265,000	731,892	194,580	0	**5,191,472**
NFTN	0	400,000	400,000	0	**800,000**
Capital Investments	**3,055,000**	**0**	**0**	**0**	**3,055,000**
Gauteng Provincial Government	2,055,000	0	0	0	**2,055,000**
NFTN	1,000,000	0	0	0	**1,000,000**

Summary	Year 1	Year 2	Year 3	Year 4	Total Year 1- 4
Total Gauteng Provincial Govt.	**6,320,000**	**731,892**	**194,580**	**0**	**7,246,472**
Capital Investment	2,055,000	0	0	0	**2,055,000**
Seed Funding - Operations	4,265,000	731,892	194,580	0	**5,191,472**
Totan NFTN	**1,000,000**	**400,000**	**400,000**	**0**	**1,800,000**
Capital Investment	1,000,000	0	0	0	**1,000,000**
Seed Funding - Operations	0	400,000	400,000	0	**800,000**

4.6 Sustainability and Pricing

To examine the sustainability and affordability of the training centre, it is useful to benchmark the cost per student and per module for the different training programmes, as summarized below.

Budget Item	Cost (Rand) Diploma Course	Part-Time Modules	Learnership/NCV
Cost per student	23,000	2,200	49,000
Cost per student and module	2,875	2,200	0
Cost per day	359	367	408

The part-time training courses appear to be similar in cost to the full-time diploma course, despite the fact that less time is required per module. This is due to the less efficient manner in which these part-time courses can be delivered. The part-time module cost is almost three times higher than the current price of R750 per student and module. This is due to the fact that a practical training component has been added to the modules, and no subsidies have been taken into account.

However, in both cases the cost per day compares very well with that of similar industry courses. For example, the SA Federation of Civil Engineering Contractors in 2009 offered a comprehensive range of industrial training courses which typically ranged from R450 – 550 per day. Similarly, FET colleges typically charge of the order of R350 – 450 per day for NQF level 2 – 4 training, depending on the study direction.

In order to assess the affordability of such courses to the local industry, it is instructive to consider the typical current training costs paid by the foundries that responded to the industry survey. As can be seen in the table below, almost half of these foundries are currently paying more than R2,000 per course.

Range	Training Demand (Students p.a.)	Proportion of foundry employees (%)
<R1,000	4	27%
R1,000 - R2,000	4	27%
R2,000 - R3,000	3	20%
>R3,000	4	27%
Totals	**15**	**100%**

Similarly, the foundries interviewed typically indicated that costs of around R1,500 – 2,000 for a 4 – 5 day course would be acceptable. This translates into costs of around R 300 – 500 per day, which is in the range of the cost estimates above and suggests that it should be possible to cover the operating costs of the training centre from training revenues on a sustainable basis. However, since the proposed costs are substantially higher than the current R750 paid by the industry per module, the centre will need to be marketed effectively to the industry and particularly the smaller foundries. For sustainability, it will be necessary to make use of the Merseta funding available for training.

The estimated cost of a foundry **learnership** or **NCV programme** is some R49,000, which includes theoretical and practical training components. This compares with the typical cost of an engineering learnership at an FET college of around R39,000 – 52,000 per annum. A summary of typical NCV course costs obtained from a college is provided in the table below for comparative purposes. This table also shows the contribution that is required from the learner or the learner's employer, to augment the funding received by the college from the Department of Higher Education and Training.

Programme	2010 Total Cost	2010 Learner Contribution	2011 Total Cost	2011 Learner Contribution
Civil Engineering Construction	35,200	7,050	39,200	7,900
Electrical Infrastructure Construction	34,700	7,000	38,600	7,700
Engineering & Related Design	47,000	9,400	51,700	10,400
Process Plant Operations	0	0	39,500	7,900
Mechatronics	47,700	9,600	52,400	10,500
Hospitality	41,750	8,400	47,000	9,400

Note that where the learner is unable to afford this amount, a grant can be obtained by the learner to cover this amount, through the National Students Financial Aid Scheme. EEC is able to routinely assist with such applications.

Additional revenue could be realized from the use of the training centre facilities for short courses, technical talks, industry meetings, and for the development and prototyping of casting processes and products. This would enhance the sustainability of the centre.

In summary, it is concluded that the cost structure of the centre is competitive with similar training initiatives, and that there is good potential that the centre will be able to cover its operating expenses from training revenues in a sustainable manner. Nevertheless, some subsidies may be required for small foundries, which could be sourced from the existing SAIF/NFTN training programme which makes provision for such subsidies.

It must be emphasized that public sector funding will need to be accessed for the foundry learnerships to ensure sustainability. This will most likely require the conversion of the learnerships to NCV training programmes, as outlined earlier. Funding opportunities include student bursaries from the Department of Higher Education and Training, which can be accessed through the collaborating FET college, as well as funding from Merseta for the Accelerated Artisan Training Programme (AATP). This makes provision for up to R120,000 per student to achieve an accelerated trade (artisan) qualification within an 80 week period.

4.7 Impact and Performance Management

The training centre is expected to impact positively on the foundry industry in the greater Gauteng region through the facilitation of practical training (required for Merseta-accredited qualifications). Other positive contributions could include the centre acting as a hub for complementary training (short courses, technical presentations, industry meetings), thereby facilitating interaction between industry players and information exchange. Moreover, the centre could have a substantial role in the development and transfer of appropriate technology, in collaboration with industry and universities.

In terms of industry development, the mentoring and upskilling of emerging foundries (SMEs) will form an important part of the Centre activities. This is expected to have a positive impact on the potential growth of these foundries.

The estimated production volume in Gauteng under full production conditions, rather than the current lower production levels as a result of the economic downturn, is some 29,000 tons of ferrous metal per annum. If the contributions of the training centre result in a combined improvement of only 0.5% in scrap rate and production efficiency, then the positive financial impact on the industry would be about R45 million per annum. In comparison, the initial establishment cost of the centre represents less than 10% of this figure, suggesting a substantial potential payback on the investment.

The following criteria should form part of the performance management for the Centre:

- Number of students trained
- Number of qualifications achieved
- Number of new entrants / school leavers trained and placed in industry
- Financial measurements – within budget and sustainable on the operational level, i.e. cover operational costs;
- Accreditation of the centre, trainers, and training courses – quality benchmark
- Level of additional activities – short courses, presentations and colloquia with international and local experts
- Funding leveraged from other sources to expand activities (e.g. from SAIF, NFTN, Merseta, National Skills Fund, etc.)
- Positive impact on industry in terms of number of companies involved, growth in production and employment.

4.8 Risk Analysis and Critical Success Factors

The following key success factors have been identified:

- Seed funding for capital equipment and initial set-up and operating costs;
- Support from UJ in terms of provision of building and training facilities and contributing overhead costs;
- Establishment of an effective collaboration agreement between UJ and Ekurhuleni East College for FET for the delivery of foundry learnerships;
- Strong leadership will be required within the training centre as well as appropriate skills and industrial experience in foundry technologies and operations. This will need to be sourced and placed in UJ;
- Appropriate pricing for courses and strong marketing;
- Strong industry support (linked to appropriate pricing and marketing);
- Effective administration and management – administrative support from UJ (office and secretarial facilities).

Key risks are related to the above factors, i.e. the success of the centre would be at risk if any of the above key success factors are not achieved.

4.9 Recommendations and Implementation Plan

In the previous sections, two options for implementing the proposed training centre were outlined. Both appear to be feasible both financially and operationally. However, taking into account all factors, it is considered that Option 2 is the most fabourable option, i.e. locating the foundry training centre at EEC.

Although this has the disadvantage of requiring an additional R2 million in initial seed funding, this option is significantly more robust from an operational management, administrative, and financial perspective. The training centre is better aligned with the mandate of EED than with UJ. Moreover, from and operational financial perspective, Option 2 is clearly associated with a significantly lower break-even point, which increases the long term robustness and sustainability of the initiative. It is therefore recommended to pursue implementation of Option 2 as first priority.

The key implementation steps for the training centre in terms of Option 2 are the following:

1. Successful conversion of the current foundry learnerships (melter, moulder, patternmaker) into an NCV programme (or an "N-Programm") to enable financial support from the Department of Higher Education and Training;

2. Negotiate joint development agreement between NFTN as the implementing agency and Ekurhuleni East College as the training centre host;
3. Secure seed funding for establishment of the training foundry;
4. Recruit training centre manager and specialist practical foundry technology trainer;
5. Detail design of facility layout;
6. Source equipment (new and used);
7. Design and construct suitable building and supply infrastructure;
8. Install and commission facility;
9. Launch Training Centre;
10. Draft training schedule and market to industry
11. Finalise training schedule based on inputs from industry. Based on interest and number of students for the full diploma course, engage additional trainers on full-time basis or initial part-time basis (phased approach).

It is recommended to engage an experienced foundry consultant to lead the implementation process. Provision for the associated costs has been made in the capital investment schedule.

The process to secure seed funding and the development of the training offerings and schedules should be driven by the project champions, i.e. SAIF and the NFTN.

Timescales:

- Based on past experience, the typical time required to establish the training centre from approval of seed funding is around 12 months. The longest lead time item is the MF induction melting furnace, and thus this timescale could be reduced if a suitable used MF furnace can be sourced in good condition.
- The development and marketing of the training schedule should commence in parallel to the establishment of the foundry infrastructure. This will provide a good indication of the short-term uptake of the training offerings, and enable a decision to be made as to when to engage the training centre manager/trainer on a full-time basis.

REFERENCES

1. SAIF Foundry Industry Analysis 2003: The Growth Potential in the Foundry Industry and Recommendations on Exploiting Available Opportunities; SAIF, 2003.
2. Castings Directory 2007, published by Castings SA, 2007.
3. Castings Directory 2011, published by Castings SA, 2011.

ANNEXURE A

Survey – Gauteng Foundry Industry Training Centre

1. Your company name?

2. Total number of your foundry staff?

3. How many staff do you currently train per annum?

❍ <5 ❍ 5 - 10 ❍ 11 - 20 ❍ 21 - 40 ❍ > 40

4. What is the typical cost for a training course per person?

❍ < R1 000 ❍ R1 000 – R2 000 ❍ R2 000 – R3 000 ❍ > R3 000

5. What type of training is most needed in your company? (Tick up to 2)

❍ Melting
❍ Moulding/core making
❍ Pattern making
❍ Machine operators
❍ Metallurgy
❍ Other

6. If Other, please specify.

7. **Is multi-skilling important?**

❍ Yes ❍ No

8. How do you currently train foundry staff?

- ❍ In-house
- ❍ SA Institute of Foundrymen courses
- ❍ University of Johannesburg
- ❍ Other

9. If Other, please specify.

10. Do you feel there is a need for a dedicated practical foundry industry training centre in Gauteng?

❍ Yes ❍ No

11. Would you make use of such a centre to train your staff?

❍ Yes ❍ No

12. Where should the centre be located?

- ❍ University of Johannesburg
- ❍ Vaal University of Technology
- ❍ Other
- ❍ Close to or at a large foundry
- ❍ Ekurhuleni

13. If Other, please specify.

14. Approximately how many staff would you send for practical training per annum?

❍ <5 ❍ 5 - 10 ❍ 11 - 20 ❍ 21 - 40 ❍ > 40

15. What is the maximum distance you think is acceptable for staff to travel for training?

❍ < 10 km ❍ 10 – 20 km ❍ 21 – 50 km ❍ 51 – 100 km