

# Payback period for the acquisition of a Three Dimensional Printer in the South African foundry Industry:

Presenter: Elvis Gonya

Institution: University of Johannesburg

Department: Metallurgy



# Presentation outline

- What is Additive Manufacturing (AM)
- Additive manufacturing technologies
- General advantages of AM
- Relevance of AM in South African Foundries
- Current status of AM in South Africa
- Why low adoption of AM in South African Foundries
- Cost of AM
- Capital Budgeting process of AM
- Results, Conclusions and Questions



# What is Additive Manufacturing

Additive manufacturing (AM) processes have been available in South Africa for more than a decade. AM involves producing physical objects (parts) layer by layer from 3D digital data.



# Additive Manufacturing commercial technologies

Currently there are several commercial technologies of additive manufacturing including:

- Three Dimensional Printing (3DP)
- Selective Laser Sintering (SLS)
- Fused Deposition Modelling (FDM)
- Laminated Object Manufacturing (LOM)
- Electron Beam Melting (EBM)
- Stereolithography



# General Advantages of Additive Manufacturing

- Reduction of design lead time,
- Cannot be limited by component complexity (Any shape possible)
- Tailor-made products - Customisation of individual products
- Integration of different activities (reduce the points of assembly)
- Freedom of producing any number of units in a batch,
- Reduction of production costs in certain cases (Inventory cost)



# The Relevance of AM into S.A Foundries

How can South African foundries benefit from additive manufacturing technology?



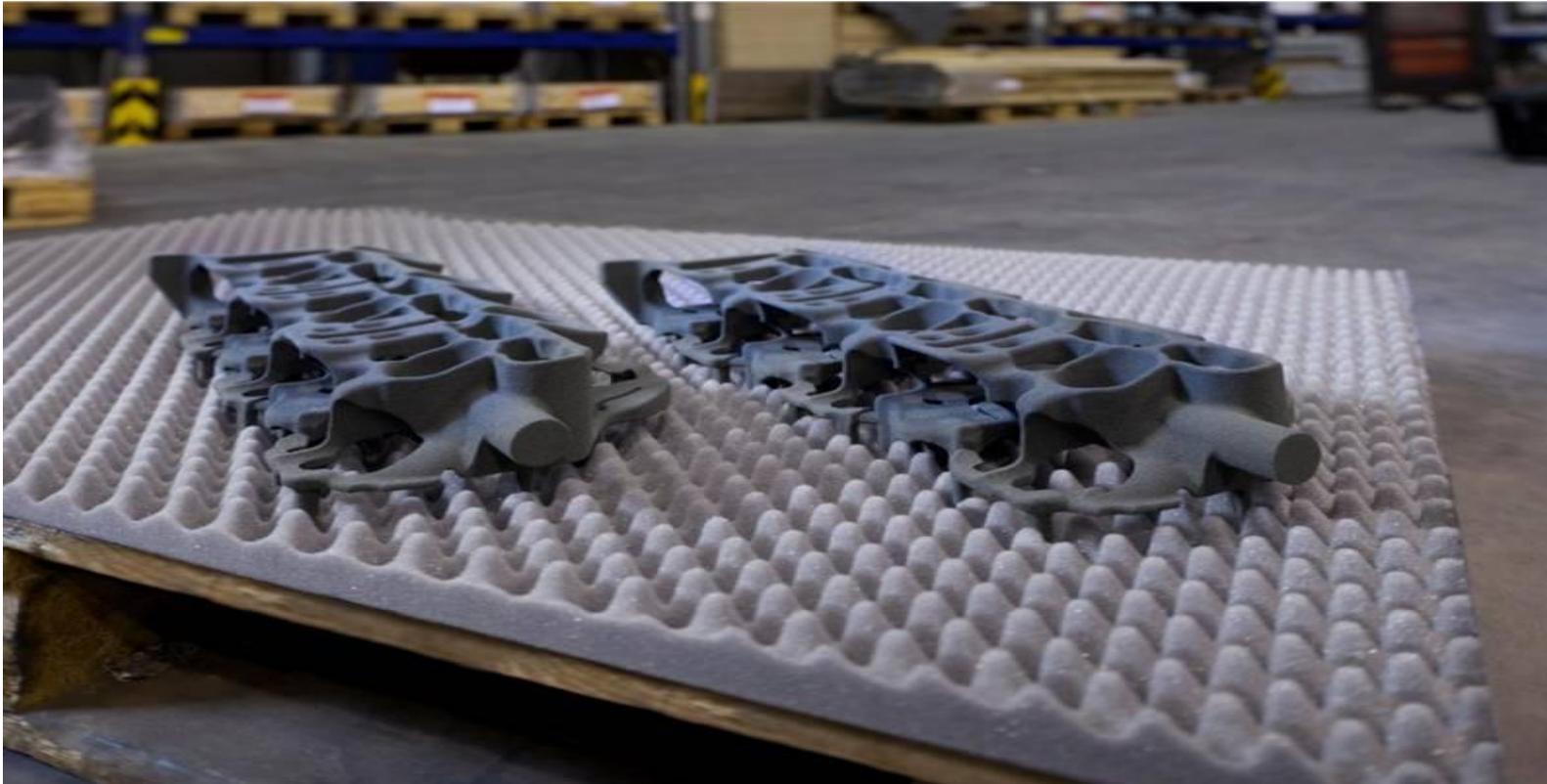
# The Relevance of AM into S.A Foundries

Three dimensional printing (3DP) has been successfully applied to the metal casting field for the direct fabrication of sand moulds and cores.



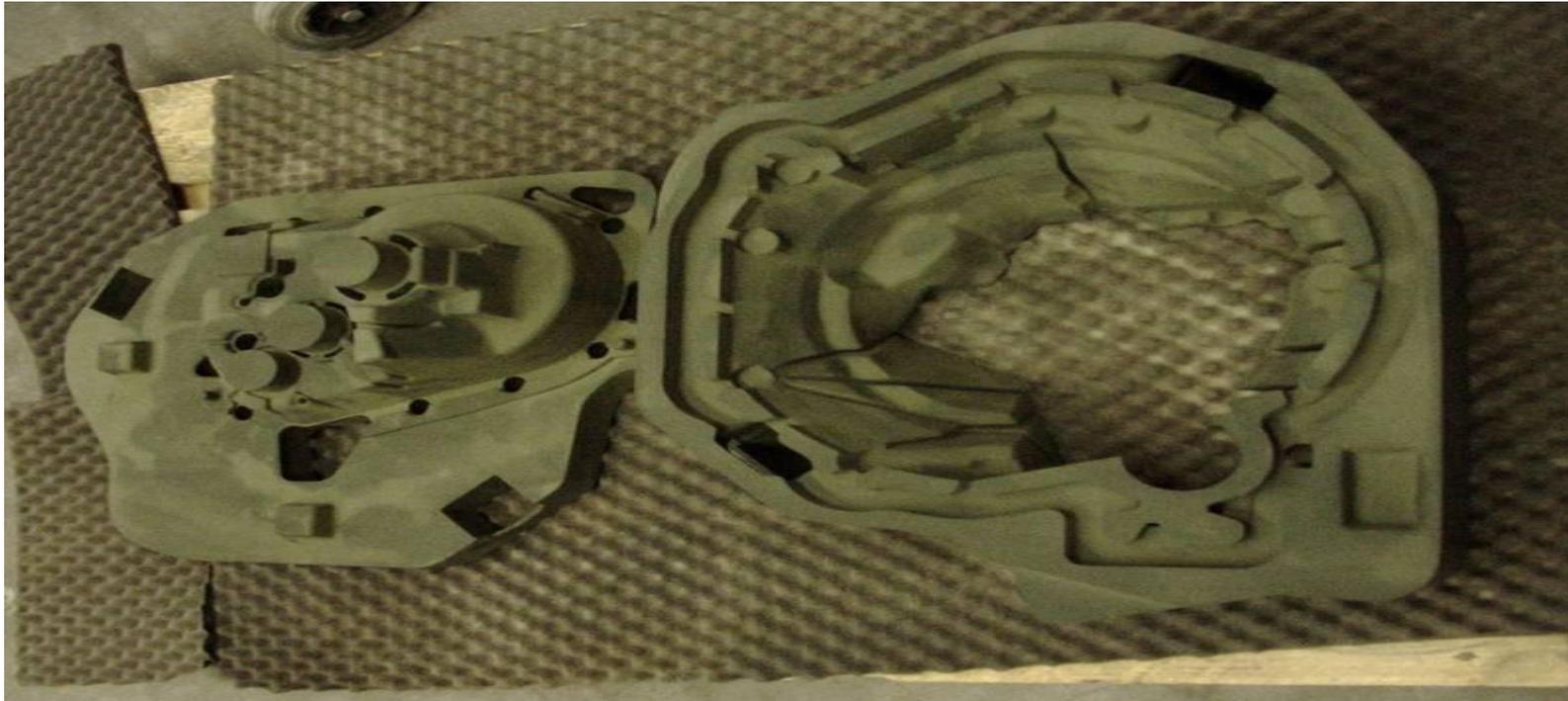
# The Relevance of AM into S.A Foundries

- Ability to produce sand moulds with complex cores (e.g. sand moulds for water jackets).



# The Relevance of AM into S.A Foundries

- In addition to save costs, AM also help reduce longer lead times associated with production of sand moulds (e.g. clutch housing sand moulds)



# Where is this AM technology in S.A

Currently 3DP technologies used to manufacture sand moulds are only available at the academic institutions and innovation centers such as:

- Central University of Technology in Free State (CUT) and
- The Vaal University of Technology (VUT)
- University of Johannesburg
- University of Potchefstroom
- University of Stellenbosch



# Why not currently adapted by S.A Foundries

Despite the benefits that has been cited in literature, AM technologies such as 3DP are still not well implemented by many of S.A Foundries.

The following major reasons have been cited on literature:

- The investment of AM is too costly (main focus)
- Properties of parts produced by AM are not yet well researched
- Availability of materials suitable for AM still lacking locally

However, the purpose of this presentation is too focus on one area which is: “The investment of AM is too costly”



# How costly is AM-equipment?

The VX1000 manufactured by VoxelJet and currently available in one of the research institution in S.A could cost an estimated price of \$1,048,468 and converting that to S.A Rands (\$1 = R13 average) = **R13 630 084**.

This Price includes:

(complete system including VX1000, two print heads, JB Mover, Powder Reclaim Station, Unpacking Station, Wax Infiltration Vat, Convection Oven, Finish Station, Material Extraction Equipment, Consumables, and software)

- Obvious this price may excludes shipping costs, inwards costs, installation costs and other relevant costs that may be incurred to bring the machine to working conditions stipulated by management.



# Equipment costs

Is the equipment of AM technology too costly in such a way that it may become virtually impossible for S.A foundries to invest on?



# Capital budgeting technique

The previous answer can be answered by applying capital budgeting technique, that helps us to evaluate the benefit of the investment such as:

- Pay Back cash discounted method

In this method, we compare the initial investment of AM with the expected cash flows in order to check if its worthwhile to invest or how long will this investment payback.



# The capital budgeting process of AM

The following research methodology will be followed during the course of the study:

Collection of secondary data mainly focusing on the following areas:

- Obtain a full precise costs associated with acquiring 3DP printers
  - Machine costs, shipping costs, inwards costs and other relevant costs
- Quantify full costs parameters associated with running AM machines
  - Data preparation costs - labour, energy, and computational costs
  - Operational costs - labour, energy, and machine running costs
  - Material costs – sand, binding agent, and cleaner costs



# The capital budgeting process of AM

- Estimate the expected revenues from sale of parts produced by AM technology.
- The expected revenues is then compared against variable costs (identified on the previous slide) in order to arrive at generated cash flows.
- Other quantitative factors to be taken into account during the study
  - Cost of capital (rate of return) applicable to S.A foundries
  - Inflation (in order to adjust the discounted rate)
  - Sensitive analysis (total risk analysis) - To evaluate risk of the investment



# Results

- There is still a lack of data around this AM technology, thus a concrete decisions cannot be made at this stage regarding the evaluation of this investment.
- Data are still being collected from the various sources in an effort to generate cash flows that can be used for capital budgeting.
- Currently only the machine costs, cost of capital, inflation can be calculated, however these parameters are insufficient to conduct the capital budgeting process due to lack of cash flows.



# Conclusion

- It is expected that upon conclusion of the study that a clear picture around costs of AM technology will be revealed
- The researcher hopes by the end of the study, S.A foundries will have a bit of understanding on rate of returns that AM may bring to their firms.
- Cost of AM technology has been identified as one of the barrier to adoption of this technology, and do hope that this study will clarify such issue.



Thank you

Questions?

