





# MSME Umbrella Programme Policies and Programmes

### **Volume IX**

#### **Technology Analysis of Tool Rooms by Fraunhofer Institute**

- Analysis and Further Steps: CITD Hyderabad
- Analysis and Further Steps: IGTR Indore
- Analysis and Further Steps: IDTR Jamshedpur
- Analysis and Further Steps: IDEMI Mumbai
- Analysis and Further Steps: CTTC Kolkata
- Analysis and Further Steps: CTR Ludhiana
- Analysis and Further Steps: IGTR Ahmedabad
- Analysis and Further Steps: IGTR Aurangabad
- Analysis and Further Steps: CTTC Bhubaneswar

### Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps CITD Hyderabad







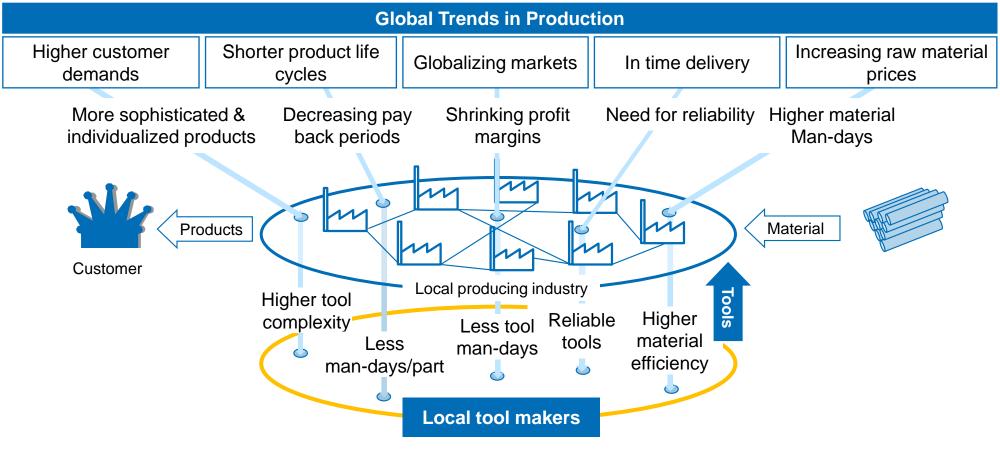
Delhi, 01.-02. November 2012





## Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





### Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

### Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

#### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### Goals of Production

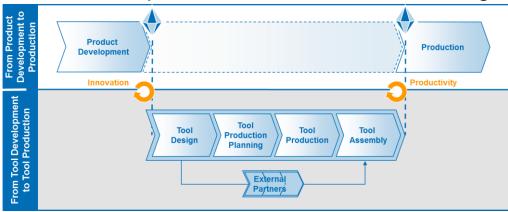
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





### A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



#### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

#### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



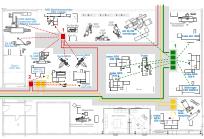


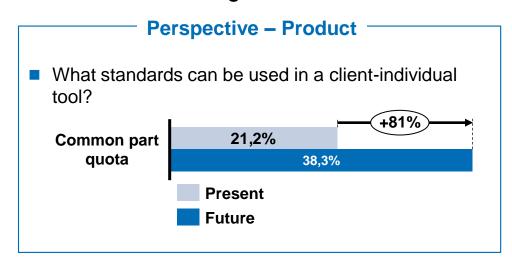
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

#### **Perspective- Order Processing**

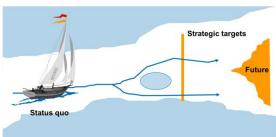
Which standards in order processing enable unique tooling?





#### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

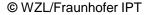


#### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

#### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

#### Day II

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





### The CITD Hyderabad has a strong focus on offering training in design, tooling, and automation



Introduction



»Top-class training institutes in tool technology and design«

Hyderabad (Andhra Pradesh) Market

Now: Strong industries in aerospace,

automotive, and defense

Future: Aerospace is expected to

continue being a key industry

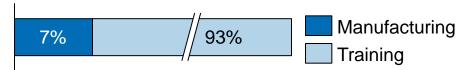
Customer Industries

Aerospace, automotive, defense,

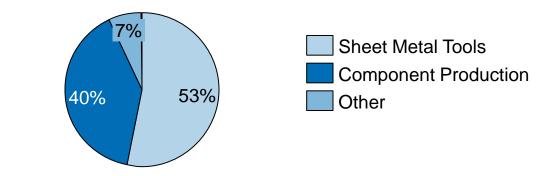
explosives/ incense

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

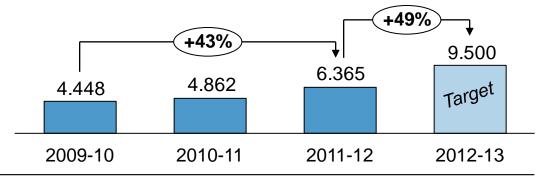




#### Manufacturing



#### Training [Trainees Trained]



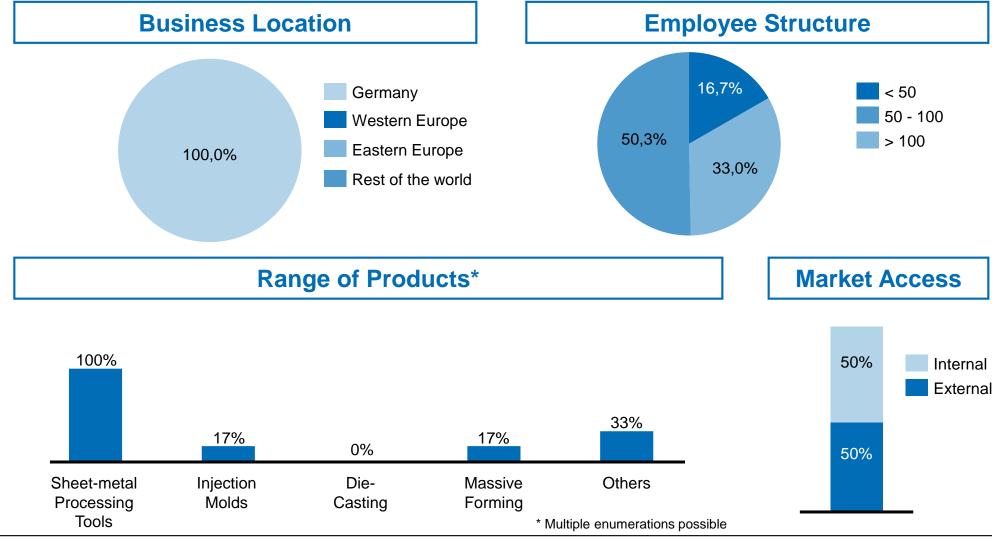
© WZL/Fraunhofer IPT





### The reference group contains companies which are comparable to the tool room





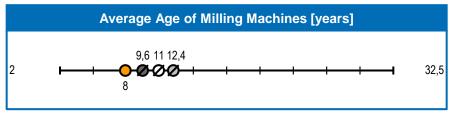


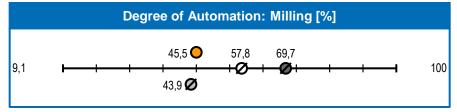


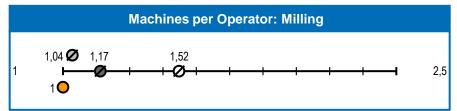
### Technological resources are the enabling factors of a successful tool room

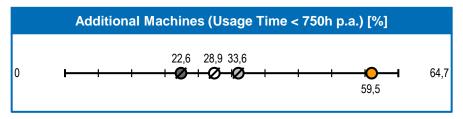


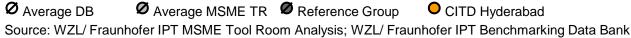
#### Analysis Technology (I/VIII)











#### **Findings**

- The average age of milling machines is lower in comparison to other reference groups
- There are many old, unproductive machines (also milling machines) which were not taken into account
- This high number is noticeable as the value is much higher compared to other reference groups

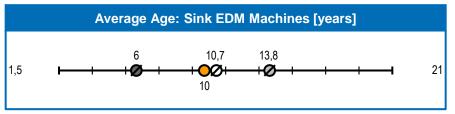


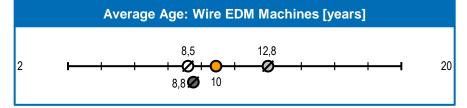


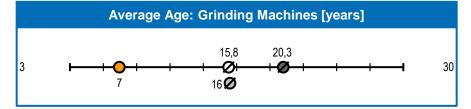
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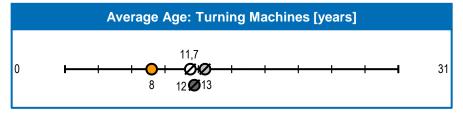


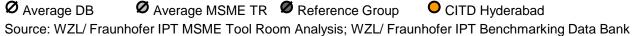
#### Analysis Technology (II/VIII)

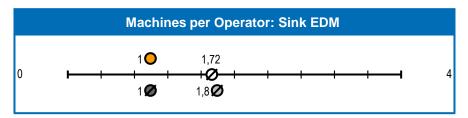


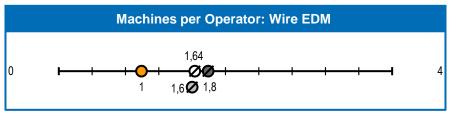


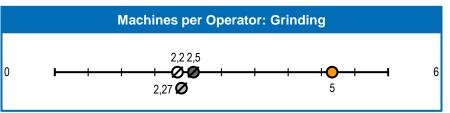


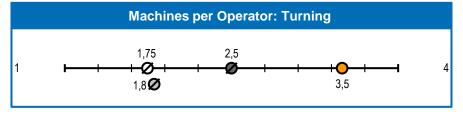












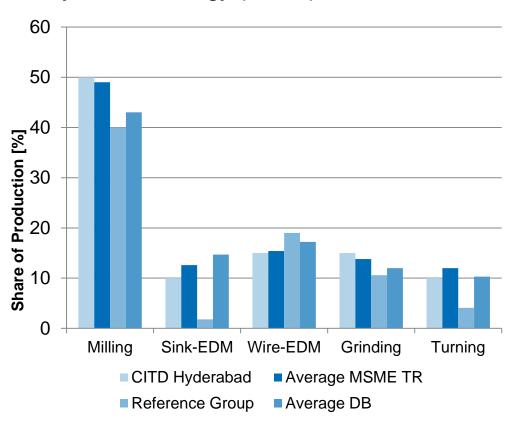


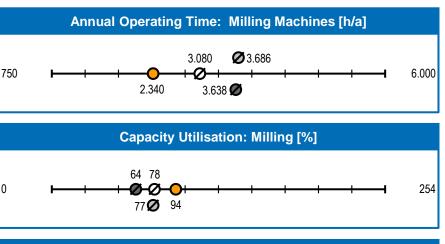


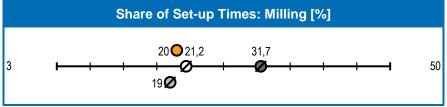
### The economic application of technological resources is described with the technology organization



Analysis Technology (III/VIII)







The annual operating time of the most important technology is low

Ø Average DB Ø Average MSME TR Ø Reference Group ○ CITD Hyderabad



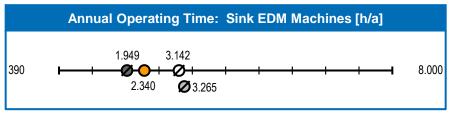


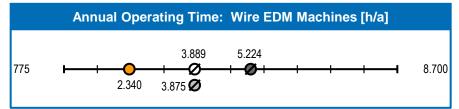


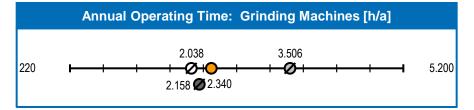
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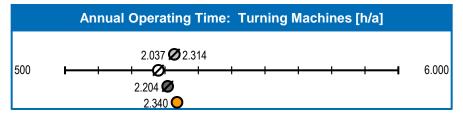


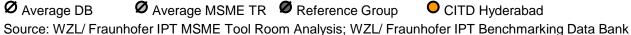
Analysis Technology (IV/VIII)

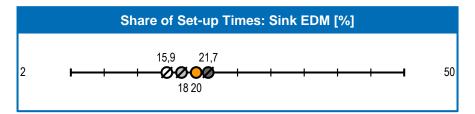


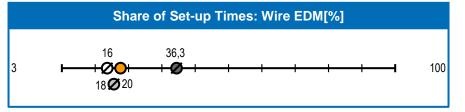


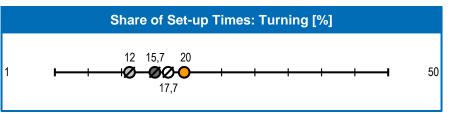


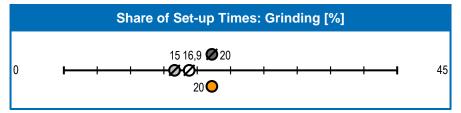












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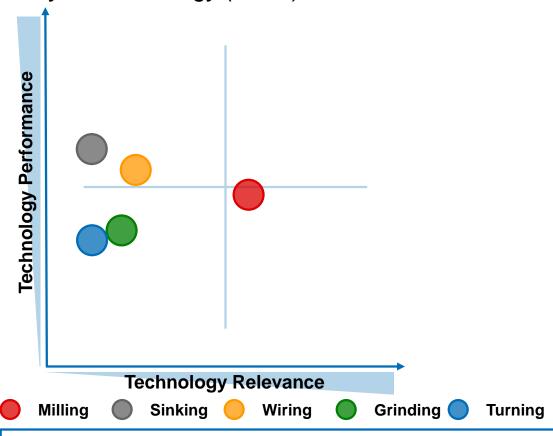




## The economic application of technological resources is described with the technology organization







#### **Findings**

- The overall performance of the machinery is on a high level whereupon the milling and wire-EDM machine are on an average level
- Sink-EDM, grinding and turning machines are characterized by high machine performances
- The technology portfolio shows that there is still potential for the milling technology by upgrading the machinery

The high performance values are sufficient but it has to be taken into account that there are many unproductive old machines within the tool room

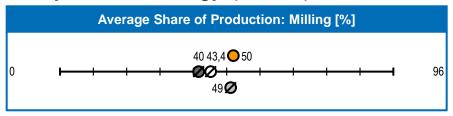


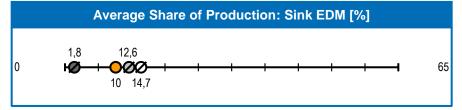


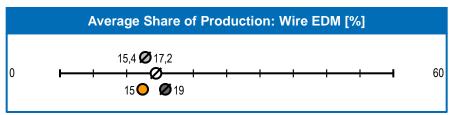
## Additional Information: Data for machine performance analysis

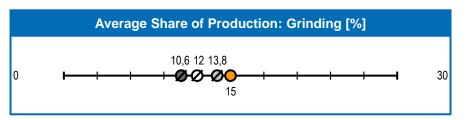


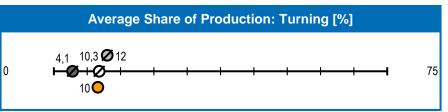
Analysis Technology (VI/VIII)











Average DB Average MSME TR Reference Group

OCITD Hyderabad

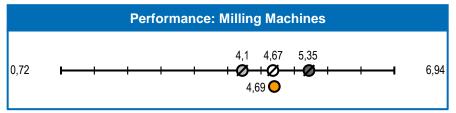


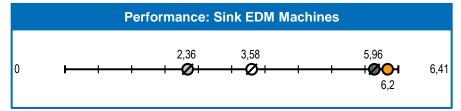


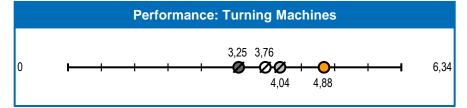
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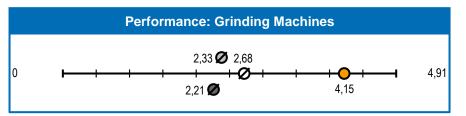


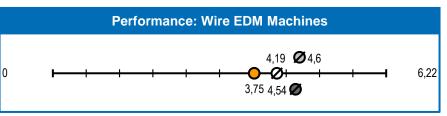
#### Analysis Technology (VII/VIII)











Average DB

Average MSME TR Reference Group

O CITD Hyderabad

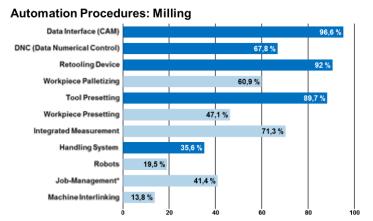


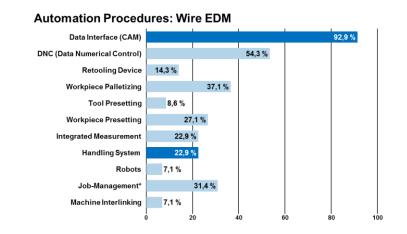


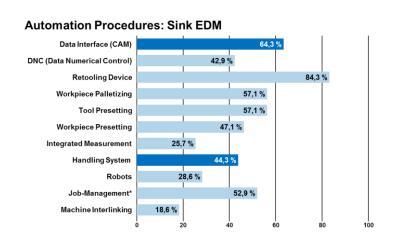
### Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

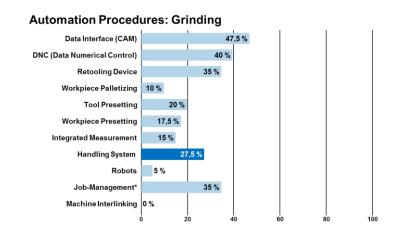


Analysis Technology (VIII/VIII)









Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

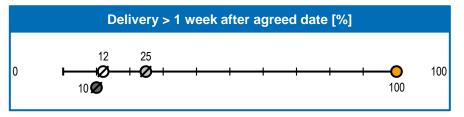


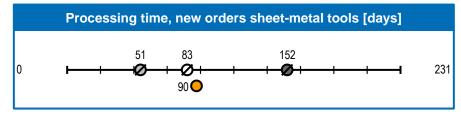
MSME Hyderabad 2011

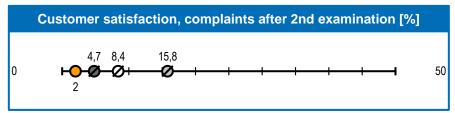
### The organisational capabilities are the key to process efficiency and sustainable development of a tool room

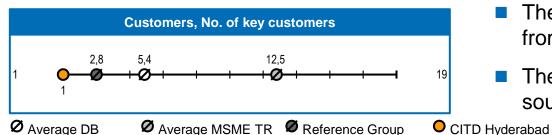


Analysis Organisation (I/II)









#### **Findings**

- The Tool Room has the worst due date reliability no orders were delivered on time
- The lead times for sheet metal tools are on a competitive level – tool dimensions differ compared to the specific reference group
- The product quality meets the customer demands better than all reference groups
- The focus customer portfolio is not being employed to increase the organisational capability of the Tool Room
- The product portfolio features a great diversity from tools over components to fixtures
- The organisational structure has to start with a sound product portfolio to enhance process quality

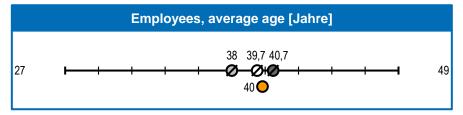


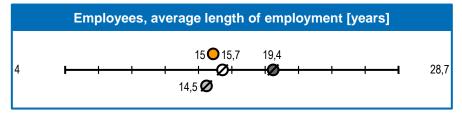


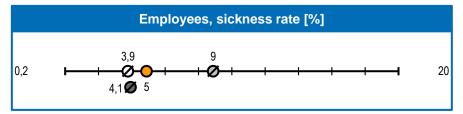
### The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)







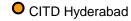
#### **Findings**

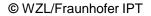
- The average age of the employees is compareable to all reference groups – the different demographic characteristics between India and Germany are not noticeable in Tool Rooms
- The average job tenure shows extensive experience among the work force
- Organisational capability for meeting crucial process parameters has to be intergrated into the culture going forward

The most relevant process parameter in tool making is neglected entirely at CITD Hyderabad – The product portfolio and production planning and control have to be addressed immediately

Average DB

Average MSME TR Reference Group





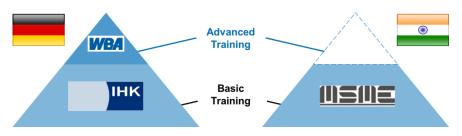




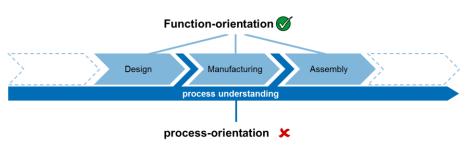
### Education is the backbone for the upgrade of capabilities and future innovation and development



#### Analysis Training



General Finding: Lack of advanced training



**General Finding:** Lack of process-orientation

#### **Findings**

- The general findings do also apply to CITD Hyderabad
- The enhancement of available facilities for increasing intake capacity is the right step for successfully facing a growing student body
- Strengths are courses with regard to automation and systems
- The field of automation and process-orientation will gain value over the next years and should be established as the focal point of the training programme
- The know-how about automation and systems should be used to transfer these competencies into application for manufacturing and tool making





### Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



#### **Technology**

- High overall machine performance
- Multiple machine work

#### **Organisation**

 High product-specific know-how of employees

#### **Training**

- Competence in automation as well as transfer and embedded systems
- Inclusion of managerial and organizational topics in curriculum
- Integration of trainees into the manufacturing process



#### **Technology**

- Very time-consuming set-up process
- High number of unproductive machines

#### **Organisation**

- Lack of process structure in all departments involved into order fulfillment
- Lack of post-calculation
- Lack of process quality

#### **Training**

 Lack of exposure for students to EDM manufacturing process





### The target state serves as reference point for the orientation of the next development steps



Target State



#### **CITD Hyderabad Vision**

Develop **competencies** by transferring the extensive know-how on **automation** and systems in manufacturing applications. Continue to strengthen the training expertise in automation and systems

#### **Mission Technology**

 Adjustment of the technological ressources and processes on the specific requirements of sheet metal tools and component production

#### **Mission Organisation**

- Development of a milestone process structure
- Integration of training knowhow into manufacturing application
- Design of strategy defining the future focus of manufacturing activities

#### **Mission Training**

- Intensification of training activities on automation and systems
- Set-up of courses addressing the interference between manufacturing and automation and systems

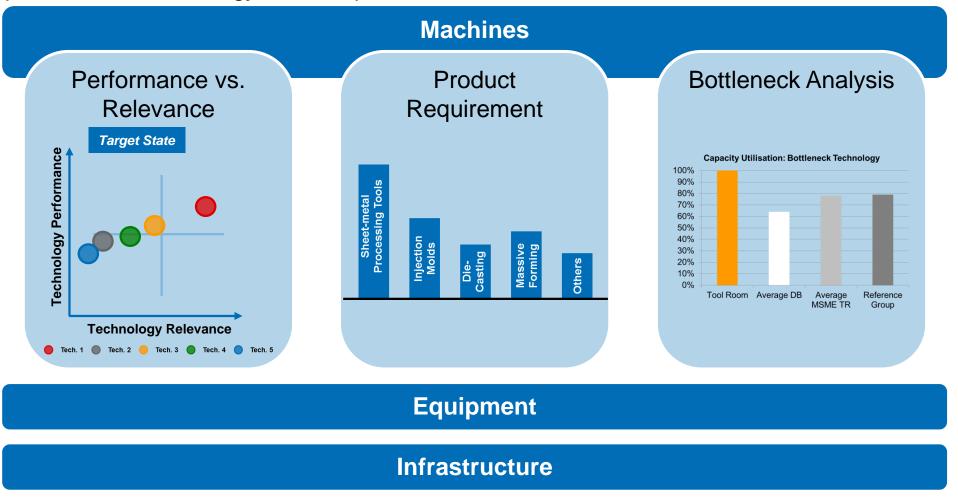




### Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

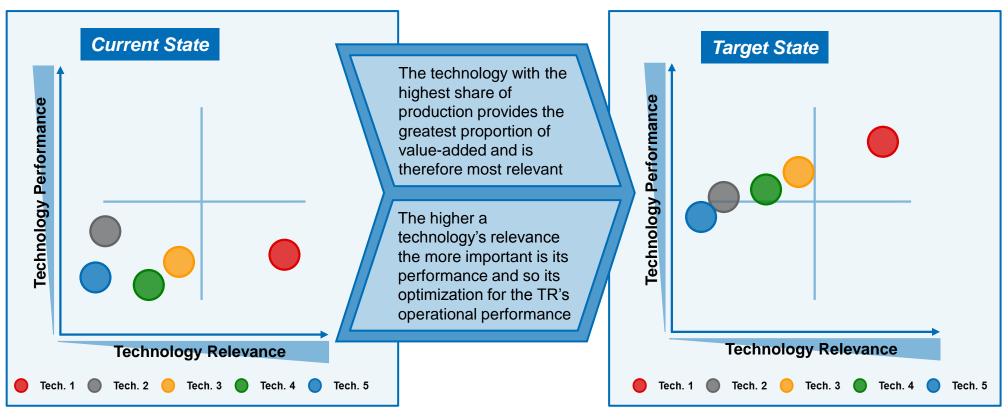




## The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

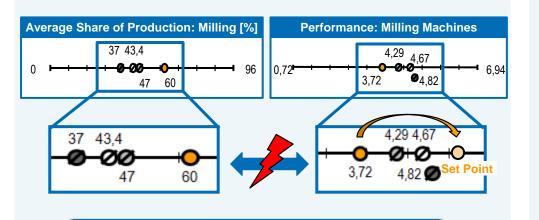




## Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness



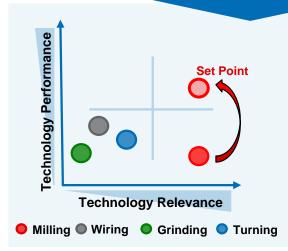
Explanation of Technology Roadmap & Investment Advice





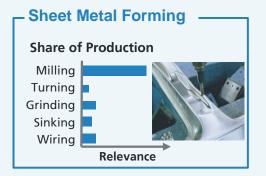


The investment recommendation consists of a large-sized milling machine and a medium-sized milling machine



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.

#### **Application Examples**









### Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The 5S-Method helps to create a save, clean and tidy workplace.





## A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



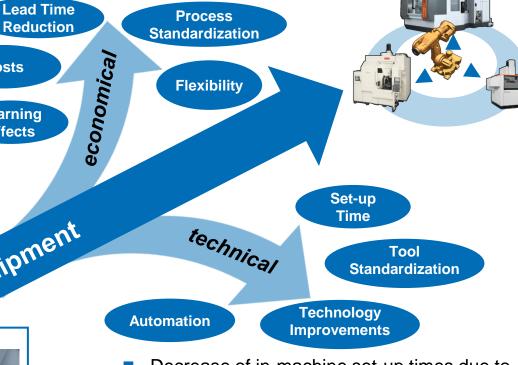
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



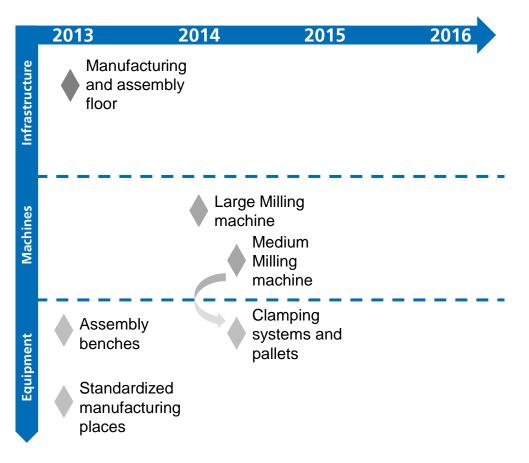


Assembly benches

### Since the infrastructure aspect is an intregal factor for the Tool Rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
  - Renewal of old manufacturing and assembly floors (partial)
  - Use of standardized assembly benches with defined equipment (hammer, file etc.) and a visible order
  - Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Machines
  - Large-sized CNC milling machine (DMG NHX 5000, 5500, Hermle C42 or comparable) for large parts, so that a 3-axis machine can be suitable
  - Medium sized CNC milling machine (Hermle C30, DMU 50 and comparable) with a high accuracy, automated tool changer and the possibility for a high automation degree
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





### Measures for bridging the gap between that status quo and the target state with regard to technology



#### Advice Technology

**Short-Term Measures** 

Target: Enhancement of milling capabilities

Standardization of milling tools and determination of process parameters

Result: Number of milling tools is reduced which results in process improvement possibilities

Target: Reduction of set-up times

SMED Workshop

Result: Action plan for efficiency improvements within the manufacturing department

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

> Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

Target: Enhancement of overall machinery performance

Disinvestment of old (manual) machines

Result: Machinery is adjusted to the requirements of a modern production

#### **Proposed Project**

Standardization of all relevant manufacturing resources

**Duration:** 

Man days:

Support:

10 months 2

20

WZL/ WBA/ IPT





### Measures for bridging the gap between that status quo and the target state with regard to organisation



#### Advice Organisation

**Short-Term Measures** 

**Target:** Establishment of milestone process for the entire order fulfillment process

Design of structured milestone process for order processing

Result: Structured process with detailed milestone for increased process quality

Target: Use of training competencies to create added value in manufacturing

Identification of action fields for the implementation of automation and systems into manufacturing applications

Result: Competitive edge through synergies between training and manufacturing

#### **Long-Term Measures**

**Target:** Planning and control of manufacturing of tools

Set-up of a planning and control routine for the entire order fulfillment process

Result: Infrastructure for sustainably lower lead times and enhanced due date reliability

Target: Strategy of focus of future manufacturing activities

Development of a strategy for the future development of manufacturing

Result: Sound strategy for addressing market demands on core competencies with future manufacturing activities

#### **Proposed Project**

Identification of action fields for the implementation of automation and systems into manufacturing applications **Duration:** Man days: Support:

1 week 10 WZL/ WBA/ IPT





### Measures for bridging the gap between that status quo and the target state with regard to training



#### Advice Training

**Short-Term Measures** 

Target: Intensification of development of know-how and experts on automation and systems

Design of a road-map for further development of know-how and teaching on automation and systems

Result: Road-map for core competencies in training which is aligned with the future development of manufacturing

#### **Long-Term Measures**

**Target:** Creation of an infrastructure to transfer the know-how on automation and systems into industry and innovation

> Set-Up of course offerings addressing the interference between automation and systems and manufacturing

Result: Courses addressing the competence of CITD Hyderabad and the development in the manufacturing industry

#### **Proposed Project**

Design of a road-map for further development of know-how and teaching on automation and systems **Duration:** 

Man days:

Support:

1 week

10

WZL/ WBA/ IPT





### Overview of the results of the analysis and the proposed next steps towards the target state



#### Summary

#### Strength

Tigh overall machine performance

Product-specific know-how of employees

Training competencies in automation and systems

#### **Potential**

Time-consuming set-up process

Lack of process quality

Lack of EDM machines



#### **CITD Hyderabad Vision**

Develop **competencies** by transferring the extensive know-how on **automation and systems** in manufacturing applications. Continue to strengthen the **training expertise in automation** and systems

#### **Technology Project Proposal (30 man days)**

Standardization of all relevant manufacturing resources

#### **Benefit**

Rationalization of processes resulting in higher machine runtimes & shorter lead times

#### **Organisation Project Proposal (10 man days)**

Identification of action fields for the implementation of automation and systems into manufacturing applications

#### **Benefit**

Using existing know-how for productivity enhancements

#### **Training Project Proposal (10 man days)**

Design of a road-map for further development of know-how and teaching on automation and systems

#### **Benefit**

Enlargement of training portfolio aligned with core competencies





#### **Contact Information**









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### Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps IGTR Indore







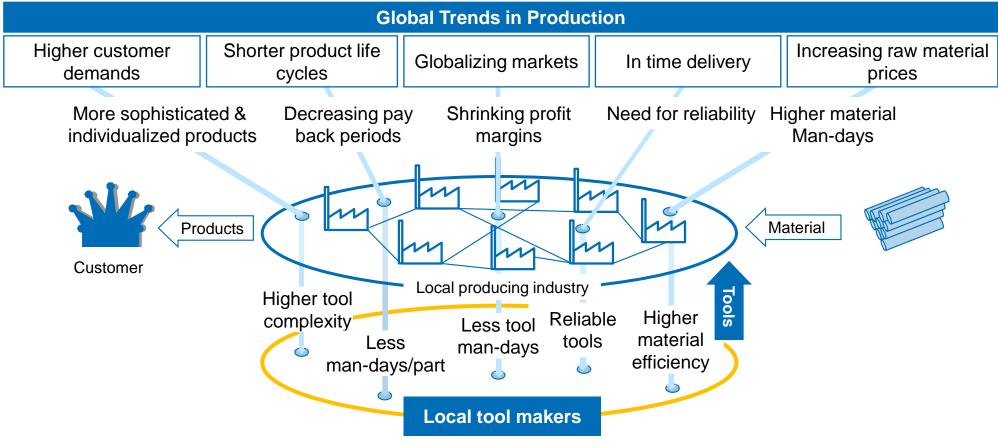
Delhi, 01.-02. November 2012





## Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





## Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

### Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

#### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### Goals of Production

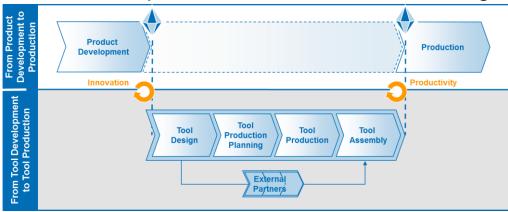
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





## A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



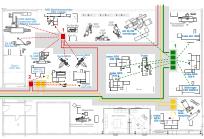


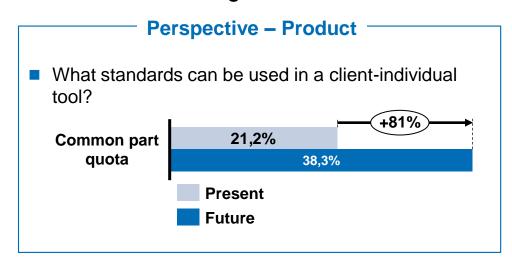
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

### **Perspective- Order Processing**

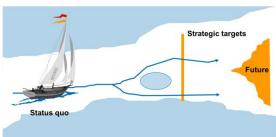
Which standards in order processing enable unique tooling?





### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

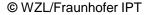


### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

### Day II

#### Dr. K. Kuhlmann & K. Arntz

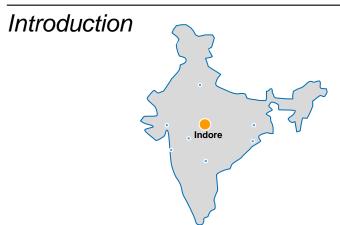
- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





# The IGTR Indore focuses on engineering and various tool types while offering a broad training program





»Complete solutions for the customer under one roof«

Indore (Madhya Pradesh) Market

Now: Automotive, pharmaceutical &

local physics research

Future: Further strengthening of

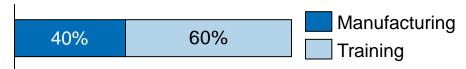
automotive and physics research

Customer Industries

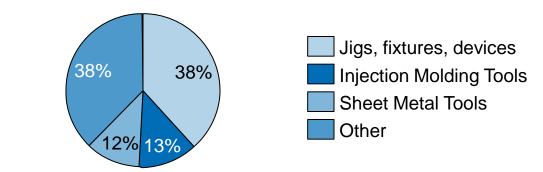
Automotive, medical, packaging, pharmaceutical, research

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

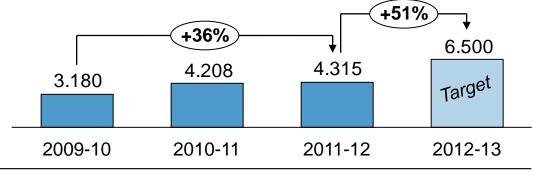




### Manufacturing



### Training [Trainees Trained]

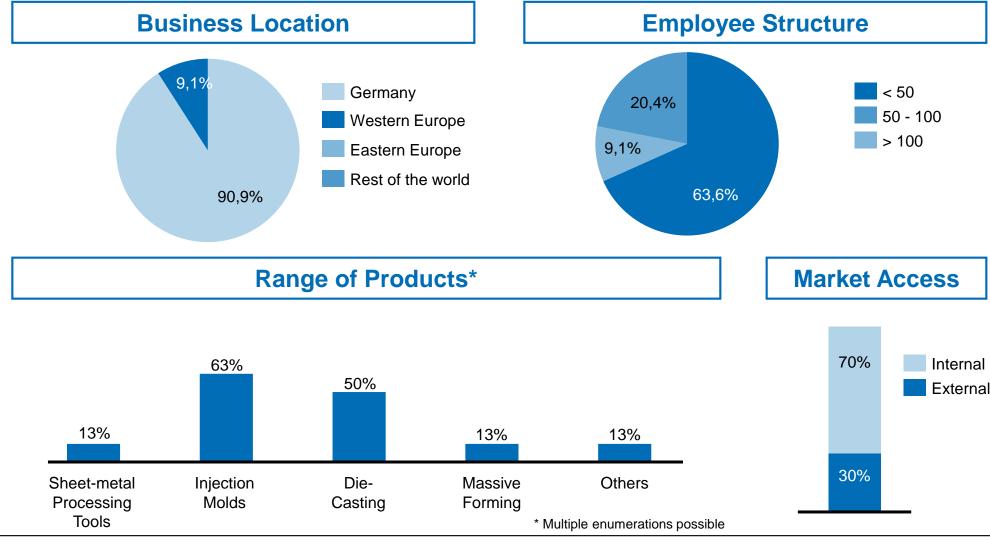






## The reference group contains companies which are comparable to the tool room





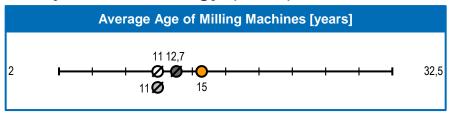


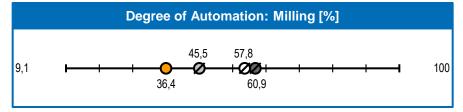


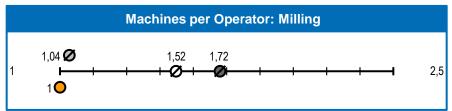
### Technological resources are the enabling factors of a successful tool room

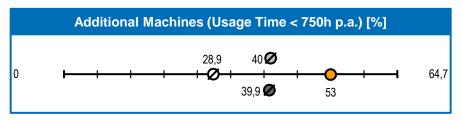


### Analysis Technology (I/VIII)











### **Findings**

- The visit has already shown that the resources are on a medium level. But especially the milling machines must be upgraded which is also shown by the high average age of these machines
- The automation degree is lower compared to the reference groups and the average data bank value which is caused by the boundary conditions in India
- The strict assignment of one worker to a specific machine is noticeable. Even though it results in maximum machine utilization, it lowers the productivity
- Disinvestments within the production department are needed in order to increase the machine performance and to support organizational changes

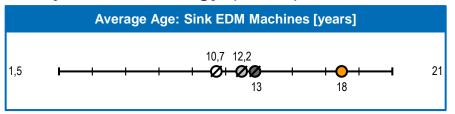


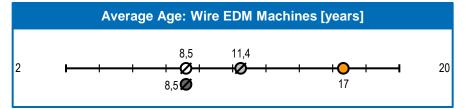


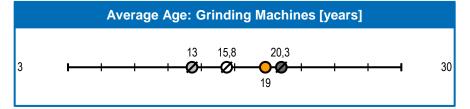
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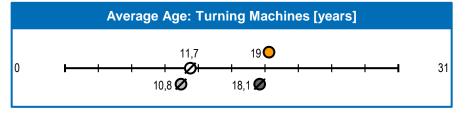


### Analysis Technology (II/VIII)

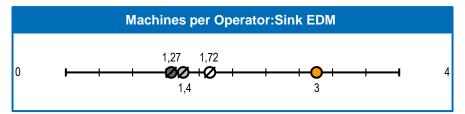


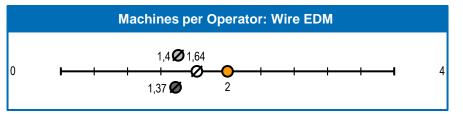


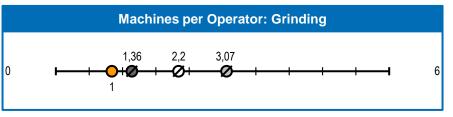


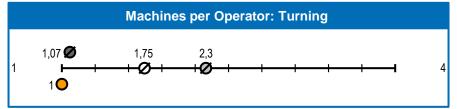












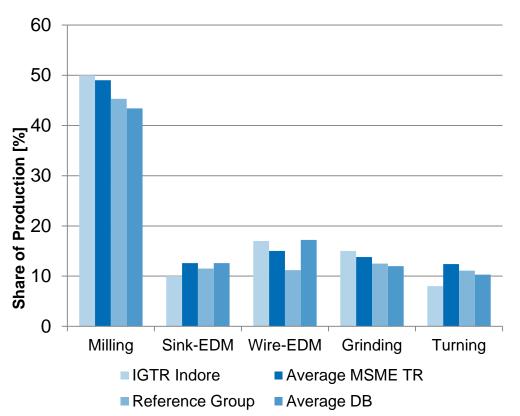


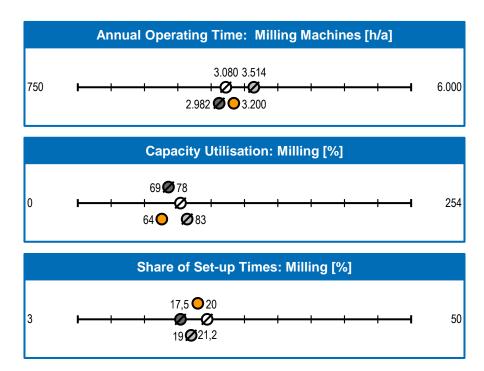


# The economic application of technological resources is described with the technology organization



Analysis Technology (III/VIII)





The machine utilization shows potential for a more efficient use of existing machines

Ø Average DB Ø Average MSME TR Ø Reference Group ☐ IGTR Indore



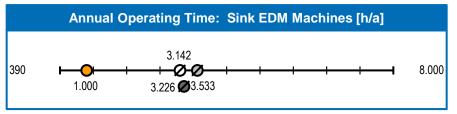


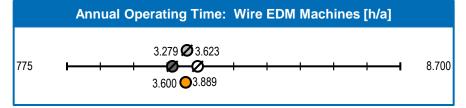


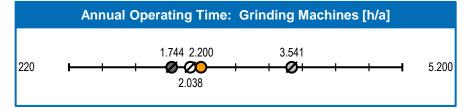
## The economic application of technological resources is described with the technology organization

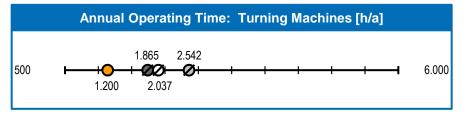


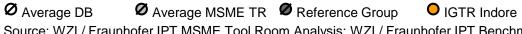
Analysis Technology (IV/VIII)

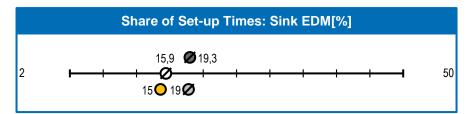


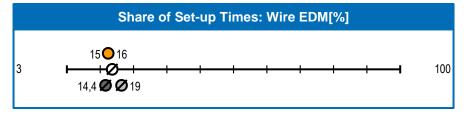


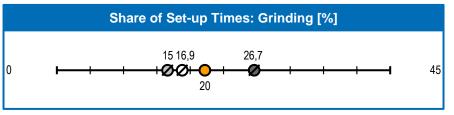


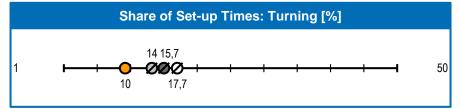












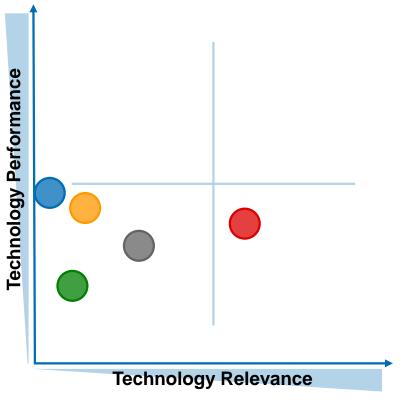




# The economic application of technological resources is described with the technology organization



Analysis Technology (V/VIII)



**Sinking** 

### **Findings**

- The technology performance distribution shows an acceptable level
- The fact that the milling technology is characterized by the highest manufacturing share, further investment has to take this technology more into account

Investments in milling and grinding machines are advisable

Turning

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

Wiring



Grinding

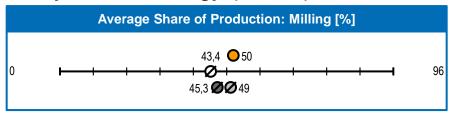


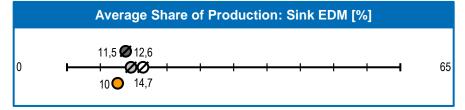
Milling

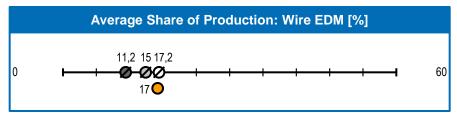
## **Additional Information:** Data for machine performance analysis

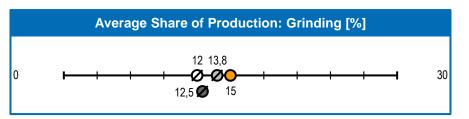


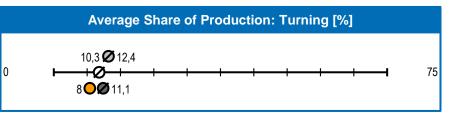
Analysis Technology (VI/VIII)











**Ø** Average DB

Average MSME TR Reference Group

O IGTR Indore

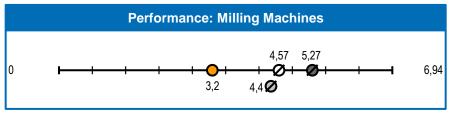


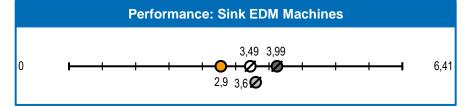


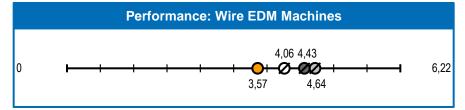
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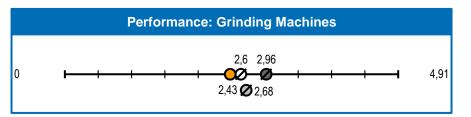


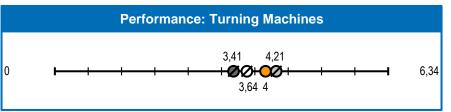
### Analysis Technology (VII/VIII)











**Ø** Average DB

Average MSME TR Reference Group

O IGTR Indore

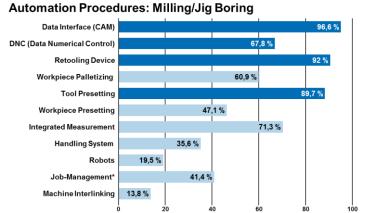


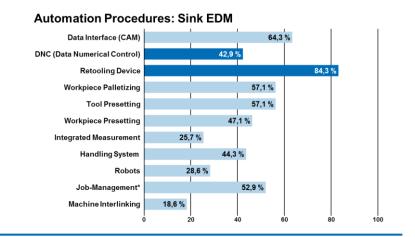


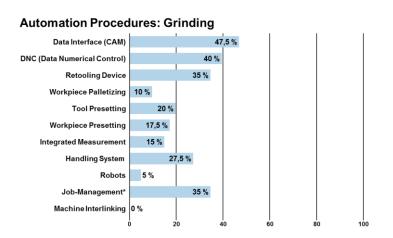
## Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

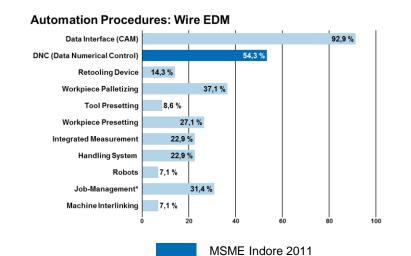












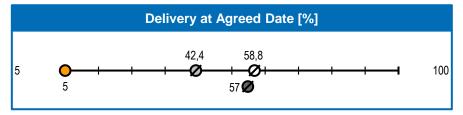


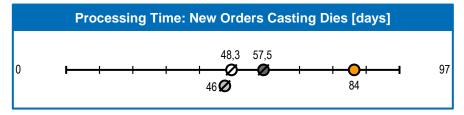


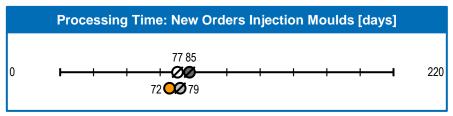
# The organisational capabilities are the key to process efficiency and sustainable development of a tool room

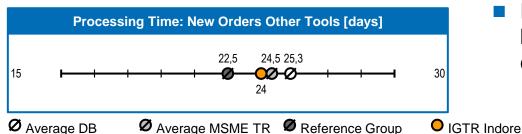


Analysis Organisation (I/II)









### **Findings**

- The vast majority of placed orders was not delivered on time
- Due date reliability has to be addressed by a consistent process planning and control to be competitive
- A great variety of different products are being offered to the customers
- The process capability with regard to lead time shows great variety in comparison to the other reference groups
- In the future a stringent strategy and product focus has to be established to operate successfully and competitively

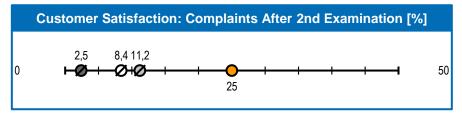


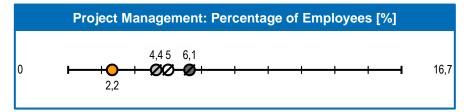


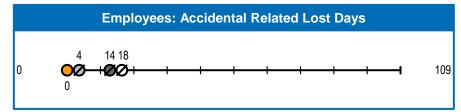
### The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)







### **Findings**

- In addition to the limited reliability the product quality does not suffice for satisfying the customer
- The reference group with a focus and customer specific systems almost benchmark with regard to customer satisfaction
- The high demands for the process organisation are not answered by manpower in the project management department
- The workplace safety is outstanding all reference groups compare worse

IDTR Indore has yet to appropriately identify and address its fields of competence to achieve differentation – Customised applications and fixtures have the potential to fill that gap

Average DB

Average MSME TR Reference Group



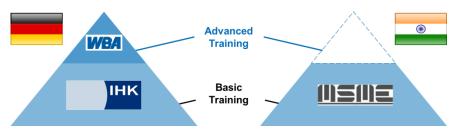




## Education is the backbone for the upgrade of capabilities and future innovation and development



### Analysis Training



General Finding: Lack of advanced training



**General Finding:** Lack of process-orientation

### **Findings**

- Differentiating factor of the training programme could not be identified – although acquiring students with high potential could be a key factor
- The training facilities are well structured space for further enhancement of intake capacity would be available
- The varying resource utilization has to be answered by further course offering that address industry professionals besides students
- The analyzed course manages to comprehensively cover all the relevant aspects of tool and die making in a short course format

### Course analyzed:

Condensed Course in Tool & Die Making (1 Year)





## Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings





- Multiple machine work
- High technological know-how in injection molding

### **Organisation**

Strong competencies in engineering processes

### **Training**

Training programme for machinist trade



### **Technology**

- Average machine age is high
- Machine performance is low compared to all reference groups

### **Organisation**

- Very low process quality (due date reliability)
- Missing focus of products is harmful to process quality and long-term profitability

### **Training**

- Missing link between engineering competence and course offerings
- Varying capacity utilization of training resources





## The target state serves as reference point for the orientation of the next development steps



Target State



### **IGTR Indore Vision**

Develop towards a market player known for engineering of complex customer applications and outstanding technological know-how. Create a reputation as trainer for specialists in customer specific engineering solutions

### **Mission Technology**

 Productivity improvements will be realized by machine investments and disinvestments and the implementation of suitable equipment

### **Mission Organisation**

- Establishment of tidiness and order in all departments
- Definition of strategic focus on engineering-intense products
- Implementation of a sound process structure for increased process quality

### **Mission Training**

- Establishment of connection between course offerings and strategic focus
- Continuation of identifying courses with differentiating potential (compare machinist trade course)

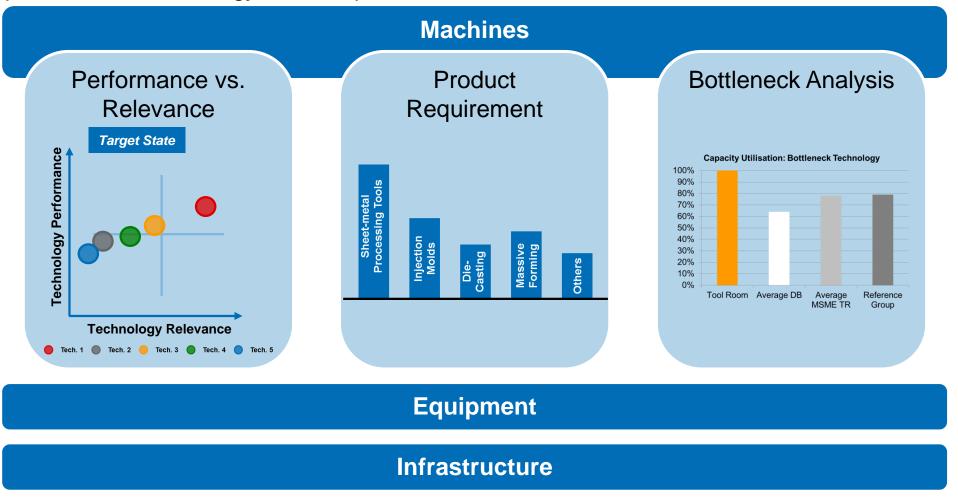




# Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

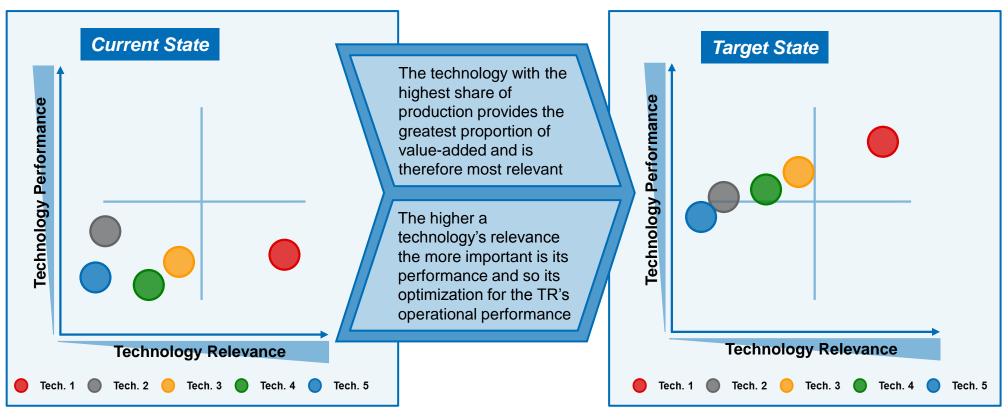




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

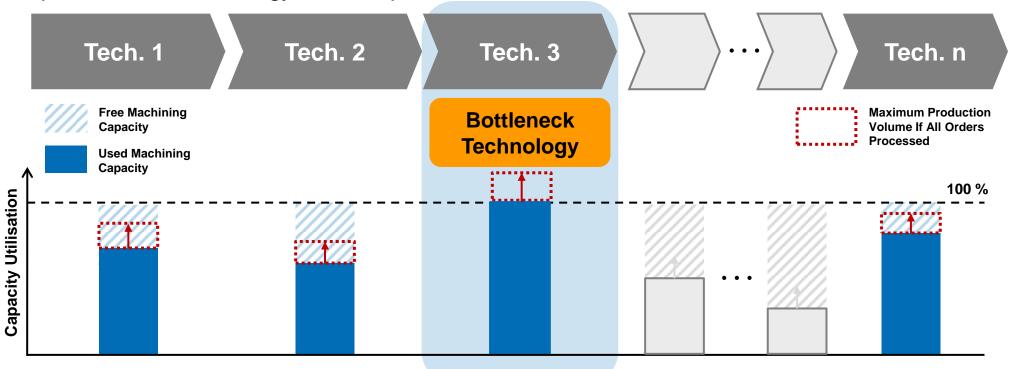




# Bottlenecks have to be eliminated by investing in machinery in order to improve the production capacity



Explanation of Technology Roadmap & Investment Advice



Great potential to create additional value-added in preceding and following manufacturing processes because of inefficient capacity utilisation

The bottleneck technology restricts the possible production capacity of the whole manufacturing chain

Source: Information concerning Bottlenecks was given by the TR's via the benchmarking sheet (by Fraunhofer IPT)

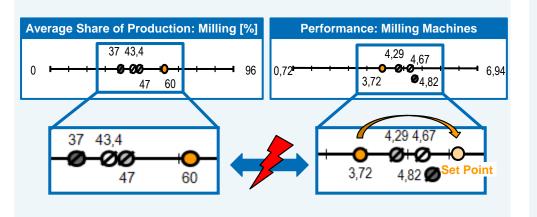




# Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness

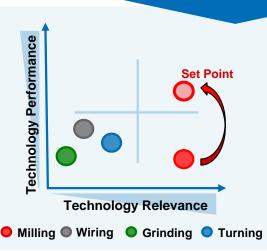


Explanation of Technology Roadmap & Investment Advice



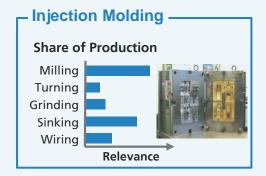


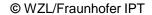
The investment recommendation consists of a replacement of a large-sized and medium-sized milling machine, a surface grinding machine and Wire-EDM machines



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.

### **Application Examples**









# Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The *5S-Method* helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



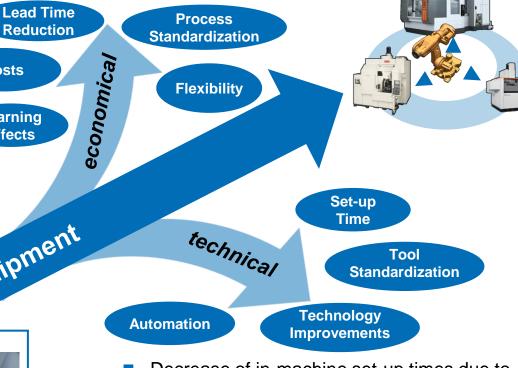
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



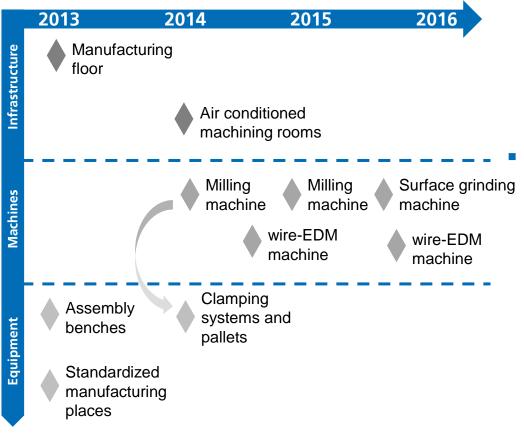


Assembly benches

# Since the infrastructure is an intregal factor for the Tool Rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure (
  - Renewal of old manufacturing and assembly floors
  - Use of standardized assembly benches with defined equipment (hammer, file etc.) and a visible order
  - Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
  - Precision machining requires nearly constant temperatures: Air conditioned machining rooms

#### Machines

- Overall machine age is too high so that the investment speed must be higher
- Large-sized CNC milling machine (Hermle C40, DMU 70 and comparable) with medium to high precision in order to meet the requirements of today's and future parts.
- Surface grinding machine with medium to high precision in order to guarantee the precision difference to milling processes (Blohm Vario and comparable)
- Medium-sized CNC milling machine (Hermle C30, DMU 50 and comparable) with high precision. Furthermore, fundamental automation measures should be integrated with the potential of automation enlargement in the future
- Renewal of wire-EDM machines in order to take advantage of machine optimization in recent years (AgieCharmille CUT 20 P and comparable)
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





# Measures for bridging the gap between that status quo and the target state with regard to technology



### Advice Technology

**Short-Term Measures** 

**Target:** Enhancement of milling capabilities

> Standardization of milling tools and determination of process parameters

Result: Number of milling tools is reduced which results in process improvement possibilities

### **Long-Term Measures**

Target: Reduction of in-machine set-up times

> Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

Target: Enhancement of overall machinery performance

Disinvestment of old (manual) machines

Result: Machinery is adjusted to the requirements of a modern production

**Proposed Project** 

Disinvestment of old (manual) machines

**Duration:** 

4 months

Man days:

Support:

15

WZL/ WBA/ IPT





# Measures for bridging the gap between that status quo and the target state with regard to organisation



### Advice Organisation

**Short-Term Measures** 

**Target:** Establishment of milestone process for the entire order fulfillment process

Design of structured milestone process for order processing

Result: Structured process with detailed milestone for increased process quality

Target: Establishment of 6S Routine

Set-Up of a 6S Routine

Result: Sustained process efficiency and increased duration of life cycle of resources

### **Long-Term Measures**

Target: Use of a standardized process structure for order processing

Design of a process structure for the entire order fulfillment process for testing, calibration and manufacturing

Result: Sustainable routine for increased due date reliability and process stability

Target: Exploitation of competencies with regard to product and process for development and profitability

Development of a measure-plan for the exploitation of core competencies with regard to product and process

Result: Detailed plan for addressing core competencies for future development and increased customer value

### **Proposed Project**

Development of a measure-plan for the exploitation of core competencies with regard to product and process **Duration:** Man days: Support:

1 week 10 WZL/ WBA/ IPT





# Measures for bridging the gap between that status quo and the target state with regard to training



### Advice Training

**Short-Term Measures** 

**Target:** Sound portfolio of course offerings that are aligned with operative competencies

Design of strategic training portfolio

Result: Set-up for increased quality of training

### **Long-Term Measures**

Target: Implementation of the designed strategic training portfolio

Implementation of the designed strategic training portfolio

Result: Higher quality of training to set the foundation for future development

Target: Initiatives for balancing capacity utilization of training resources throughout the entire calendar year

Design of an action plan to structure course offerings to balance capacity utilization

Result: Action plan for balanced capacity utilization of training resources for the entire calendar year

### **Proposed Project**

Design of an action plan structuring course offerings in order to balance capacity utilization **Duration:** 

Man days:

Support:

1.5 weeks

14

WZL/ WBA/ IPT





## Overview of the results of the analysis and the proposed next steps towards the target state



### Summary

### Strength

🚹 High technological know-how

Strong competencies in engineering

Training programme for machinist trade

### **Potential**

Old machinery

Low process quality

Missing link between training and manufacturing focus



#### **IGTR Indore Vision**

Develop towards a market player known for engineering of complex customer applications and outstanding technological know-how. Create a reputation as trainer for specialists in customer specific engineering solutions

### **Technology Project Proposal (15 man days)**

Disinvestment of old (manual) machines

### **Benefit**

Reduction of labor intensity, productivity enhancements, and a support for cleanliness and tidiness

### **Organisation Project Proposal (10 man days)**

Development of a measure-plan for the exploitation of core competencies with regard to product and process

### **Benefit**

Becoming a leader in exploited competency fields

### **Training Project Proposal (14 man days)**

Design of an action plan to structure course offerings to balance capacity utilization

### **Benefit**

Improvement of training capacity utilization





### **Contact Information**









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## Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps IDTR Jamshedpur







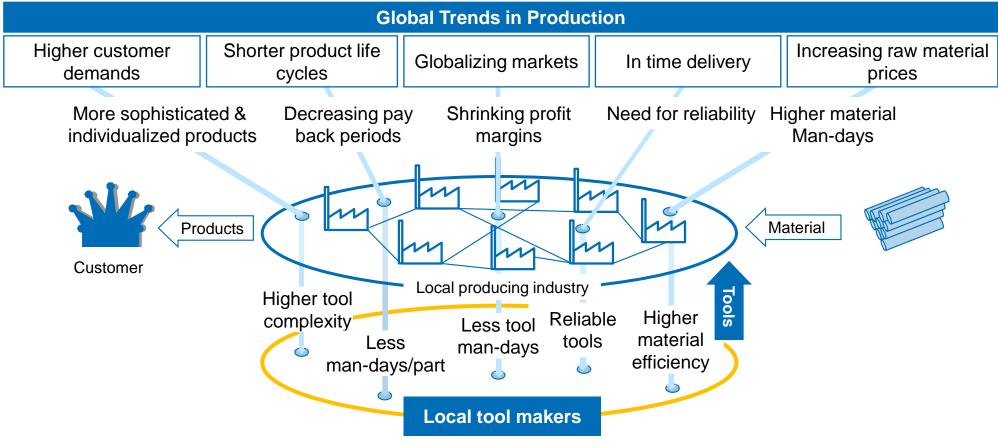
Delhi, 01.-02. November 2012





# Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





# Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

## Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

### **Goals of Production**

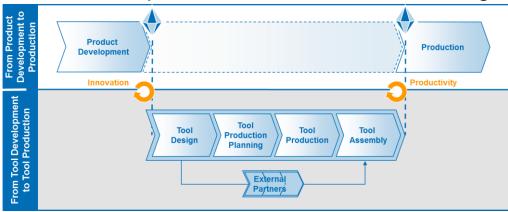
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





## A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



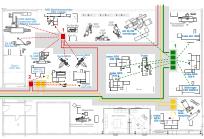


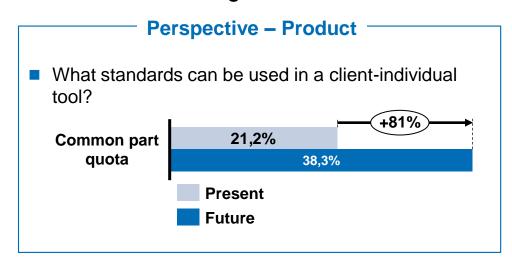
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

### **Perspective- Order Processing**

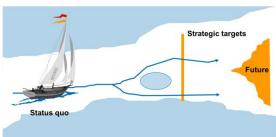
Which standards in order processing enable unique tooling?





### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

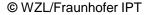


### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support: WZL/WBA/IPT

engineers)

#### Day I



Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production
   Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

### Day II

Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





# The IDTR Jamshedpur has offers extensive training and manufacturing in an automotive center



Introduction



»Manufacturing for aerospace and automotive as well as diverse training portfolio«

### Jamshedpur (Jharkhand) Market

Now: Strong local industrial

environment of automotive sector

Future: Further enhancement of capacity

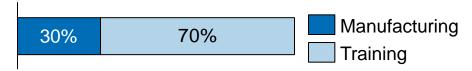
of automotive sector

#### Customer Industries

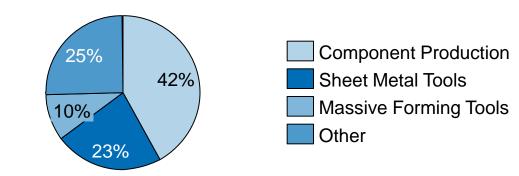
Aerospace, Automotive, Steel, Telecommunication

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

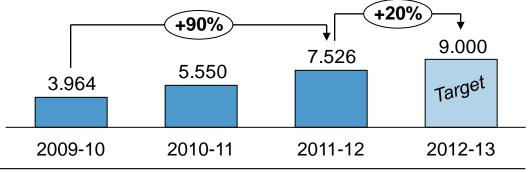




## Manufacturing



### Training [Trainees Trained]



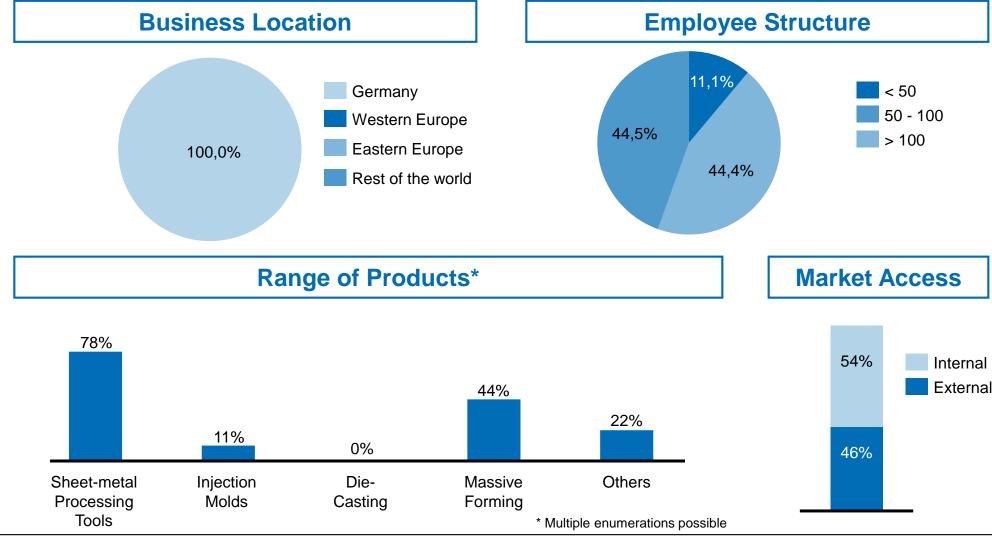
© WZL/Fraunhofer IPT





# The reference group contains companies which are comparable to the tool room





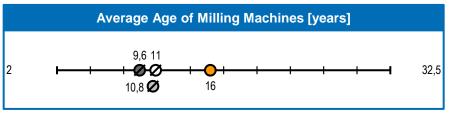


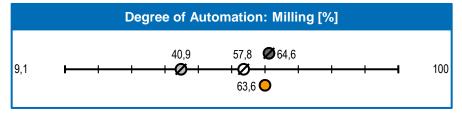


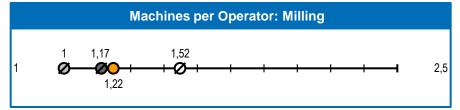
# Technological resources are the enabling factors of a successful tool room

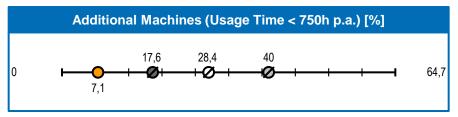


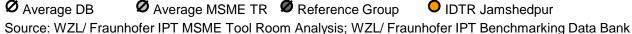
## Analysis Technology (I/VIII)











### **Findings**

- The average age of milling machines is higher compared to the reference groups, although it is the main manufacturing technology in Jamshedpur
- The automation degree is comparatively high resulting in multiple machine work in all manufacturing technologies
- A very low proportion of unproductive machines is positive

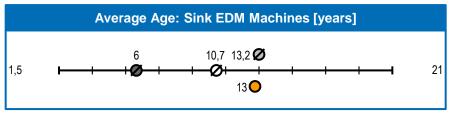


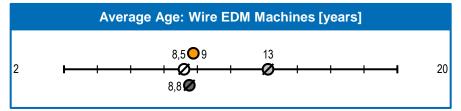


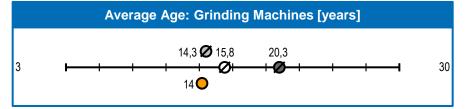
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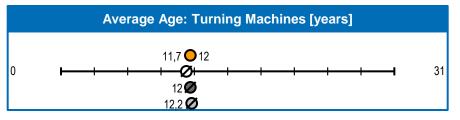


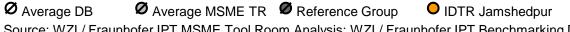
Analysis Technology (II/VIII)

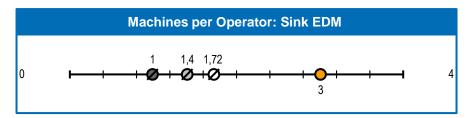


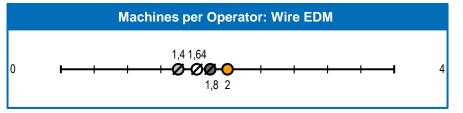


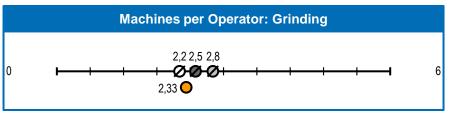


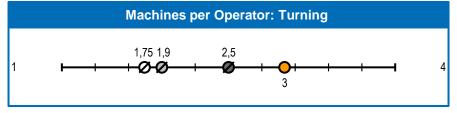












Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

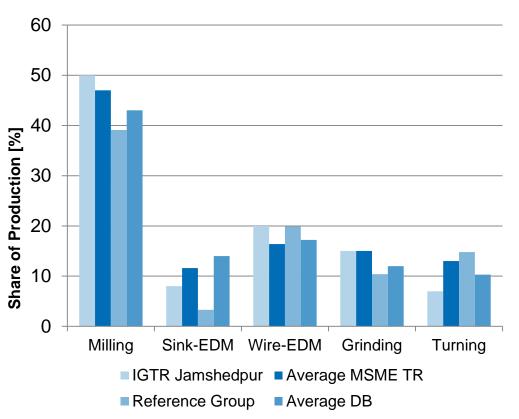


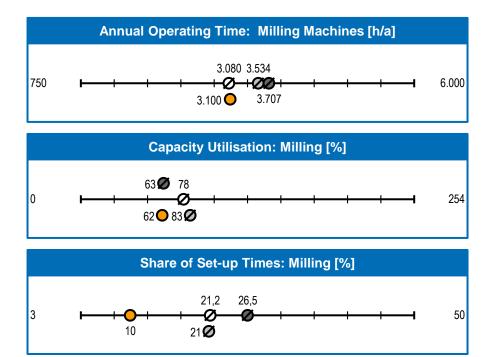


# The economic application of technological resources is described with the technology organization



Analysis Technology (III/VIII)





The share of set-up times needs to be analyzed as the visit does not reflect such a low value

Ø Average DB Ø Average MSME TR Ø Reference Group □ IDTR Jamshedpur

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

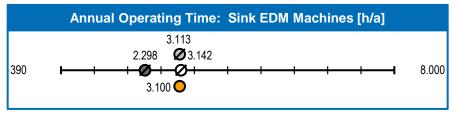


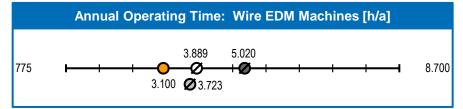


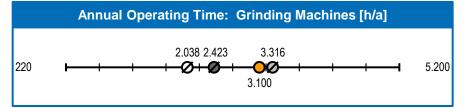
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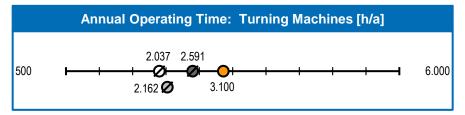


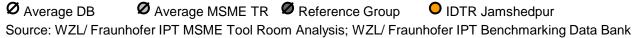
Analysis Technology (IV/VIII)

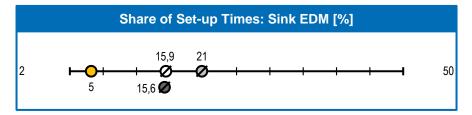


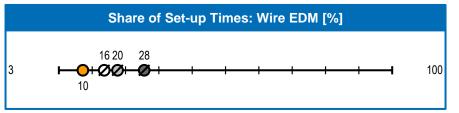


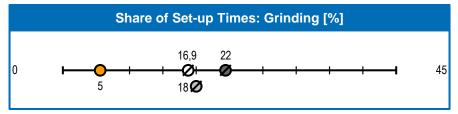


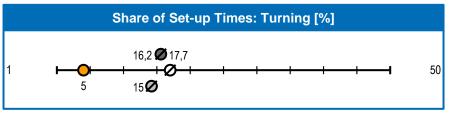












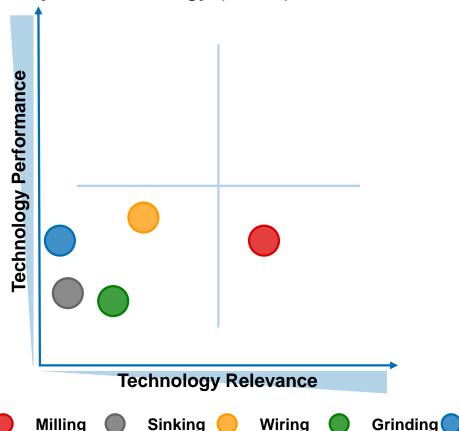




# The economic application of technological resources is described with the technology organization







### **Findings**

- The technology portfolio visualizes that the performance of existing milling machines is too low in due consideration of the technology relevance and the manufacturing of massive forming tools
- The performance of wire-EDM machines fits the requirements of sheet metal forming tools
- In due consideration of sheet metal forming tools, the performance value for grinding machines is low

Investments in milling and grinding machines is necessary

**Turning** 

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

Wiring

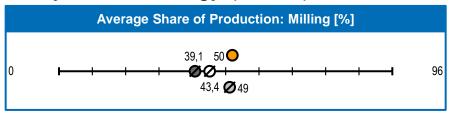


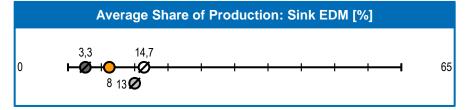


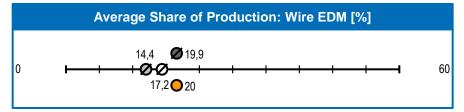
# Additional Information: Data for machine performance analysis

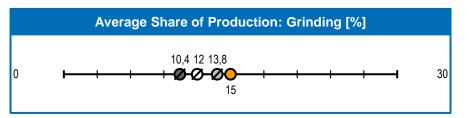


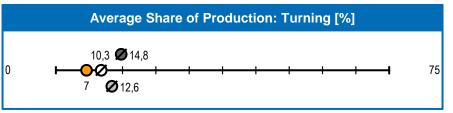
Analysis Technology (VI/VIII)











Average DB Average MSME TR Reference Group IDTR Jamshedpur Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

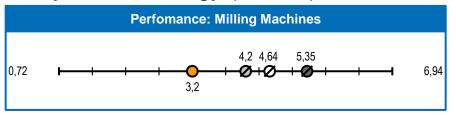


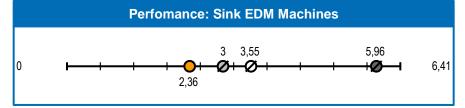


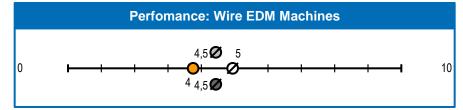
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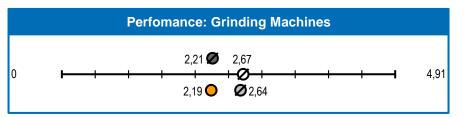


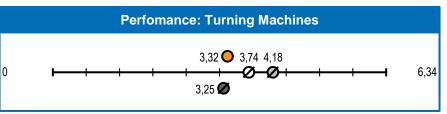
Analysis Technology (VII/VIII)











**Ø** Average DB

Average MSME TR Reference Group

O IDTR Jamshedpur

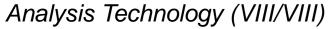
Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

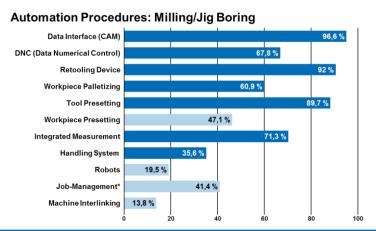


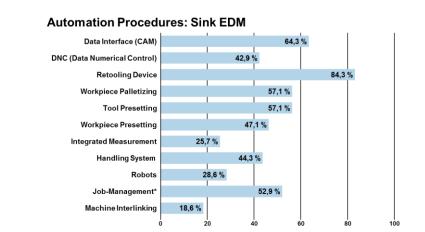


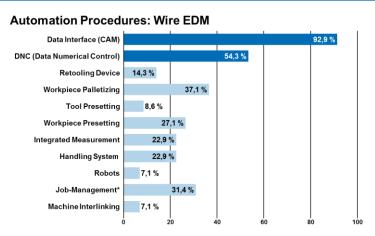
# Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

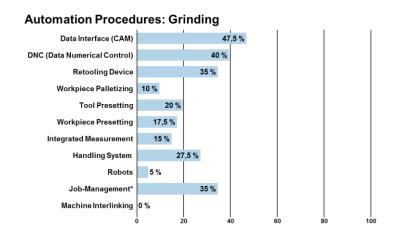












Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

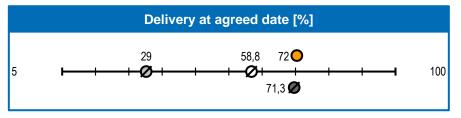


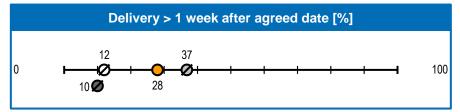


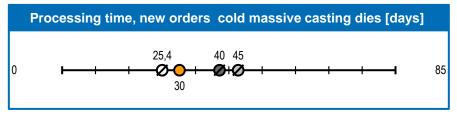
# The organisational capabilities are the key to process efficiency and sustainable development of a tool room

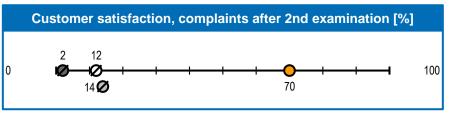


Analysis Organisation (I/II)









### **Findings**

- The due date reliability is on a competitive level the average of the specific reference group is very comparable
- Especially in the automotive sector due date reliability is the top priority for flow in the series production
- The products are either being delivered on time or with a great delay
- The smaller tools in the product portfolio can be manufactured quicker compared to the reference groups
- The high process quality is opposed by limited product quality for the customer

Ø Average DB Ø Average MSME TR Ø Reference Group □ IDTR Jamshedpur Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

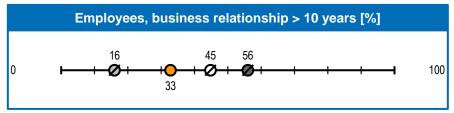


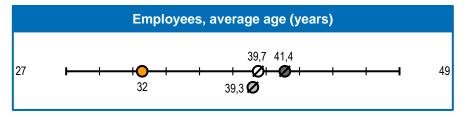


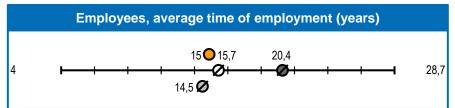
# The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)







### **Findings**

- IDTR Jamshedpur has achieved good consistency in its long-term relationships with the customers
- Consistent customer relationships can often be translated into a higher price level
- The Tool Room is set for sustainable future development with a very young work force
- Analysed in conjunction with the average job tenure IDTR Jamshedpur is in a unique situation for upgrading its capabilities further

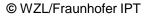
IDTR Jamshedpur requires a better process structure in the future to take pressure of its project management department – the understanding for organisational capability is established

Average DB

Average MSME TR Reference Group



Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



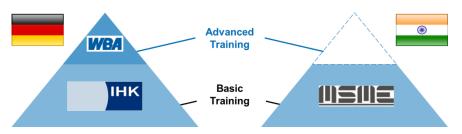




# Education is the backbone for the upgradation of capabilities and future innovation and development



## Analysis Training



General Finding: Lack of advanced training



General Finding: Lack of process-orientation

### **Findings**

- Short-term courses are launched to address market specific requirements for education – these courses should always be aligned with the overall training focus (positive example: welding; negative example: mobile phone repair)
- Course offerings in tool fitting is a competitive advantage and should be strengthened – fitting is the crucial part of the process chain for automotive tool suppliers
- The training facilities for design-oriented classes requires expansion – either physical facilities or a more attractive offering of e-classes
- Training of students from weaker social backgrounds should be continued and extended





# Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

- High performance of wire-EDM machines
- Multiple machine work

### **Organisation**

- High level of process quality
- Post-calculation is a milestone of the order fulfillment process

### **Training**

 Availability of training opportunities for students from different social backgrounds



### **Technology**

- Low performance of milling machines
- Low standardization degree

### **Organisation**

- Process quality is based on individuals instead of structures
- Process instability in case of adjustments or changes to plan

### **Training**

Very broad course offerings





# The target state serves as reference point for the orientation of the next development steps



Target State



### **IDTR Jamshedpur Vision**

Develop towards a **leading supplier** for the **automotive industry** known for **process and product quality**. Offer a **focused** portfolio of **courses** that are **aligned** with the manufacturing **competencies** 

### **Mission Technology**

- Adaption of technological resources to sheet metal and massive forming tools for the automotive industry
- Afterwards focusing on rationalization within the manufacturing department

### **Mission Organisation**

- Explication of status quo of milestones and structure of order fulfillment process
- Set-up of visualized process structure for enhancement and sustainability of process quality

### **Mission Training**

- Definition of future competence field of training
- Junction of the know-how with regard to manufacturing for the automotive industry with course offerings

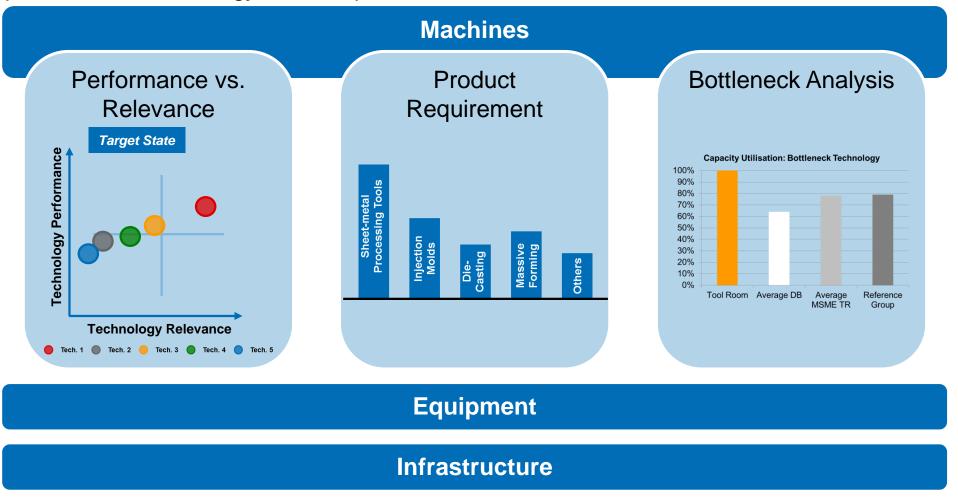




# Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

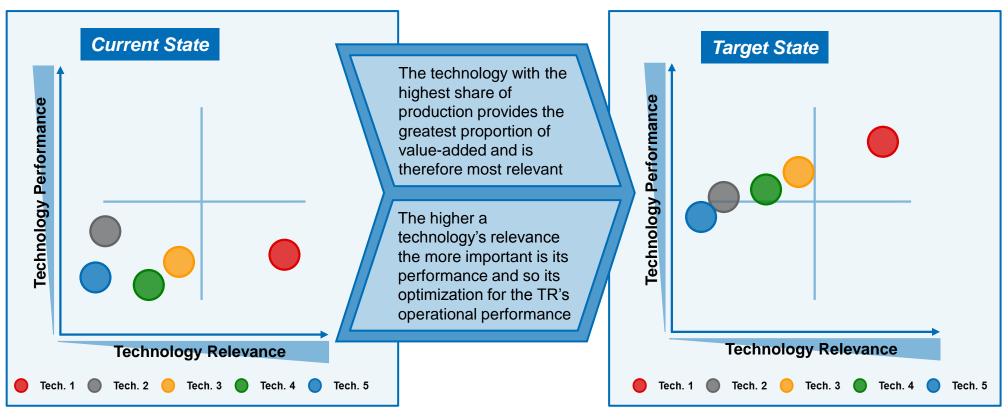




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

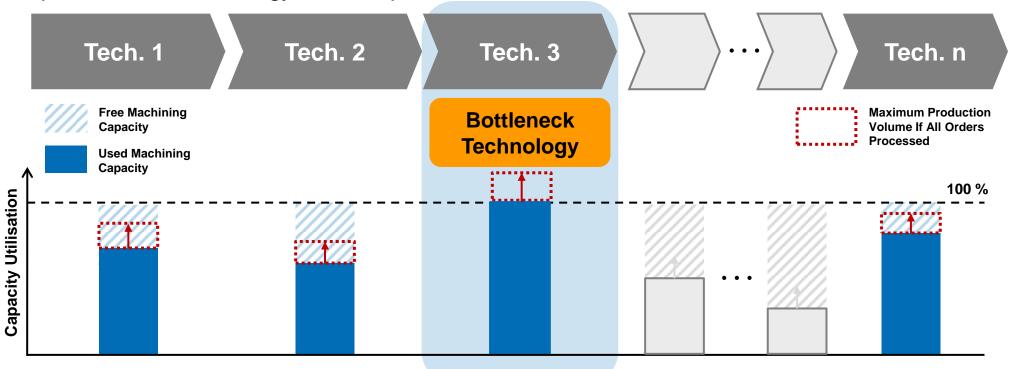




# Bottlenecks have to be eliminated by investing in machinery in order to improve the production capacity



Explanation of Technology Roadmap & Investment Advice



Great potential to create additional value-added in preceding and following manufacturing processes because of inefficient capacity utilisation

The bottleneck technology restricts the possible production capacity of the whole manufacturing chain

Source: Information concerning Bottlenecks was given by the TR's via the benchmarking sheet (by Fraunhofer IPT)

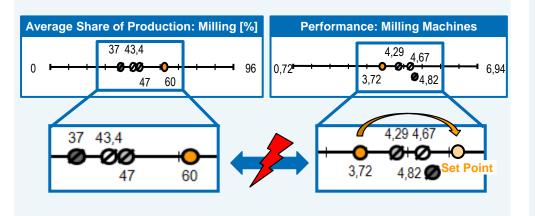




# Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness

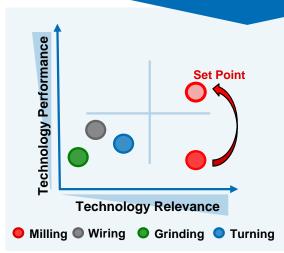


Explanation of Technology Roadmap & Investment Advice



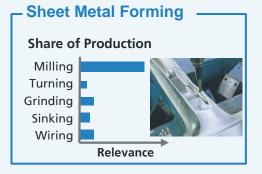


The investment recommendation consists of a large-sized and medium-sized milling machine and a grinding machine



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.











# Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The *5S-Method* helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



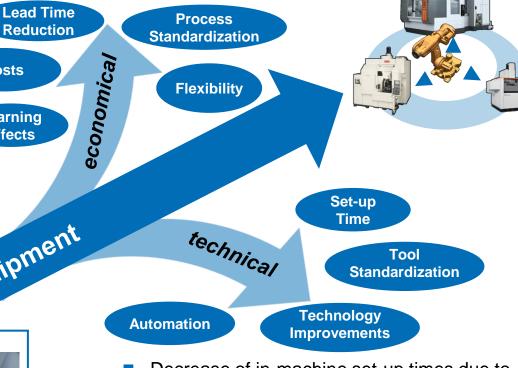
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



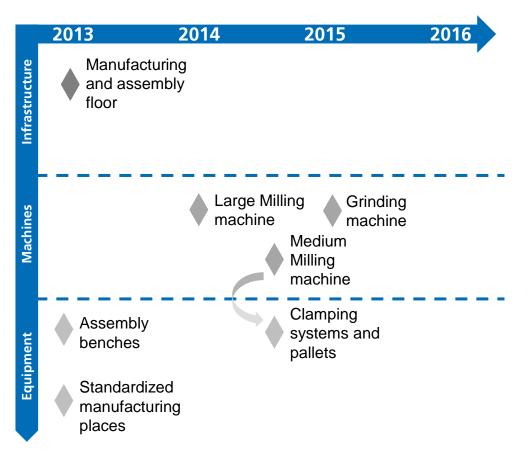


Assembly benches

# Since the infrastructure is an intregal factor for the Tool Rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
  - Renewal of old manufacturing and assembly floors
  - Use of standardized assembly benches with defined equipment (hammer, file etc.) and a visible order
  - Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Machines
  - Large-sized CNC milling machine with medium precision (DMG NHX 5000, 5500 or comparable), an extensive automation is not necessary
  - Medium sized CNC milling machine with high precision (Hermle C30, DMU 50 and comparable), an automated tool changer is required
  - Low automated Grinding machine
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





# Measures for bridging the gap between that status quo and the target state with regard to technology



## Advice Technology

**Short-Term Measures** 

Target: Reduction of manufacturing equipment in order to increase the standardization degree

Standardization of all relevant manufacturing resources

Result: Number of milling tools, clampings etc. are significantly reduced and documented

Target: Reduction of set-up times

SMED Workshop

Result: Action plan for efficiency improvements within the manufacturing department

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

> Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

#### **Proposed Project**

> Standardization of all relevant manufacturing resources

Duration:

Man days:

**Support:** 

10 months 2

20

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to organisation



# Advice Organisation

**Short-Term Measures** 

Target: Definition of current system of planning and controlling of the order fulfillment process

Process-mapping of status quo of order fulfillment process

Result: Mapped order fulfillment process for all departments

#### **Long-Term Measures**

Target: Set-up of a process structure for the future

Design of a milestone-process as reference for future order fulfillment

Result: Increased process stability of order fulfillment

Target: Quality management to increase product quality and customer satisfaction

Definition of quality gates along the order fulfillment process

**Result:** Increased product and process quality

#### **Proposed Project**

Design of a process structure for the future of timely order fulfillment with competitive product quality Duration: Man days:

2 weeks 20

Support:

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to training



### Advice Training

**Short-Term Measures** 

**Target:** Identify potential for establishing connection

Identification of potential for linking the manufacturing competencies and the course offerings

**Result:** Basis for synergies in tool manufacturing and training

#### **Long-Term Measures**

Target: Curriculum specifically addressing the field of automotive tool making

> Design of a curriculum for courses that transport the in-depth knowledge on automotive tool making to students

Result: Competitive edge in training for field of competence as basis for future development and innovative progress

#### **Proposed Project**

Design of a curriculum for courses that transport the in-depth knowledge on automotive tool making to students Duration:

Man days:

**Support:** 

1.5 weeks

15

WZL/WBA/IPT





# Overview of the results of the analysis and the proposed next steps towards the target state



## Summary

#### Strength

High performance of EDM machines

Competitive due date reliability

Training for students with different social backgrounds

#### **Potential**

Low performance of milling machines

Low process stability

Lack of focus of course offerings



#### **IDTR Jamshedpur Vision**

Develop towards a leading supplier for the automotive industry known for process and product quality. Offer a focused portfolio of courses that are aligned with the manufacturing competencies

#### **Technology Project Proposal (20 man days)**

Standardization of all relevant manufacturing resources

#### **Benefit**

Rationalization of processes resulting in higher machine runtimes and shorter lead times

#### Organisation Project Proposal (20 man days)

Design of a process structure for the future of timely order fulfillment with competitive product quality

#### **Benefit**

Simplification of order processing, shortened lead times and improved due date reliability

#### **Training Project Proposal (15 man days)**

 Design of a curriculum for courses that transport the in-depth knowledge on automotive tool making to students

#### **Benefit**

Creation of an unique selling point in training





### **Contact Information**









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# Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps IDEMI Mumbai







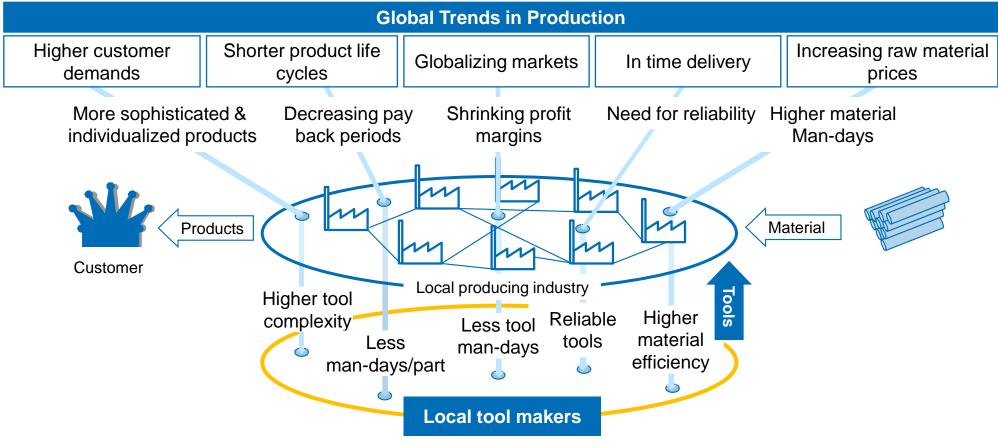
Delhi, 01.-02. November 2012





# Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





# Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

# Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### **Goals of Production**

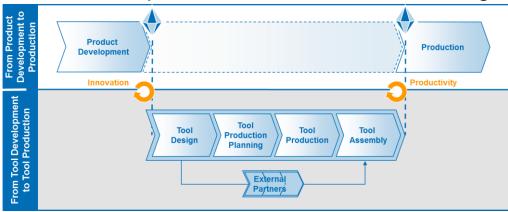
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





# A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



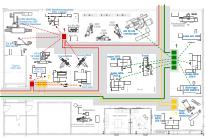


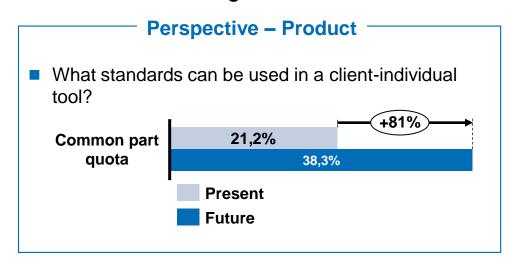
# A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

### **Perspective- Order Processing**

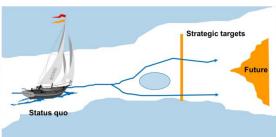
Which standards in order processing enable unique tooling?





### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

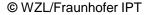


### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

#### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

#### Day II

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





# The IDEMI Mumbai is a leader for calibration & testing services – the tool room offers various tools and training



Introduction



»We are one of a few institutions in India with top-level testing & calibration services«

### Mumbai (Maharashtra) Market

Now: Various focus with strong market

for calibration & testing

Future: Further development of power

suppliers (nuclear, solar)

### Customer Industries

Automotive, general engineering, nuclear,

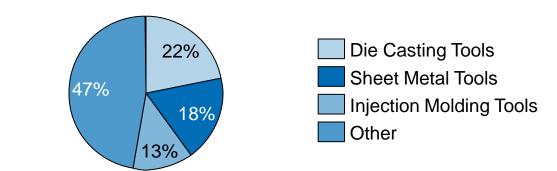
research, solar

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

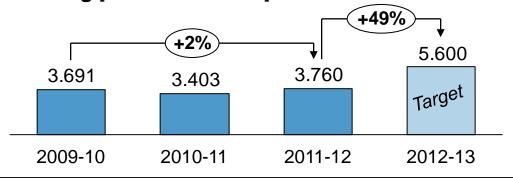




### Manufacturing



Training [Trainees Trained]



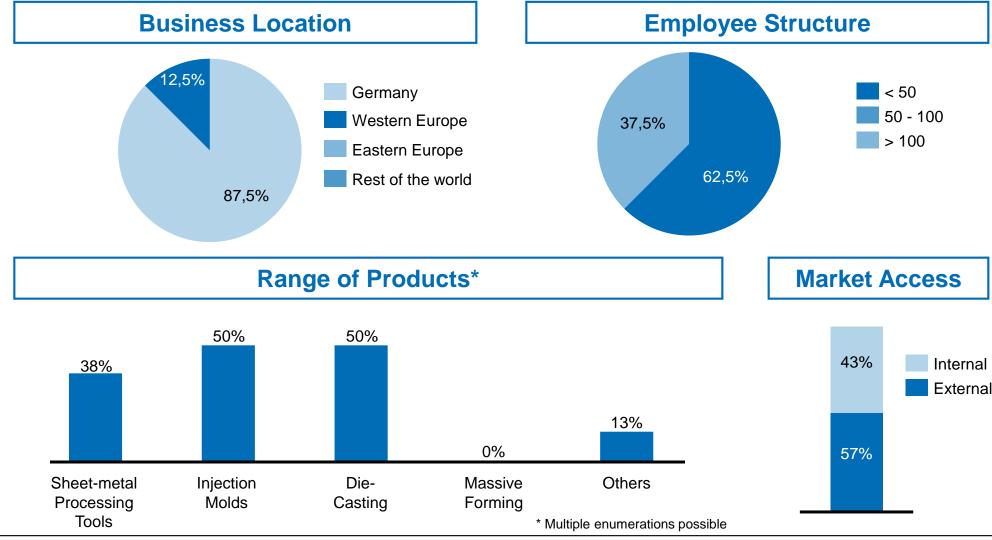
© WZL/Fraunhofer IPT





# The reference group contains companies which are comparable to the tool room





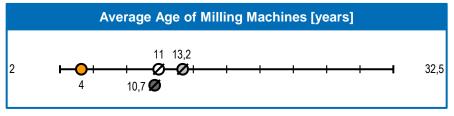


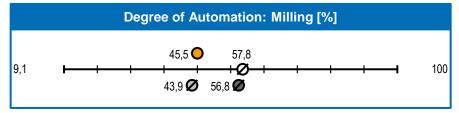


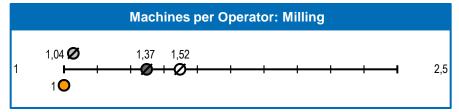
# Technological resources are the enabling factors of a successful tool room

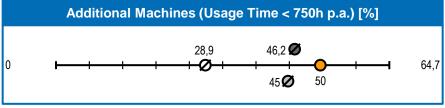


## Analysis Technology (I/VIII)











Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

## **Findings**

- The tool room is characterized by some modern, highly productive machines
- The automation degree is lower compared to the reference group and the average data bank value which is caused by the boundary conditions in India
- The strict assignment of one worker to a specific machine is noticeable. On the one hand it results in maximum machine utilization but lowers the productivity
- The last figure clarifies the visit in August, where dozens of old and low-productive machines exist

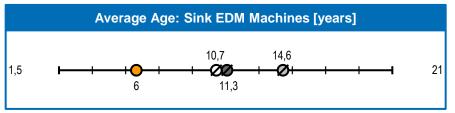


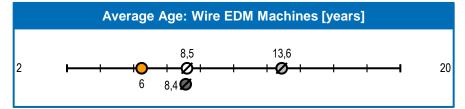


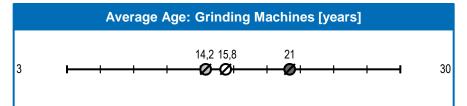
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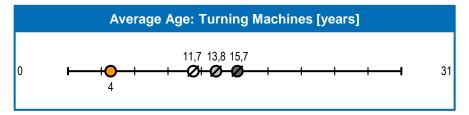


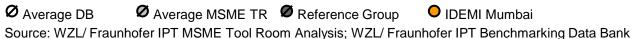
### Analysis Technology (II/VIII)

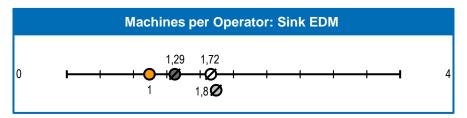


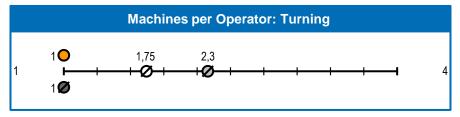


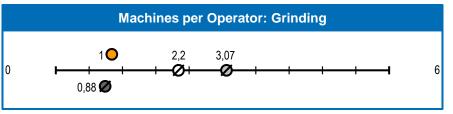


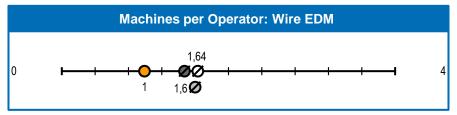












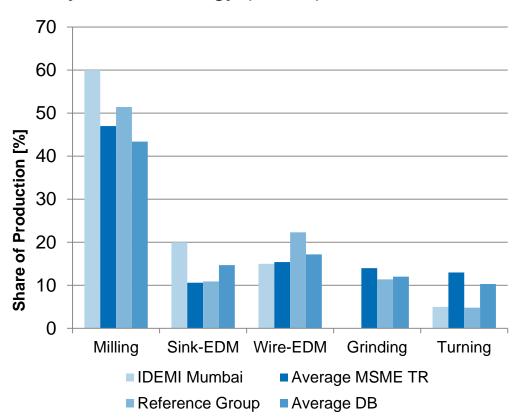


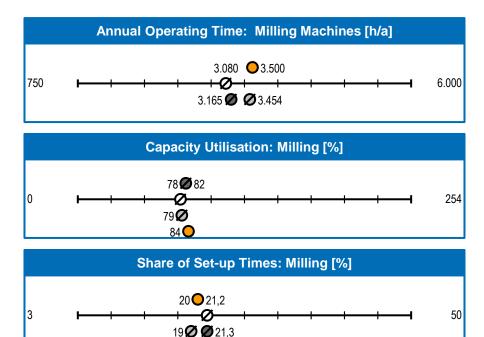


# The economic application of technological resources is described with the technology organization



Analysis Technology (III/VIII)





The set-up time seems to be on an average level but the visit showed just a low machine utilization

Average DB

Average MSME TR Reference Group

O IDEMI Mumbai



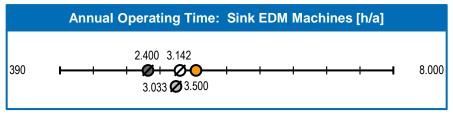


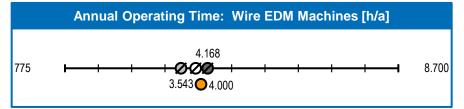


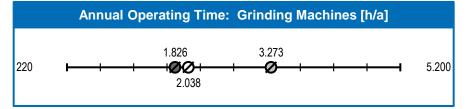
# The economic application of technological resources is described with the technology organization

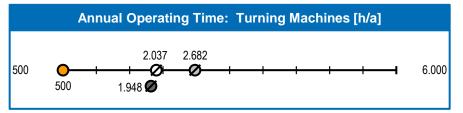


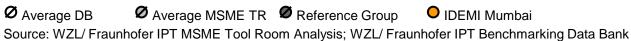
Analysis Technology (IV/VIII)

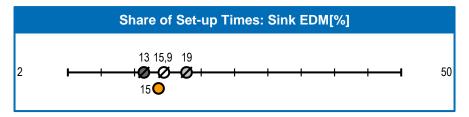


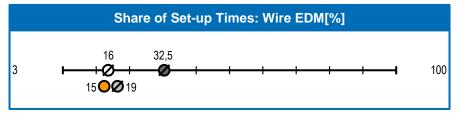


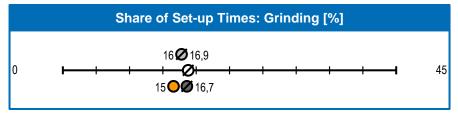


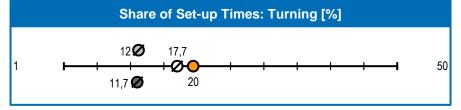












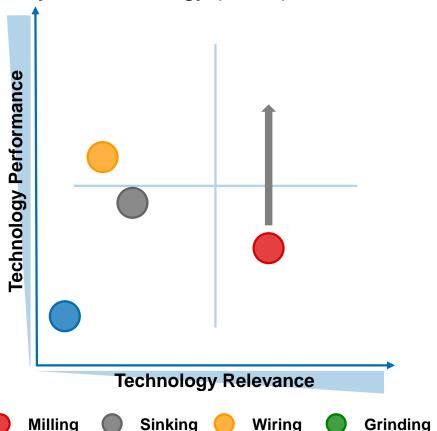




# The economic application of technological resources is described with the technology organization







### **Findings**

- Most of the applied manufacturing technologies show a sufficient distribution between relevance and performance
- Past investments in modern sink- and wire-EDM machines result in a high technological performance
- The investment strategy should take the milling technology more into account
- Although there were some investments in milling machines, the overall performance of the milling department is still too low with regard to the technology relevance

The initial situation for a technologically well positioned tool room exists

**Turning** 

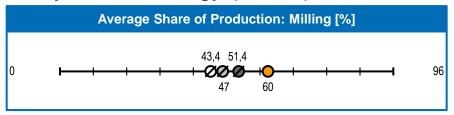


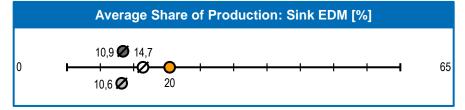


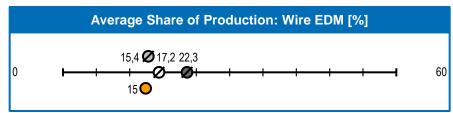
# **Additional Information:** Data for machine performance analysis

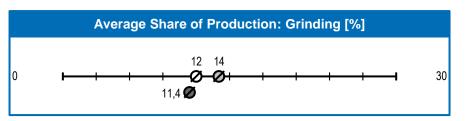


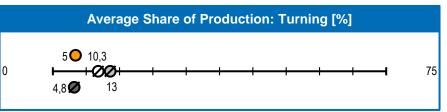
Analysis Technology (VI/VIII)











**Ø** Average DB

Ø Average MSME TR
Ø Reference Group

O IDEMI Mumbai

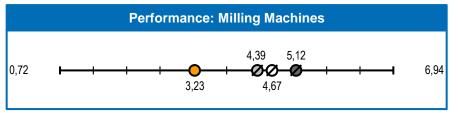


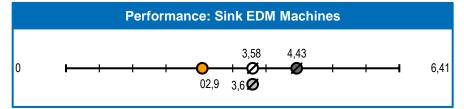


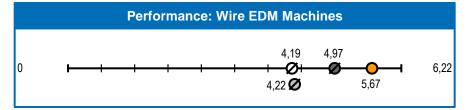
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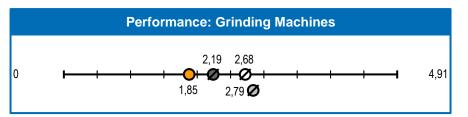


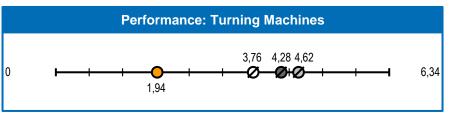
## Analysis Technology (VII/VIII)











**Ø** Average DB

Average MSME TR Reference Group

O IDEMI Mumbai

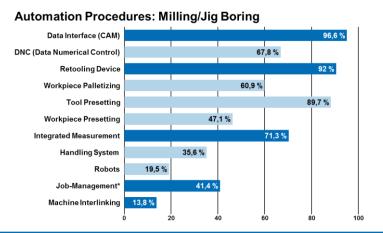


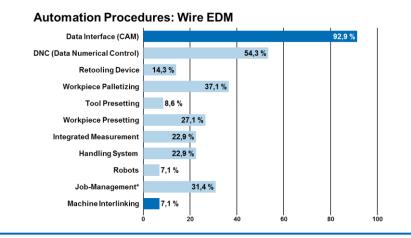


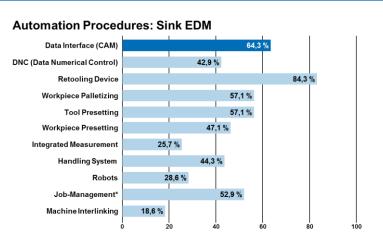
# Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

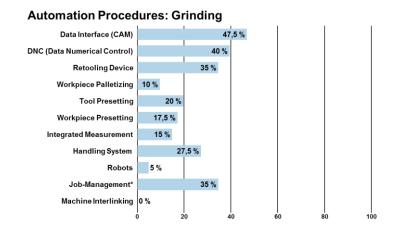


Analysis Technology (VIII/VIII)











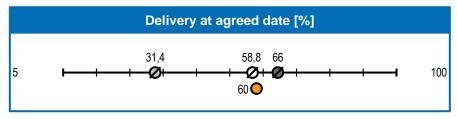


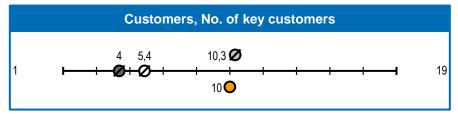


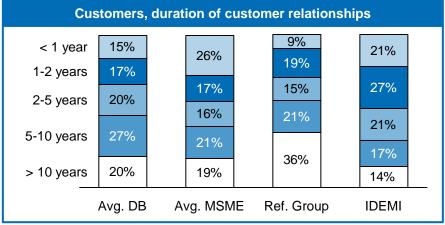
# The organisational capabilities are the key to process efficiency and sustainable development of a tool room



## Analysis Organisation (I/II)







### **Findings**

- With regard to tool making the due date reliability of the Mumbai Tool Room is on a very competitive level
- The amount of key customers is comparable to the MSME average – yet significantly above the international standard
- A high number of key customers yields little consistency in the relationship to customers
- Customer relationships have to be prolonged to enhance process capability and profitability
- The requirements with regard to organisational capability varies significantly between tool making, testing and calibration

Ø Average DB Ø Average MSME TR Ø Reference Group □ IDEMI Mumbai

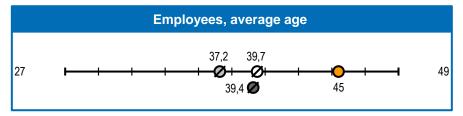


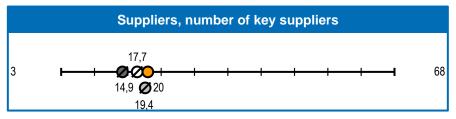


# The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)





### **Findings**

- The average age of the employees in tool making is alarming with regard to future stability
- Know-how has to be contained in the company requiring a structured knowledge transfer between the generations
- Experienced employees enable "quick-fix" solutions to individual tool making processes
- The process structure for tool making has to be upgraded significantly for a sustainable development

IDEMI Mumbai is confronted with the difficult task of serving different industries at the same time – a focus on either testing and calibration or tool making will enhance the organisational capability

Average DB

Average MSME TR Reference Group



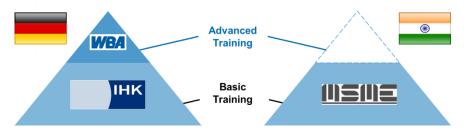




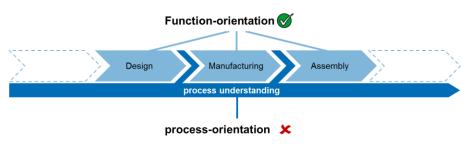
# Education is the backbone for the upgradation of capabilities and future innovation and development



## Analysis Training



General Finding: Lack of advanced training



General Finding: Lack of process-orientation

### **Findings**

- The training programme is set-up for the shortterm creation of revenue
- The training programme has to establish a clear focus to be able to excel in specific fields
- As IDEMI Mumbai has established competencies in testing and calibration; they serve as a factor of differentiation on the market
- Testing and calibration training should be strengthened
- The competence of know-how intense training for manufacturing (e.g. design) has to be sustained and strengthened





# Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

- Most modern machinery of all visited MSME tool rooms
- High competencies in CAM-programming

### **Organisation**

- Strategic position for testing and calibration
- Relatively high due date reliability

### **Training**

Unique facilities for testing and calibration



### **Technology**

- Disputable investment strategy
- Low overall machinery performance as there are too many old (manual) machines

### **Organisation**

- Organisational capabilities are individualbased instead of structure-based
- Lack of order and tidiness

### **Training**

- Standard of facilities
- Broad course offerings even beyond manufacturing, testing and calibration





# The target state serves as a reference point for the orientation of the next development steps



Target State



#### **IDEMI Mumbai Vision**

Be a **Competence center** with state-of-the-art facilities and employees for innovation and industry support with focus on **testing and calibration**.

Renowned **training** center for **testing and calibration** as well as **tool making** 

## **Mission Technology**

Adaption of the technological cababilities to the requirements of testing and calibration as well as tool making according to the overall strategy

### **Mission Organisation**

- Implementation and continuous enforcement of cleanliness and order in all tool making related acitivities
- Establishment of a standard process structure for order in testing and calibration as well as manufacturing

### **Mission Training**

- Strengthening of the programme for testing and calibration as differentiating characteristics
- Design of a strategic portfolio of course offerings around existing operative competencies of IDEMI Mumbai

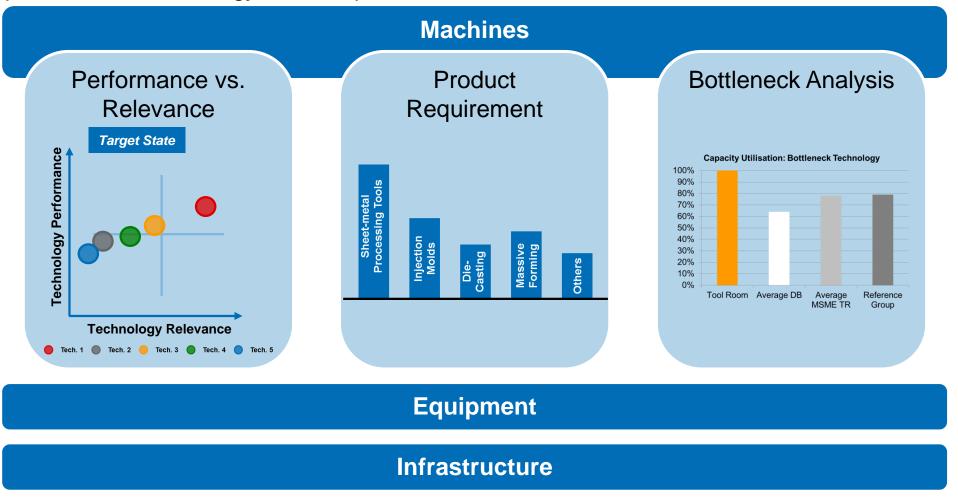




# Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

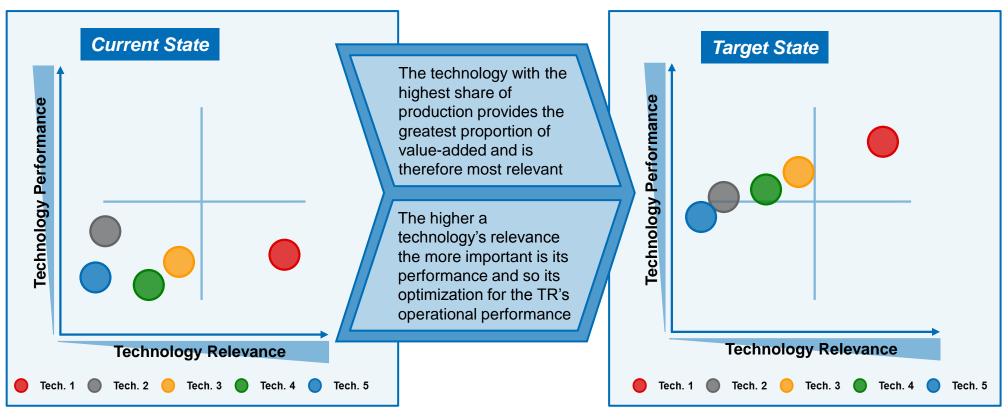




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

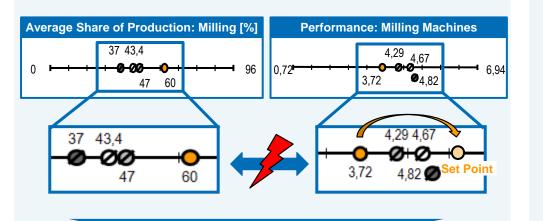




# Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness

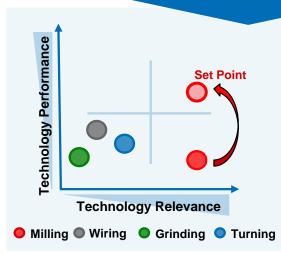


Explanation of Technology Roadmap & Investment Advice

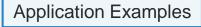


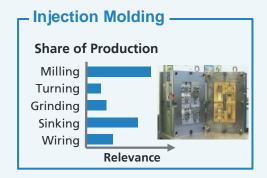


The investment recommendation consists of a new Wire-EDM machine



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.









# Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The 5S-Method helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



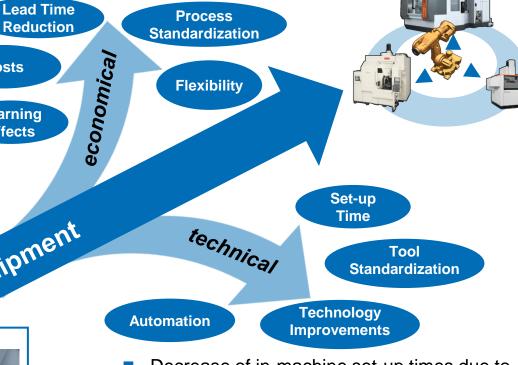
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



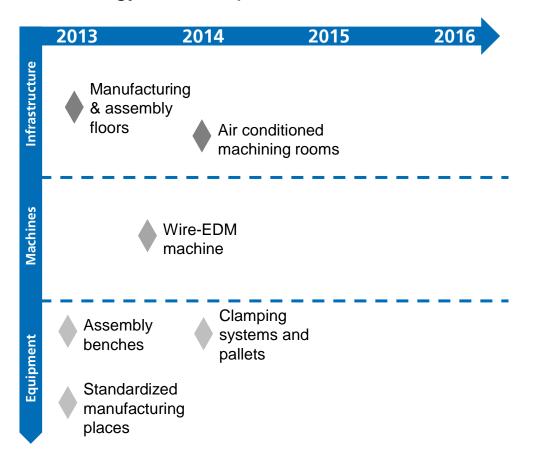


Assembly benches

# Since the infrastructure is an intregal factor for the Tool Rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
- Renewal of old manufacturing and assembly floors
- Use of standardized assembly benches with defined equipment (Hammer, file etc.) and a visible order
- Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Precision machining requires nearly constant temperatures: Air conditioned machining rooms
- Machines
  - Wire-EDM machine (AgieCharmille CUT 20 P and comparable)
  - More machines cannot to be recommended at this time, as the required capacity has to be calculated after old machines were removed
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





# Measures for bridging the gap between that status quo and the target state with regard to technology



### Advice Technology

**Short-Term Measures** 

**Target:** Reduction of old machines and enhancement of overall machine performance

Reassessment of existing machinery

**Result:** Significantly less unproductive machines

Target: Specification of the needed machine capacity

Accurate analysis of the actual machine usage

Result: The actual and future capacity is known and the basic for a long-term investment plan

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

> Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and

#### **Proposed Project**

Reassessment of existing machinery

**Duration:** 

Man days:

Support:

10 months

25

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to organisation



## Advice Organisation

**Short-Term Measures** 

Target: Sound link between the activities in testing and calibration and manufacturing

Identification of synergies between testing and calibration and manufacturing

Result: Increased competitiveness and development capabilities in both operative divisions

**Target:** Development of standard for tidiness and order in all departments

Implementation of tidiness and order

Result: Increased process efficiency through clean and structured workplace environment

#### **Long-Term Measures**

Target: Use of a standardized process structure for order processing

> Design of a process structure for the entire order fulfillment process for testing and calibration and manufacturing

Result: Sustainable routine for increased due date reliability and process stability

Target: Establishment of 6S Routine

Set-Up of a 6S Routine

Result: Sustained process efficiency and increased duration of life cycle of resources

#### **Proposed Project**

Design of a structured milestone process for order processing in testing and calibration and manufacturing **Duration:** Man days:

2 weeks 20

Support:

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to training



### Advice Training

**Short-Term Measures** 

**Target:** Sound portfolio of course offerings that are aligned with operative competencies

Design of strategic training portfolio

Result: Set-up for increased quality of training

#### **Long-Term Measures**

Target: Implementation of the designed strategic training portfolio

Implementation of the designed strategic training portfolio

Result: Higher quality of training to set the foundation for future development

Target: Initiatives for balancing capacity utilization of training resources over the entire calendar year

Design of an action plan to structure course offerings to balance capacity utilization

Result: Action plan for balanced capacity utilization of training resources of the entire calendar year

#### **Proposed Project**

Design of strategic training portfolio in alignment with operative activities in testing and calibration as well as manufacturing **Duration:** 

Man days:

Support:

2 weeks

20

WZL/WBA/IPT





# Overview of the results of the analysis and the proposed next steps towards the target state



## Summary

#### Strength

Modern machines

Good strategic positioning for testing and calibration

Advanced know how and facilities for test. and calib.

#### **Potential**

Overall low performance values of machines

Missing tidiness and order

Broad training portfolio



#### **IDEMI Mumbai Vision**

Be a **Competence center** with state-of-the-art facilities and employees for **innovation** and industry support with focus on **testing and calibration**. Renowned **training** center for **testing** and **calibration** as well as **tool making** 

#### **Technology Project Proposal (25 man days)**

Reassessment of existing machinery

#### **Benefit**

Reduction of labor intensity, productivity enhancements and a support for cleanliness and tidiness

#### Organisation Project Proposal (20 man days)

Design of a structured milestone process for order processing in testing and calibration and manufacturing

#### **Benefit**

**Benefit** 

Simplification of order processing and upgrading of process quality

#### **Training Project Proposal (20 man days)**

Design of strategic training portfolio in alignment with operative Improvement of training offers activities in testing and calibration as well as manufacturing





### **Contact Information**









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# **Analysis of MSME Tool Rooms**

Milestone Documentation

Analysis and Further Steps CTTC Kolkata







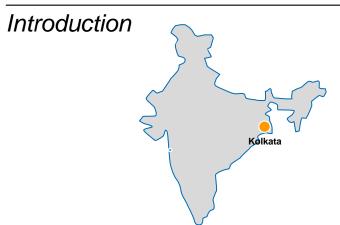
Aachen, August 2013





# The CTTC Kolkata offers its products to state-owned companies and offers training to the entire region





»We are a competent partners for our customers and are developing a training center for Bengal and bordering regions«

### Kolkata (Bengal) Market

*Now:* Few businesses in the area due

to historic background

Future: Growing economy from various

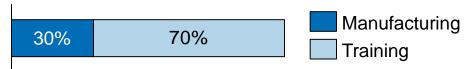
industries

#### Customer Industries

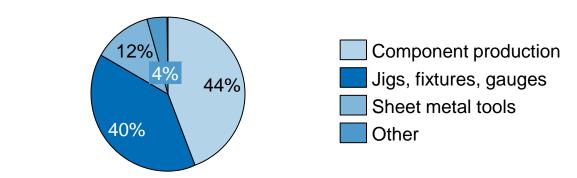
Aeronautics, military, railways, white goods

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

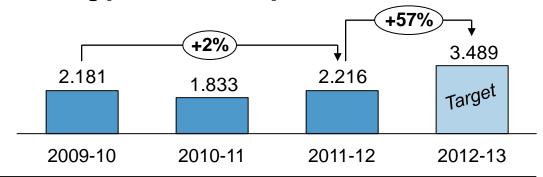




### Manufacturing



#### Training [Trainees Trained]

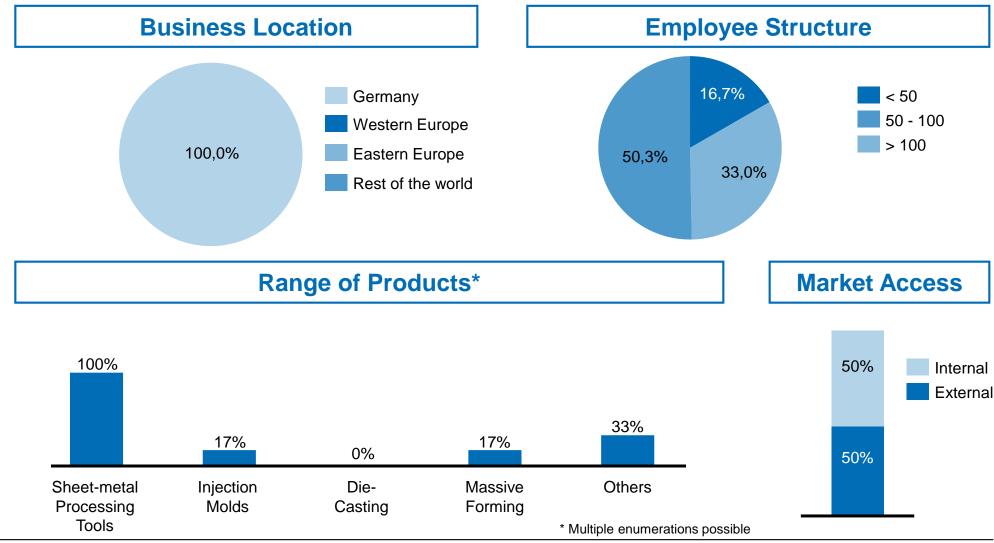






# The reference group contains companies which are comparable to the tool room









# The manufacturing department is characterized by old machinery and antiquate manufacturing operations



## Capability Technology





- Machinery
  - Overall age of the machines is very high which results in lower accuracy and especially in a low productivity of the overall machinery
  - High machine diversity results in a difficult investment and development path

- CAx-Systems
  - High proportion of 2D design, only CNC machined parts are designed in 3D
  - Tools are partially designed in 2D and 3D
  - Diverse usage of design programs which has to be standardized
- Manufacturing Equipment
  - No standardized clamping systems
  - Excessive usage of cooling lubricants
  - Milling tools are ordered on demand
- Innovation

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From a technological perspective the Tool Room has to get upgraded within every technological dimension

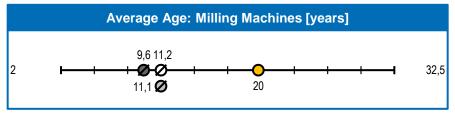


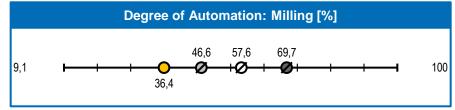


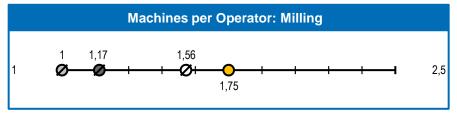
# Technological resources are the enabling factors of a successful tool room

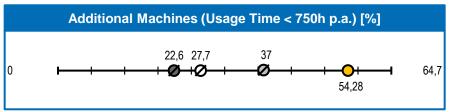


### Analysis Technology (I/VIII)









### **Findings**

- The average age of the main technology machines is much higher in contrast to all reference groups
- The degree of automation is lower compared to the reference group and the average data bank value
- The strict assignment of workers to specific machines is noticeable. Even though it results in maximum machine utilization, it lowers productivity
- The number of machines running with low productivity is too high

Ø Average DB Ø Average MSME TR Ø Reference Group ○ CTTC Kolkata Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

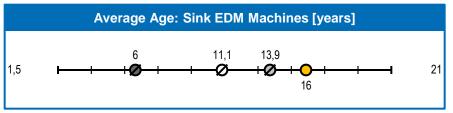


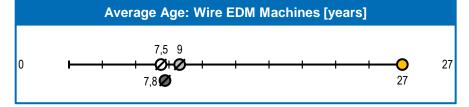


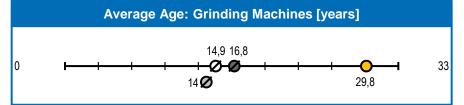
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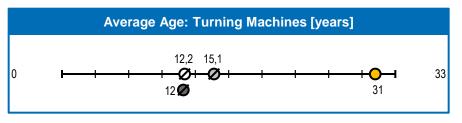


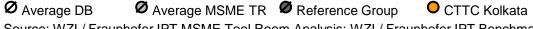
## Analysis Technology (II/VIII)

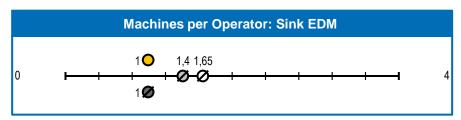


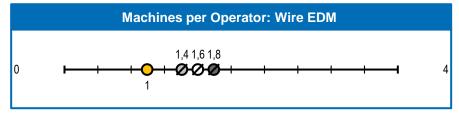


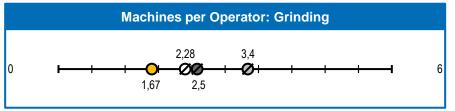


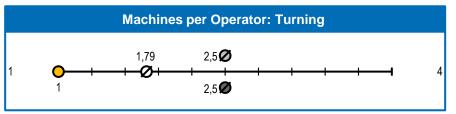












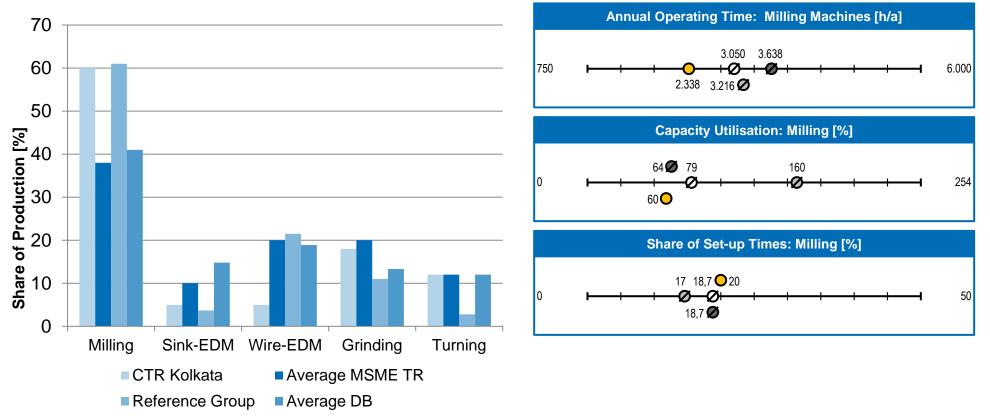




# The economic application of technological resources is described with the technology organization



Analysis Technology (III/VIII)



Annual operating time of milling machines being the core technology is below average

Average DB

Average MSME TR Reference Group

OCTTC Kolkata



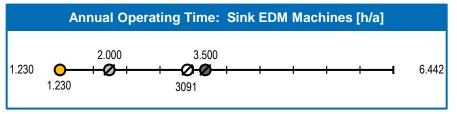


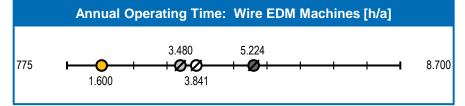


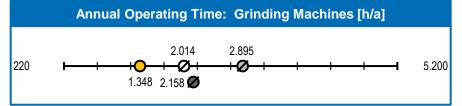
# The economic application of technological resources is described with the technology organization

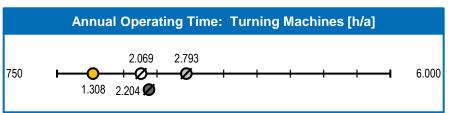


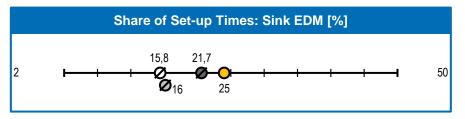
Analysis Technology (IV/VIII)

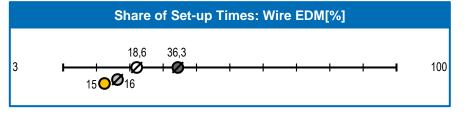


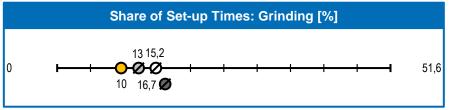


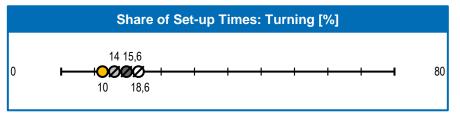














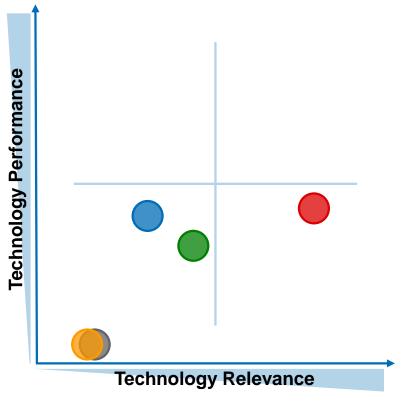




# The economic application of technological resources is described with the technology organization



Analysis Technology (V/VIII)



### **Findings**

- High share of grinding machining shows a potential of milling process improvement
- Investments and deinvestments in every manufacturing technology is highly recommended

Sinking Wiring Grinding Turning

Overall technology performance is below average in contrast to all reference groups

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



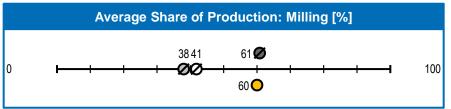


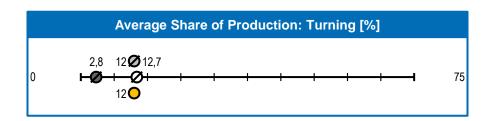
Milling

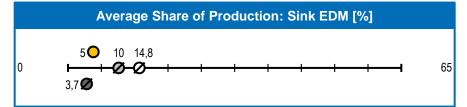
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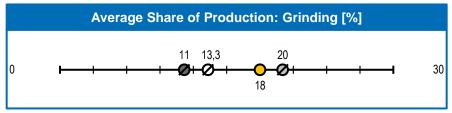


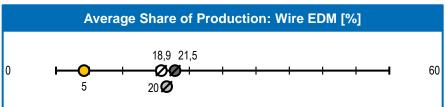
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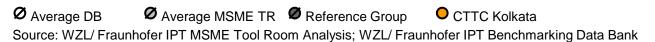












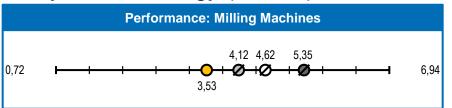


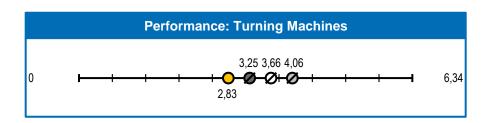


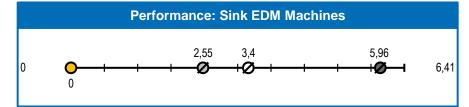
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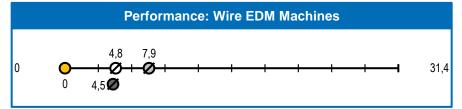


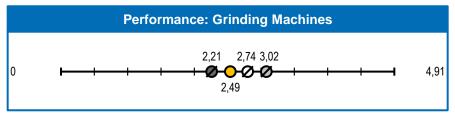
## Analysis Technology (VII/VIII)













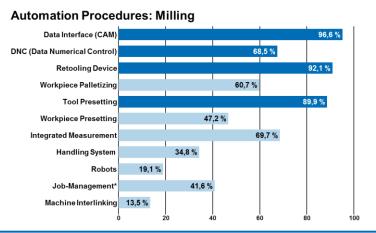


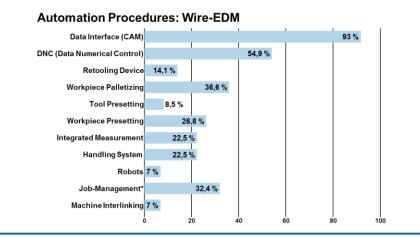


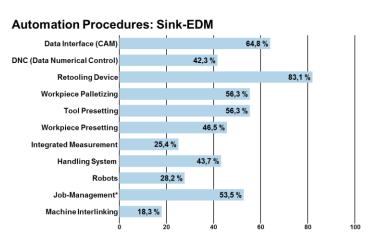
# Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

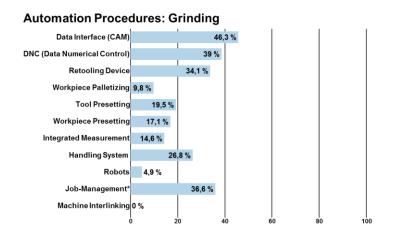


Analysis Technology (VIII/VIII)





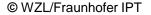




Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



MSME Kolkata 2012



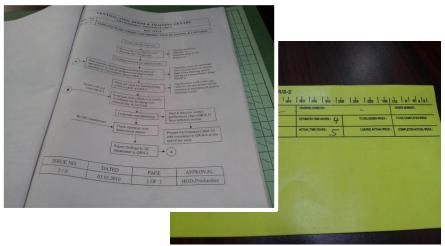




# CTTC Kolkata is still using the organizational structure that had been implemented when it was originally set-up



## Capability Organization



#### Order Fulfillment Process

- Due date reliability and lead time are at a comparatively low level
- Missing structure, planning and controlling along the entire order fulfillment process
- A post-calculation is not part of the process; intransparent costs are inevitable result

### Capacity Utilization

- Capacity utilization of the CNC machines has to be increased in the future
- The value creation depth is extremely high growing businesses in the area have to be used as future partner

### System Application

- No transparent accounting system is in place and has to be developed – causes for low liquidity cannot be tracked
- No data with regard to the order fulfillment process is available electronically

### Employees

- Trainees are integrated into the manufacturing process
- The qualification of the employees is comparatively low the highest of all analyzed Tool Rooms

### Surroundings

During the visit cleanliness and order were at a good level

The organizational structure has to be redesigned to achieve reliable processes and transparent costs

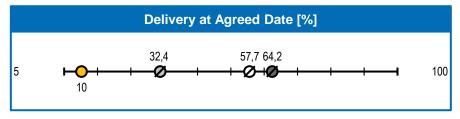


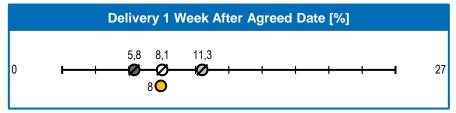


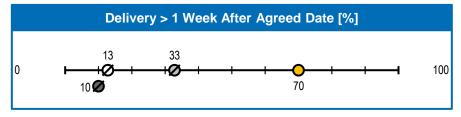
# The organizational capabilities are the key to process efficiency and sustainable development of a tool room

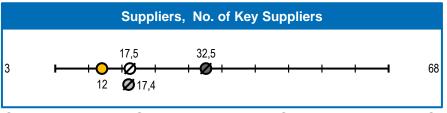


Analysis Organization (I/II)









### **Findings**

- Tool manufacturing does not depend on external factors (almost 100% internal value creation); suppliers have to be continuously developed as the industrial environment is growing in Bengal
- CTTC Kolkata has to improve its planning in the PPC department: planning structures that have been set-up by the Danish decades ago are still being used
- The inventory and stock in especially raw material are currently unknown they have to be tracked and controlled for process and cost efficiency as well as sustainable supplier relations

Ø Average DB Ø Average MSME TR Ø Reference Group ○ CTTC Kolkata

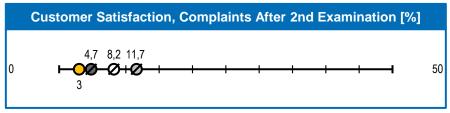


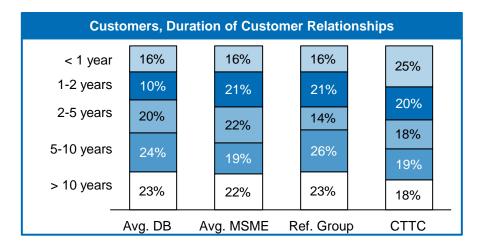


## The organizational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organization (II/II)





### **Findings**

- The customer satisfaction is on a competitive level in comparison to the MSME average and the specific reference group
- The structure of customer relationships is representative of an established organization; however CTTC Kolkata relies on state-owned business as key customers; the build-up of the local industry can be supported
- Long customer relationships are used by successful tool rooms to achieve higher profit levels

CTTC Kolkata features low capabilities in all aspects of organization – a focus on specific core products and the implementation of standard processes is the key for the next steps in the development

Average DB

Average MSME TR Reference Group









## The training is of comparatively low relevance for CTTC Kolkata as of now



## Capability Training



### Course Offerings

- 5 long-term courses for graduates and nongraduates as well as 20 mid- and shortterm courses
- Many courses are tool and die specific;
   synergies between training and
   manfacturing are not used

#### Curriculum

- Course content is subject-specific and fits the requirements of the course description
- Post diploma courses give a deeper understanding of required knowledge for students

#### Resources

- Resources regarding the machines and existing systems are on a good level; infrastructure for audiovisual training improve the training
- Simulation programs are not available and could improve the training

### Training Staff

- Trainers are generally well educated; however sufficiently qualified staff is missing for some courses (i.e. hydraulics and pneumatics)
- Further addition of trainers planned to be able to improve course-specific qualification of trainers at CTTC Kolkata and increase overall intake capacity

Sufficiently qualified staff is the key for successful training and have to be employed for all courses





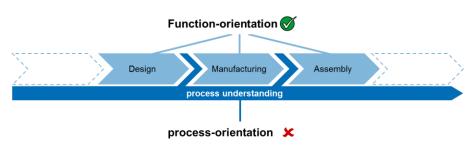
## Education is the backbone for the upgradation of capabilities and future innovation and development



## Analysis Training



General Finding: Lack of advanced training



**General Finding:** Lack of process-orientation

#### **Findings**

- The campus, resources and training programme offer a basic learning environment for professionals of the future
- The infrastructure for hosting students from the entire regions require improvement to increase intake capacity
- The course offerings is very focused in comparison to other Tool Rooms this can support the continuous build-up of competence in training
- The courses analyzed are focused on core knowhow areas in manufacturing – this is a key for training students to be experts of the future
- As the business environment around CTTC Kolkata is currently developing rapidly the demands of the industry and students have to be identified to be able to possibly adapt courses





## Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

 Restricted number of milling tools with standardized cutting parameters

### **Organization**

- Holistic approach to the future development of CTTC Kolkata
- Understanding of the employees of value and principle of process orientation

### **Training**

- Sound focus in a course offering for tool and die making and the industrial sector
- Improvement of didactic tools, i.e. audiovisual infrastructure, support the training efficiency

**Potentials** 

### **Technology**

 Lack of machine utilization results in low actual capacities and cost efficiency

### **Organization**

- Missing transparent controlling make tracking of causes for cost factors and low liquidity difficult
- Missing focus with regard to product and process

#### **Training**

- Staff is not sufficiently qualified for all courses
- Infrastructure for resident-students have to be improved





## The target state serves as reference point for the orientation of the next development steps



Target State



#### **CTTC Kolkata Vision**

Develop to be a **leader in training** professionals for the future in Bengal.

Continue to **improve competences** in tool and die making **by establishing a focus** in manufacturing **with regard to the tools** offered to customers

### **Mission Technology**

 Improve the overall capability of all resources (manpower, machines, system) for tool production

### **Mission Organization**

- Establish transparent accounting structure for cause-specific allocation of costs
- Establish a standardized structure for the order fulfillment process

### **Mission Training**

- Upgrade the qualification of training for the required course offerings
- Improve the infrastructure for resident-students to be able to cater to a growing intake capacity in the future





# Measures for bridging the gap between that status quo and the target state with regard to technology



## Advice Technology

**Short-Term Measures** 

**Target:** Enhancement of overall machinery performance

Disinvestment of old machines

**Result:** Machinery is adjusted to the requirements of a modern production

#### **Long-Term Measures**

**Target:** Enhancement of overall machinery performance

Investments in regard with modern manufacturing technology

Result: Machinery is adjusted to the requirements of a modern production

Target: Advancement of milling cababilities

> Training of all manufacturing workers in regard with modern manufacturing technology

Result: Machinists are able to use the potentials of modern technologies in regard with productivity and quality

**Proposed Project** 

Disinvestment of old (manual) machines

Duration:

Man days:

Support:

4 months

15

WZL/ WBA/ IPT





# Measures for bridging the gap between that status quo and the target state with regard to organization



## Advice Organization

**Short-Term Measures** 

Target: Definition of a transparent accounting structure for controlling and cost tracking

> Define the accounting structure to be able to control and track costs cause-specifically

Result: Defined accounting structure for training and manufacturing

Target: Definition of the future key products and target customer group for manufacturing

Define the key products and respective customers for CTTC Kolkata to focus on in the future

Result: Defined key products and target customer group for manufacturing

#### **Long-Term Measures**

Target: Establishment of a standardized process and planning structure in manufacturing

> Develop and establish a standardized process for order fulfillment in conjunction with a planning structure in PPC

Result: Established standard order fulfillment process and planning structure

Target: Specification of long-term orientation of manufacturing competence and innovation

Specify the long-term orientation of manufacturing competence and innovation based on existing fields of strength

Result: Specified long-term orientation of manufacturing competence and innovation

#### **Proposed Project**

Definition of future key products and target customer groups as well as long-term orientation for manufacturing **Duration:** Man days: Support:

2 weeks 20 WZL/ WBA/ IPT





# Measures for bridging the gap between that status quo and the target state with regard to training



## Advice Training

**Short-Term Measures** 

Target: Definition of requirement of infrastructure for resident-students to increase intake capacity in training

Define the plan for development of intake capacity and specify required infrastructure for resident-students

Result: Defined infrastructure for resident-students as basis for the investment decision

Target: Acquisition of sufficiently qualified trainers for all course offerings

Specify required qualification and recruit trainers that feature this qualification for training

Result: Training staff that is sufficiently qualified for training professionals in the manufacturing industry of the future

#### **Long-Term Measures**

**Target:** Definition of the future target group for potential students from Bengal and the bordering regions

> Define the future target group with regard qualification, background, place of origin and size

Result: Defined future target group for developing CTTC Kolkata as a training center for all bordering regions

#### **Proposed Project**

Definition of the future target group for potential students form Bengal and the bordering regions **Duration:** 

1 week

Man days:

Support:

10

WZL/WBA/IPT

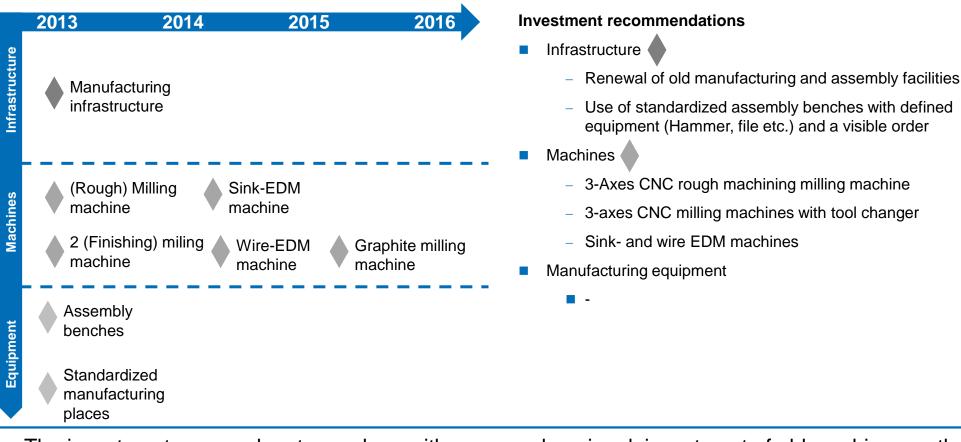




# Since the infrastructure is an intregal factor for tool rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



The investment process has to go along with a comprehensive deinvestment of old machines as the capacity in the Tool Room is sufficient





## Overview of the results of the analysis and the proposed next steps towards the target state



## Summary

#### Strength

Low number of different milling tools

Holistic approach to the future development

Focused course offerings

#### **Potential**

Lack of machine utilization

Low capability – no stringent plan for improvement

Lack of qualified training staff for course offerings



#### **CTTC Kolkata**

Develop to be a **leader in training** professionals for the future in Bengal. Continue to **improve competences** in tool and die making **by establishing a focus** in manufacturing **with regard to the tools** offered to customers

#### **Technology Project Proposal (.. man days)**

Disinvestment of old (manual) machines

#### **Benefit**

Increase of available capacities and basis for enhanced machine utilization

#### **Organization Project Proposal (20 man days)**

Definition of future key products and target customer groups as well as long-term orientation for manufacturing

#### **Benefit**

Basis for sustainable self-sufficiency and targetoriented development

#### **Training Project Proposal (10 man days)**

 Definition of the future target group for potential students form Bengal and the bordering regions

#### **Benefit**

Basis for target-oriented development of training for qualified professionals of the future





### **Contact Information**









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## **Analysis of MSME Tool Rooms**

Milestone Documentation

Analysis and Further Steps CTR Ludhiana







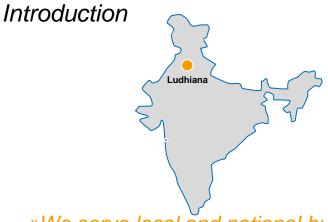
Aachen, August 2013





# The CTR Ludhiana supports the predominantly small and medium businesses of the local industry





»We serve local and national businesses with a broad spectrum in our products and resources«

### Ludhiana (Punjab) Market

Now: Small and medium businesses

from various industries

Future: Automotive sector will be

strengthened by new plants

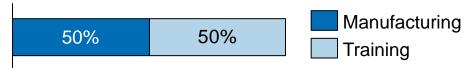
#### Customer Industries

Agricultural, bicycle, office stationary and

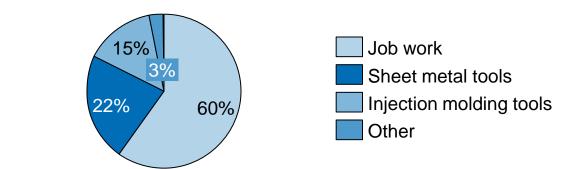
textile

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis



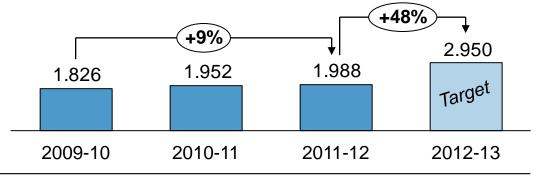


### Manufacturing



#### Training [Trainees Trained]

**IPT** 

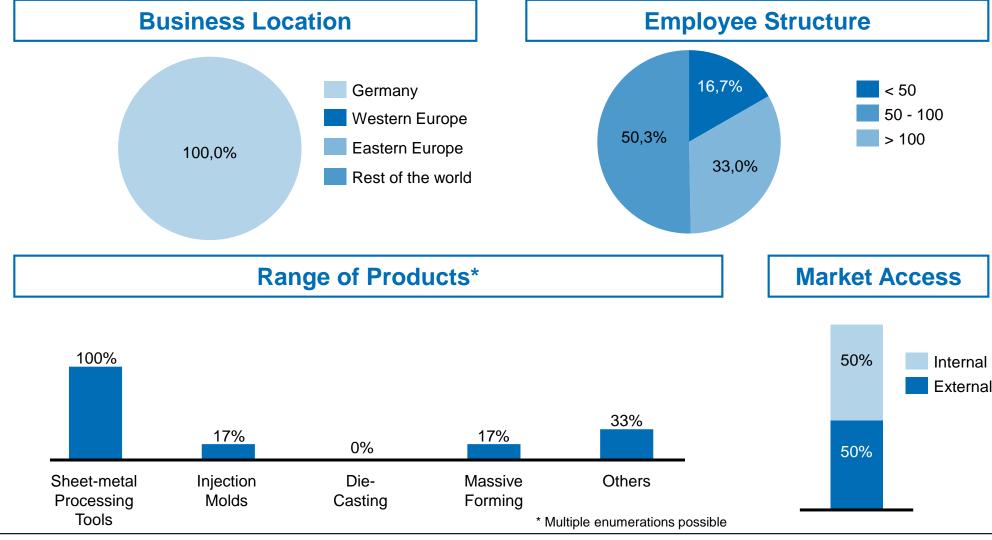






# The reference group contains companies which are comparable to the tool room









# Productivity of the manufacturing department can be increased by state-of-the-art technologies



## Capability Technology





#### Machinery

- Average machine age is high, which is especially considerable in EDM and milling technology
- Own hardening department

### CAx-Systems

- CAx process chain without process breaks since NX is used for CAD and CAM
- Usage of Catia for product design and UG is used for tool design

#### Manufacturing Equipment

- Variety of clamping systems offers flexibility but results in an increased complexity on the shop floor because of longer set-up times and storage
- High share of copper electrodes as graphite electrodes exclusively used for sharp shapes
- Manual milling tool change lowers productivity

#### Innovation

Usage of selective laser melting

Technological performance could be increased by more productive machines and more intelligent equipment although there are some modern technology approaches

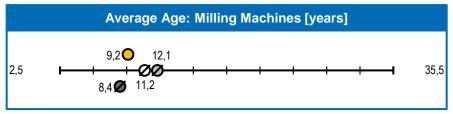


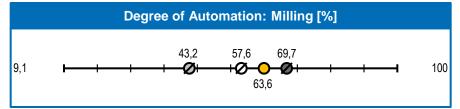


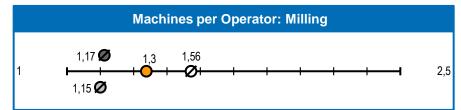
## Technological resources are the enabling factors of a successful tool room

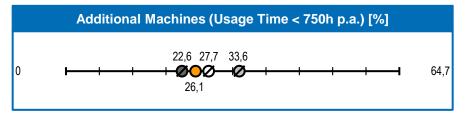


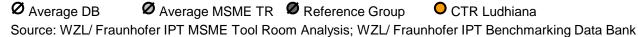
## Analysis Technology (I/VIII)











### **Findings**

- The average age of the main technology machines is on an average level and much better in contrast to other MSME Tool Rooms
- The number of machines running with low productivity is on a good level

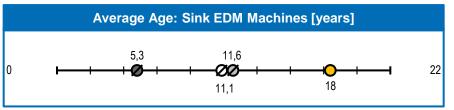
Fraunhofer

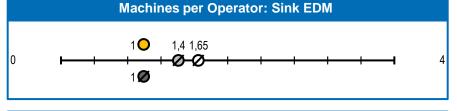


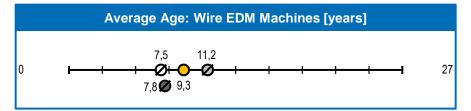
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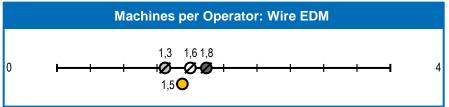


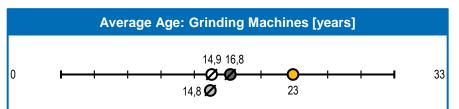
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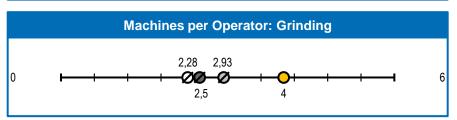


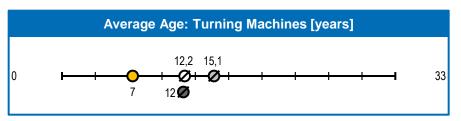


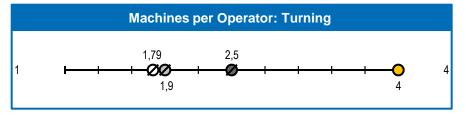












Ø Average DB Ø Average MSME TR Ø Reference Group ○ CTR Ludhiana

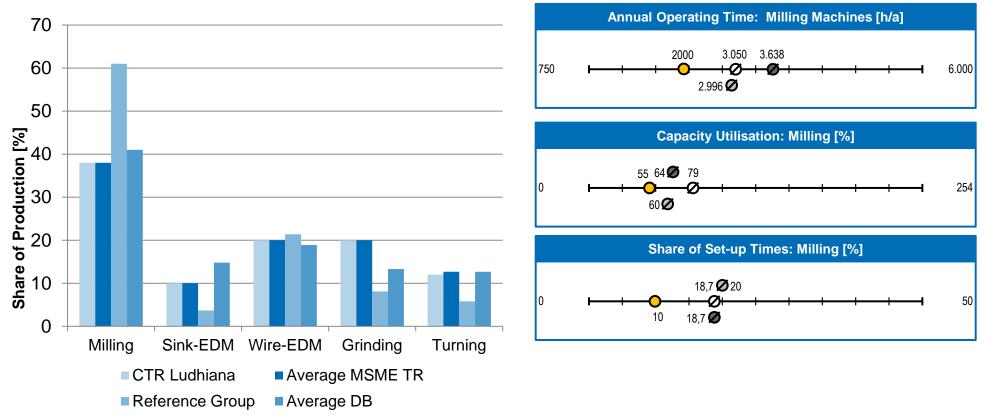




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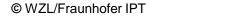


Analysis Technology (III/VIII)



Annual run time of the milling machines is much too low

Average MSME TR Reference Group OCTR Ludhiana Average DB



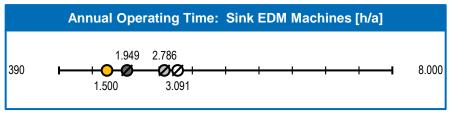


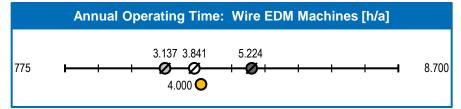


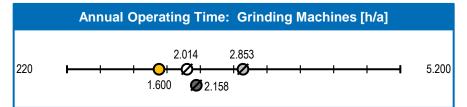
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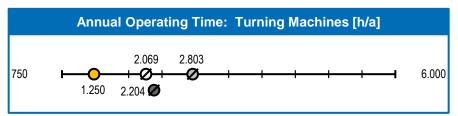


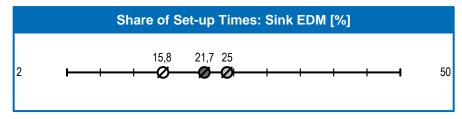
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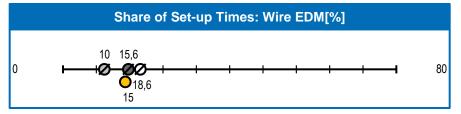


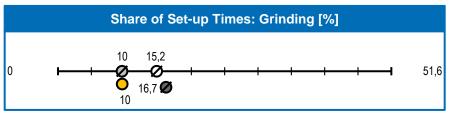


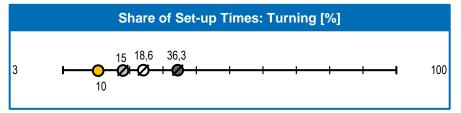












Ø Average DB Ø Average MSME TR Ø Reference Group ○ CTR Ludhiana
Source: WZL / Fraunhofer IRT MSME Tool Room Analysis: WZL / Fraunhofer IRT Renchmark

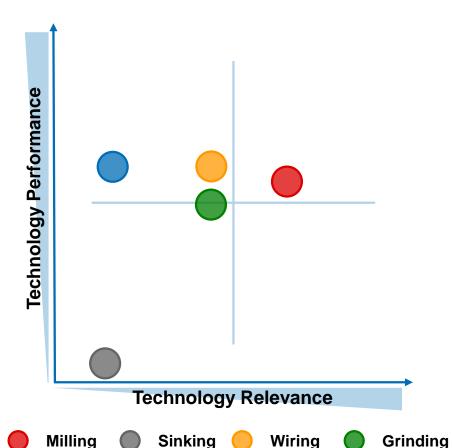




# The economic application of technological resources is described with the technology organization



Analysis Technology (V/VIII)



#### **Findings**

- Relatively low share of milling operations is caused by low capabilities and below average resources in milling
- An upgradation of the milling machinery is favorable in order to substitute redundant manufacturing processes like grinding and EDM

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



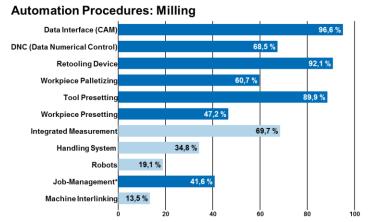
Turning

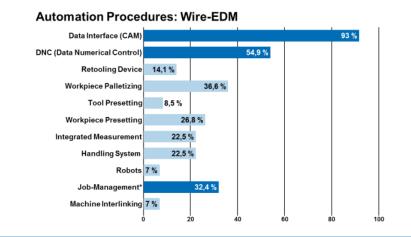


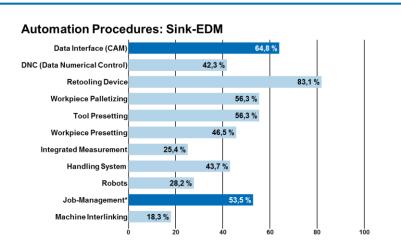
## Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

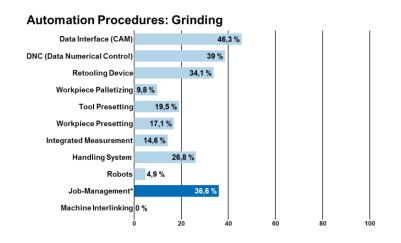


Analysis Technology (VIII/VIII)





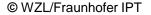




Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



MSME Ludhiana 2012



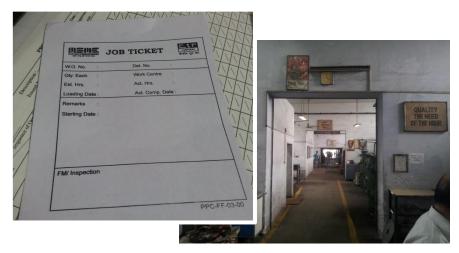




## CTR Ludhiana employs competitive organizational structures



## Capability Organization



#### Order Fulfillment Process

- Due date reliability and lead time are at a comparatively low level
- Milestone process is structured and consistently managed (customized software)
- A post-calculation is not part of the process; intransparent costs are inevitable result

### Capacity Utilization

- Capacity utilization of the CNC machines has future potential
- The value creation depth is extremely high no specific focus is existent

### System Application

- Integration of supplier libraries no CTR Ludhianaspecific standard parts are used for design in CAD
- An electronic planning system for the order management has been set-up and customized

#### Employees

- Trainees are integrated into the manufacturing process
- The qualification of the employees meets the European standard – the average age is alarmingly high

### Surroundings

 Cleanliness is not continuously maintained throughout the facilities; Order is at a good level

The ongoing development has to be continued – planning capabilities have to translate into results

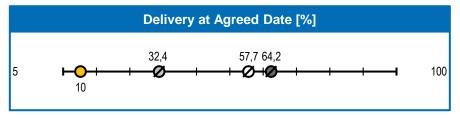


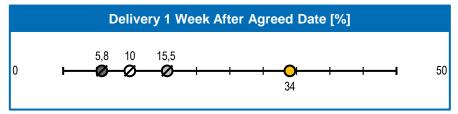


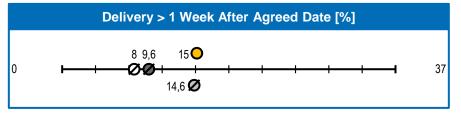
# The organizational capabilities are the key to process efficiency and sustainable development of a tool room

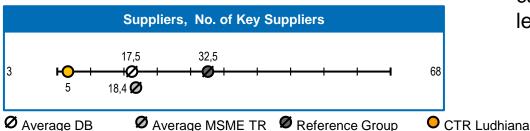


Analysis Organization (I/II)









#### **Findings**

- Tool manufacturing does not depend on external factors (almost 100% internal value creation); strategic suppliers are a positive
- CTR Ludhiana has high capabilities in the PPC department – customized planning software is successfully being employed
- The capabilities in the PPC department are not visible for the customer – due date reliability is at a very low level
- Process planning and control measures are not capable of ensuring higher reliability and lower lead times yet

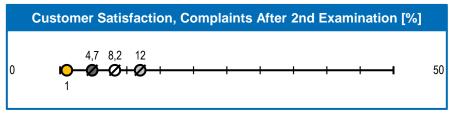


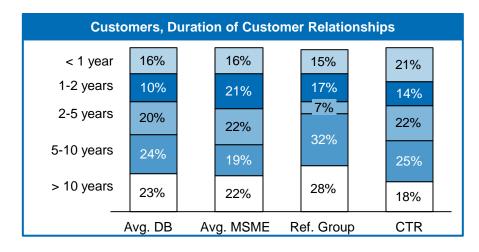


## The organizational capabilities are the key to process efficiency and sustainable development of a tool room



## Analysis Organization (II/II)





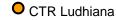
### **Findings**

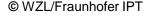
- The customer satisfaction is on a competitive level in comparison to the MSME average and the specific reference group
- The structure of customer relationships is representative of an established organization
- Long customer relationships are used by successful tool rooms to achieve higher profit levels

CTR Ludhiana features good capabilities in all aspects of organization – a focus on specific core products is the key for further development of the organizational capabilities

Average DB

Average MSME TR Reference Group









## The training is of comparatively low relevance for CTR Ludhiana as of now



## Capability Training





### Course Offerings

- 6 relevant long-term courses for graduates and non-graduates as well as 45 mid- and short-term courses
- Many courses are tool and die related which result in synergies between production and training

#### Curriculum

- Course content is very subject-specific and fits the requirements of the course description
- Post diploma courses give a deeper understanding of required knowledge for students

#### Resources

- Comprehensive training facilities with manual working stations, conventional machines – although low number of CNC controlled machines
- Simulation programs are available as a good enhancement of existing machines

### Training Staff

- Trainers are well educated and are working simultaneously in the production
- Further addition of trainers planned to be able to offer courses on mechatronics and increase overall intake capacity

Planning of tool making process could add a further dimension to training portfolio

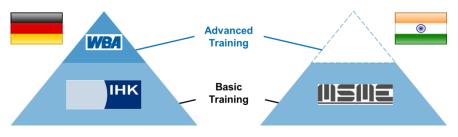




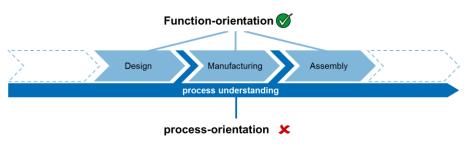
## Education is the backbone for the upgradation of capabilities and future innovation and development



## Analysis Training



General Finding: Lack of advanced training



General Finding: Lack of process-orientation

### **Findings**

- The campus, resources and training programme offer a good learning environment for professionals of the future
- Measures for expanding (C)NC-resources for training purposes have to be defined and executed
- The organizational capabilities have to be transferred into the course offerings to create differentiation
- The courses analyzed are focused on core knowhow areas in manufacturing – this is a key for training students to be experts of the future
- The course structure is in line with reference curricula in Germany (although general findings also apply here)





## Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

 Restricted number of milling tools with standardized cutting parameters

### **Organization**

- High capabilities with regard to planning and controlling of jobs
- The efficiency in tool manufacturing can be controlled accurately with customized software

### **Training**

- Solid focus in the spectrum of offered courses
- Specific courses for the demands of the local industries are offered



### **Technology**

- Relatively high share of EDM and usage of copper electrodes
- Rough machining with low performance

#### **Organization**

- Low quality of key process parameters (due date reliability and lead time)
- Missing focus in the product and resource spectrum

### **Training**

- Infrastructure of the area limits access of potential students to facilities
- Low number of CNC controlled machine





## The target state serves as reference point for the orientation of the next development steps



Target State



#### **CTR Ludhiana Vision**

Strengthen the position as a leader with regard to organizational aspects of tool and die making to support the development of the local industry in Punjab. Synchronize manufacturing competences with training of students

### **Mission Technology**

- Improve technology chains with tool production with further focus on milling technology
- Improvement of the capability of machines for a focused spectrum of technologies

### **Mission Organization**

- Establish a standardized process for larger orders with higher demands with regard to quality
- Establish a standardized process for smaller order for local businesses

### **Mission Training**

 Establish connection between the planning competence in manufacturing and the course offerings





# Measures for bridging the gap between that status quo and the target state with regard to technology



## Advice Technology

**Short-Term Measures** 

Target: Enhancement of rough machining performance

Enhancement of CNC machine proportion and application of state of the art rough milling strategies

Result: Capacity enhancement and higher productivity

**Target:** Improvement of manufacturing technology chains within the tool production

Strengthen of milling technology as well as reduction of grinding and EDM machining

Result: Higher cost efficiency and lower lead times in the manufacturing department

#### **Long-Term Measures**

Target: Implementation of a high performance milling department

Substitution of old machines and application of cutting-edge milling strategies

Result: High performance manufacturing center for the core technology

Target: Efficiency improvements by reduction of electrode milling and sink-EDM machining time

Implementation of graphite electrodes

Result: Switch from copper to graphite electrodes successfully accomplished

#### **Proposed Project**

Implementation of a high performance milling department

**Duration:** 

Man days:

Support:

6 months

30 + invest

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to organization



## Advice Organization

**Short-Term Measures** 

**Target:** Establishment of respectively focused product spectrums for local orders and large orders

> Define a product spectrum for local order and define product spectrum for large orders

Result: Defined product spectrum for local orders and for large orders

**Target:** Establishment of a standardized milestone process structure for local orders and large orders

Define a standardized milestone process structure for local orders and for large orders

Result: Defined milestone processes for local orders and for large orders

#### **Long-Term Measures**

**Target:** Implementation of milestone processes

Implement the defined milestone processes into the daily routine of PPC, manufacturing and controlling

Result: Running milestones processes for increased due date reliability and cost efficiency

Target: Establishment of standardization cycle between design, PPC and manufacturing

Set-up clear billing positions for all services and processes offered to the customer

Result: Standardization routine for continuous improvement in the products and processes

#### **Proposed Project**

Definition of product spectrums and set-up of milestone processes for local orders and large orders **Duration:** Man days: Support:

2 weeks 20 WZL/ WBA/ IPT





## Measures for bridging the gap between that status quo and the target state with regard to training



## Advice Training

**Short-Term Measures** 

**Target:** Integration of planning competence in production into training curriculum

Define and transfer planning competence into training curriculum

Result: Enhanced understandings for a key organizational competence of tool making and industrial production overall

#### **Long-Term Measures**

**Target:** Set-up of courses on mechatronics

Design as well as competence and resource build-up for courses on mechatronics

**Result:** Competitive edge in training for field of competence as basis for future development and innovative progress

**Target:** Strategy for increased attractiveness for potential students

Design of a strategy for increased value and accessibility of training for potential students

Result: Strategy for the increase in enrolled students and future differentiation

#### **Proposed Project**

Definition of the curriculum for planning as part of future training

**Duration:** 

1 week

Man days:

10

**Support:** 

WZL/WBA/IPT

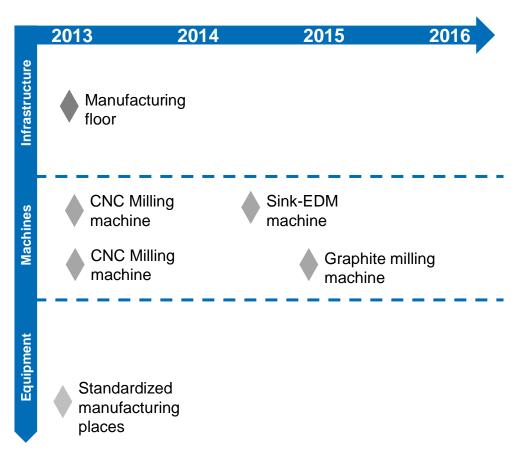




# Since the infrastructure is an intregal factor for tool rooms, this dimension is covered by the roadmap



## Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
  - Renewal of old manufacturing and assembly facilities
  - Use of standardized assembly benches with defined equipment (Hammer, file etc.) and a visible order
- Machines
  - CNC rough machining milling machine
  - CNC milling machines with tool changer
  - Sink-EDM machine
- Manufacturing equipment

\_ .





## Overview of the results of the analysis and the proposed next steps towards the target state



## Summary

#### Strength

Availability of entire process chain

High capabilities in the PPC department

Course offerings in accordance with local demand

#### **Potential**

Low exploitation of machine potentials

Low due date reliability and long lead times

Missing link between training and manufacturing focus



#### **CTR Ludhiana Vision**

Strengthen the position as a leader with regard to organizational aspects of tool and die making to support the development of the local industry in Punjab. Synchronize manufacturing competences with training of students

#### **Technology Project Proposal (20 man days)**

Implementation of a high performance milling department

#### **Benefit**

Significant reduction of set-up times (up to 70%) resulting in much higher machine capacity

#### **Organization Project Proposal (20 man days)**

Definition of product spectrums and set-up of milestone processes for local orders and large orders

#### **Benefit**

Increased cost efficiency and process reliability for all orders

#### **Training Project Proposal (10 man days)**

Definition of the curriculum for planning as part of future training

#### **Benefit**

Differentiating content for training and transferring key competence to future employees





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## Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps IGTR Ahmedabad







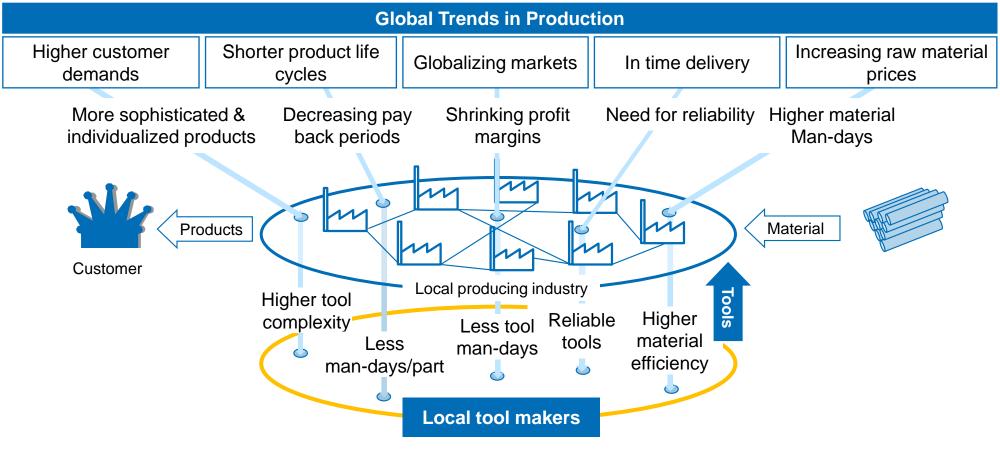
Delhi, 01.-02. November 2012





# Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





## Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

### Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

#### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### Goals of Production

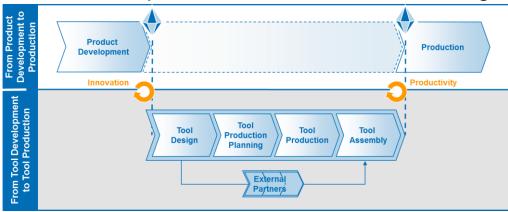
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





### A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



#### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

#### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



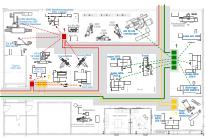


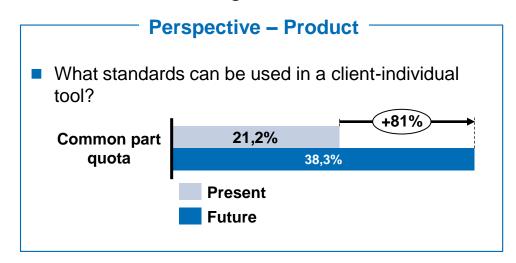
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

#### **Perspective- Order Processing**

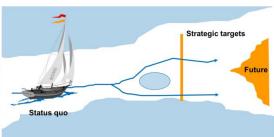
Which standards in order processing enable unique tooling?





#### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

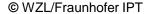


#### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

#### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

#### Day II

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





### The IGTR Ahmedabad excels in injection molding tools and continuously expands its training capacities



Introduction



»Companies from all over India approach us for complex injection molding solutions«

#### **Ahemdabad (Gujarat) Market**

Moderate intensity with various Now:

focuses

Future: Automotive sector will be

strengthened by new plants

#### **Customer Industries**

Automotive, defense, electronics, facility

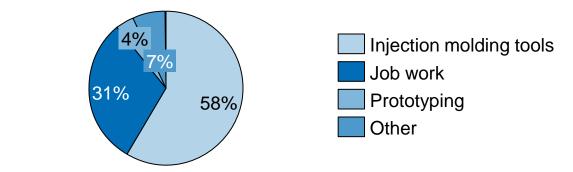
equipment, medical, packaging

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

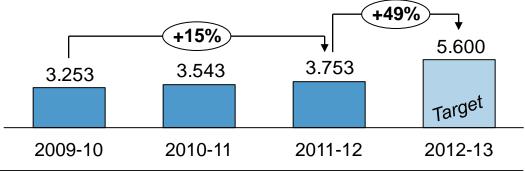




#### Manufacturing



**Training** [Trainees Trained]

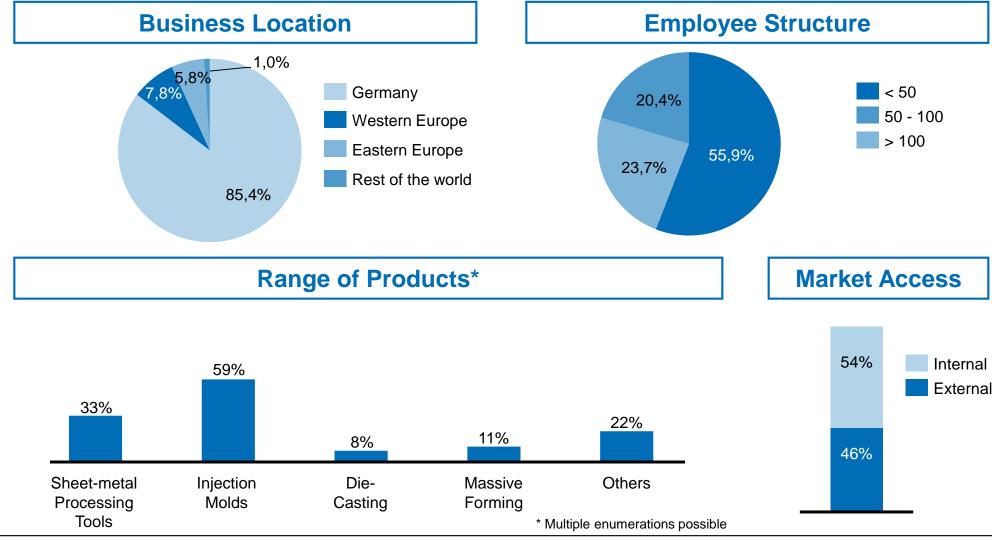






### The reference group contains companies which are comparable to the tool room





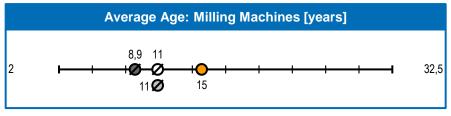


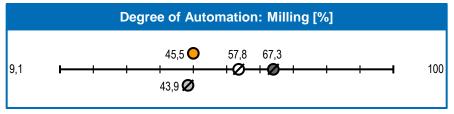


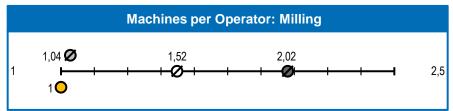
### Technological resources are the enabling factors of a successful tool room

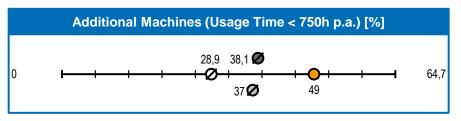


#### Analysis Technology (I/VIII)









#### **Findings**

- The average age of the main technology machines is much higher in contrast to all reference groups
- The degree of automation is lower compared to the reference group and the average data bank value which is caused by the boundary conditions in India
- The strict assignment of one worker to a specific machine is noticeable. Even though it results in maximum machine utilization, it lowers productivity
- The number of machines running with low productivity is too high

Average MSME TR Reference Group Average DB IGTR Ahmedabad

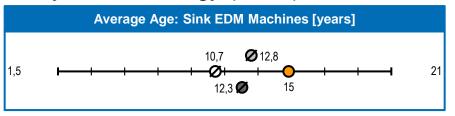


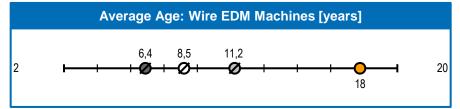


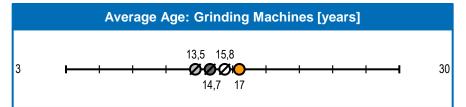
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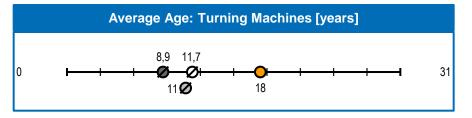


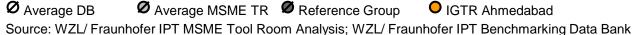
Analysis Technology (II/VIII)

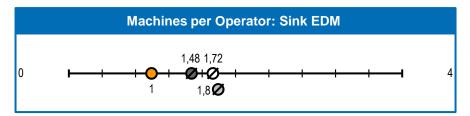


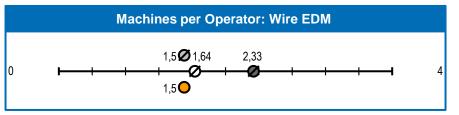


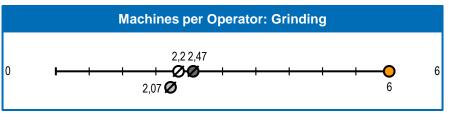


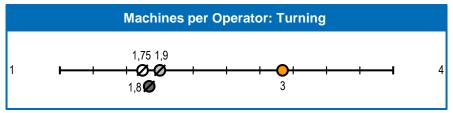












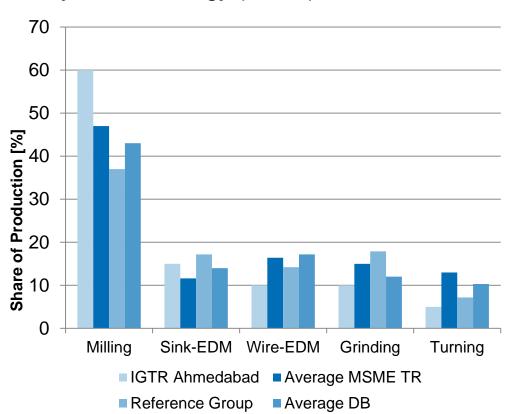


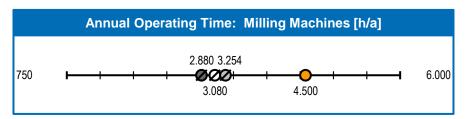


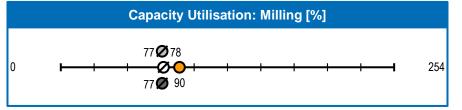
### The economic application of technological resources is described with the technology organization

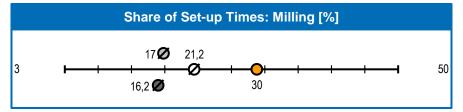


Analysis Technology (III/VIII)







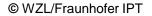


The set-up time needs about 30 % of the milling department's overall machining time

Average DB

Average MSME TR Reference Group

O IGTR Ahmedabad



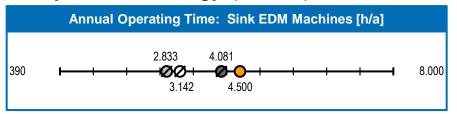


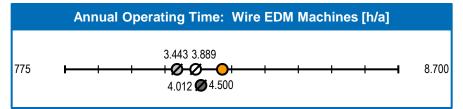


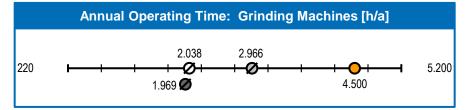
## The economic application of technological resources is described with the technology organization

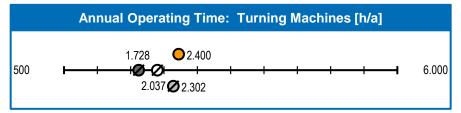


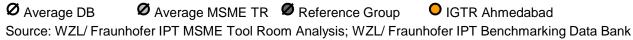
Analysis Technology (IV/VIII)

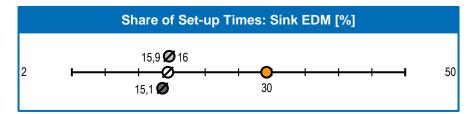


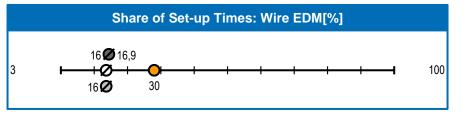


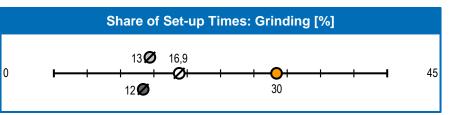


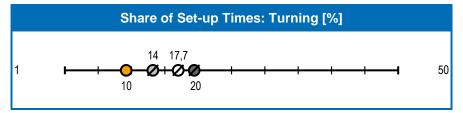












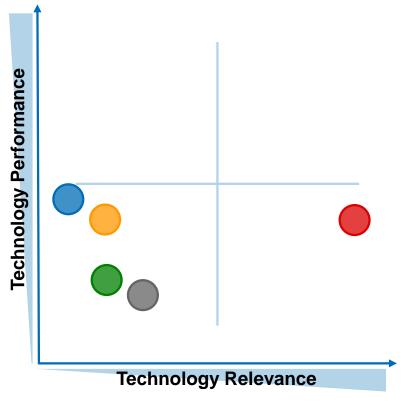




## The economic application of technological resources is described with the technology organization







#### **Findings**

- The milling technology as the most important technology in Aurangabad needs to be upgraded by investments in suitable machines for injection moulding tools
- The investment strategy raises questions, as the important sink-EDM and grinding technologies are not supported by high performance machines whereas the lathes are in good level

Milling Sinking Wiring Grinding Turning

Either the milling, sink-EDM and grinding technologies must be up-graded or a efficient tapered production is needed

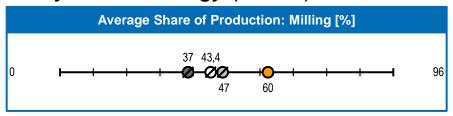


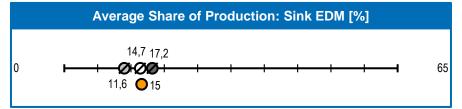


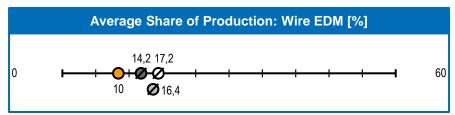
### **Additional Information:** Data for machine performance analysis

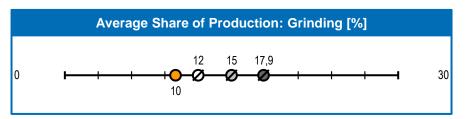


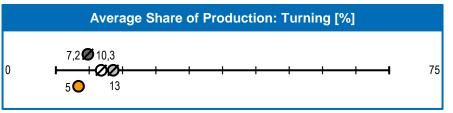
Analysis Technology (VI/VIII)











**Ø** Average DB







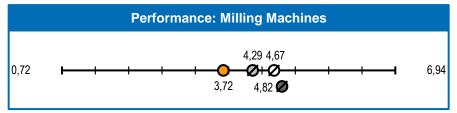


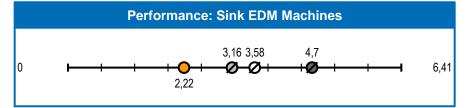


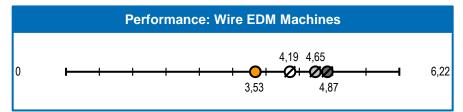
### **Additional Information:** Data for machine performance analysis

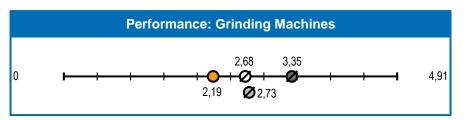


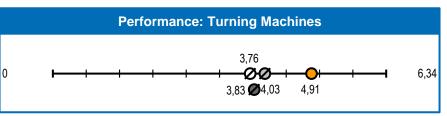
#### Analysis Technology (VII/VIII)











**Ø** Average DB

Average MSME TR Reference Group

O IGTR Ahmedabad

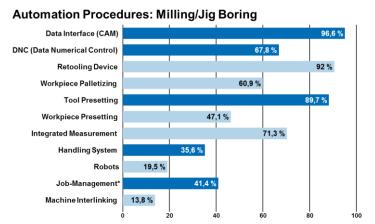


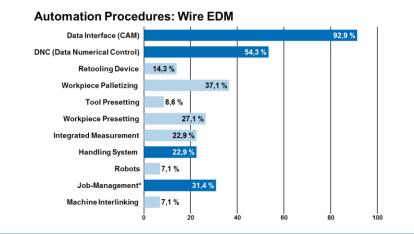


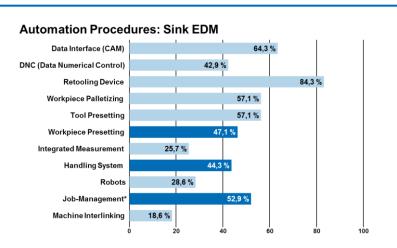
### Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

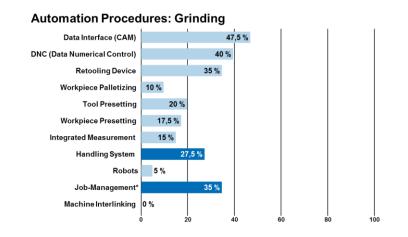


Analysis Technology (VIII/VIII)





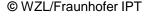




Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



MSME Ahmedabad 2011



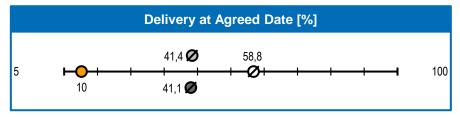


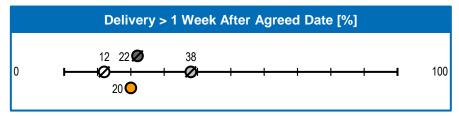


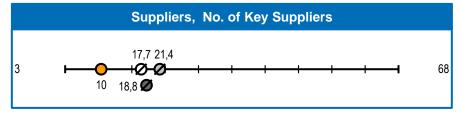
### The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (I/II)







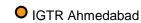
#### **Findings**

- The potentials of the focused product portfolio are not being used to enhance the reliability of the order fulfillment process
- Compared to the average of MSME tool rooms long delays of delivery are relatively seldom
- The focused product portfolio enables the tool room to work with a selected group of suppliers all reference groups show significantly higher values
- Process planning and control measures are not capable of ensuring higher reliability and lower lead times









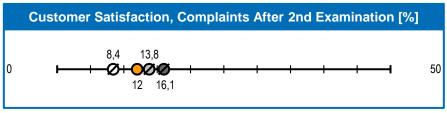


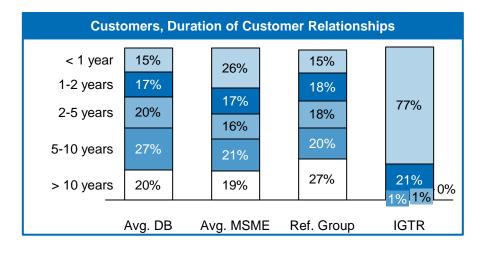


### The organisational capabilities are the key to process efficiency and sustainable development of a tool room



#### Analysis Organisation (II/II)





#### **Findings**

- The customer satisfaction is on a competitive level in comparison to the MSME average and the specific reference group
- The average of the data bank yields significant potential for enhancement of customer satisfaction the IGTR's value is 50% higher
- The structure of customer relationships shows the relatively young age of the organisation
- Long customer relationships are used by successful tool rooms to achieve higher profit levels

IGTR Ahmedabad has a bright perspective because of its focus on injection molding tools – that potential can currently not be translated into an organisational capability of international caliber

Average DB

Average MSME TR Reference Group



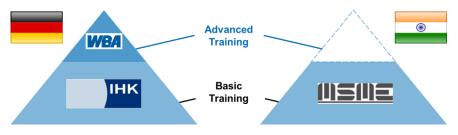




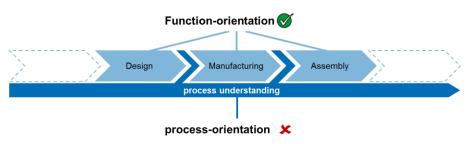
### Education is the backbone for the upgradation of capabilities and future innovation and development



#### Analysis Training



General Finding: Lack of advanced training



General Finding: Lack of process-orientation

#### **Findings**

- The campus, resources and training programme offer a good learning environment for professionals of the future
- The current measures of expanding resources to manage intake capacity should be continued
- The manufacturing focus on injection molding has to be transferred into the course offerings to create differentiation
- The courses analyzed are focused on core knowhow areas in manufacturing – this is a key for training students to be experts of the future
- The course structure is in line with reference curricula in Germany (although general findings also apply here)





## Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



#### **Technology**

- High degree of manufacturing innovation
- Availability of the entire process chain

#### **Organisation**

- Strategic focus on tools for injection molding
- Good integration into the process chain of the customer
- High standard of tidiness and order

#### **Training**

 Large facilities to attend to the required higher intake capacity



#### **Technology**

- Long set-up times
- Performance potential of machines not entirely used

#### **Organisation**

- Low quality of key process parameters (due date reliability and lead time)
- Weak structure of planning and control or order fulfillment process

#### **Training**

 Missing link between course offerings and competence fields in manufacturing





### The target state serves as reference point for the orientation of the next development steps



Target State



#### **IGTR Ahmedabad Vision**

Be a **center of competence** for **manufacturing** and **innovation** for the entire process chain of **injection molding tools**. Excel as a **training leader** for the tool making process chain with **focus** on **injection molding** 

#### **Mission Technology**

- Adjustment of technological resources to injection molding requirements
- Efficiency advancements through standardization of all relevant manufacturing equipment

#### **Mission Organisation**

- Establishment of a milestone process and subsequent planning and control of manufacturing process
- Sharpen market exposure to show added value for customers

#### **Mission Training**

 Establishment of connection between the competence focus on injection molding in manufacturing and the course offerings

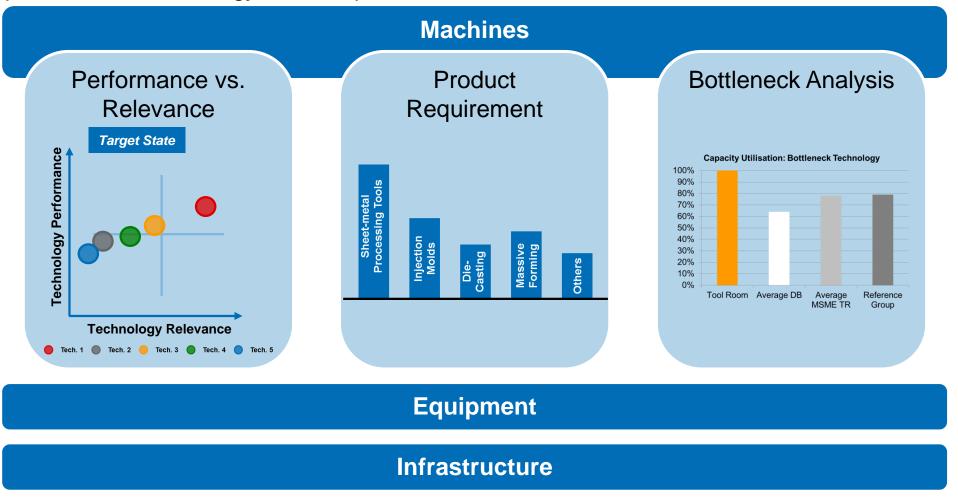




## Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

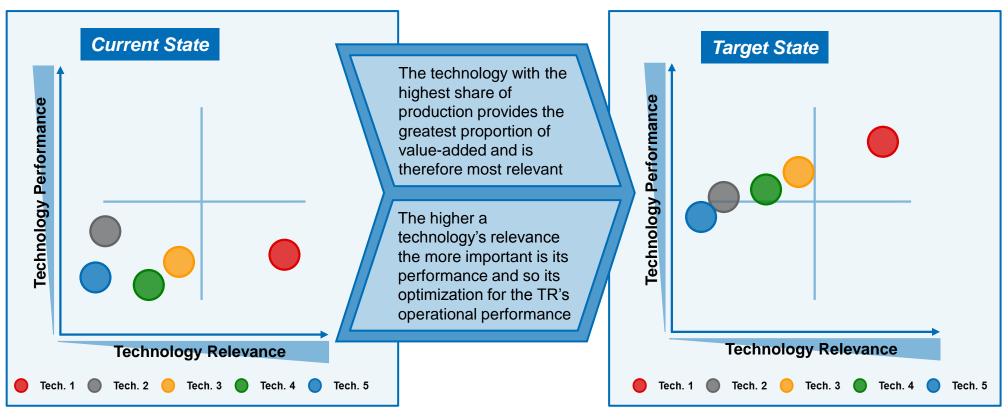




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

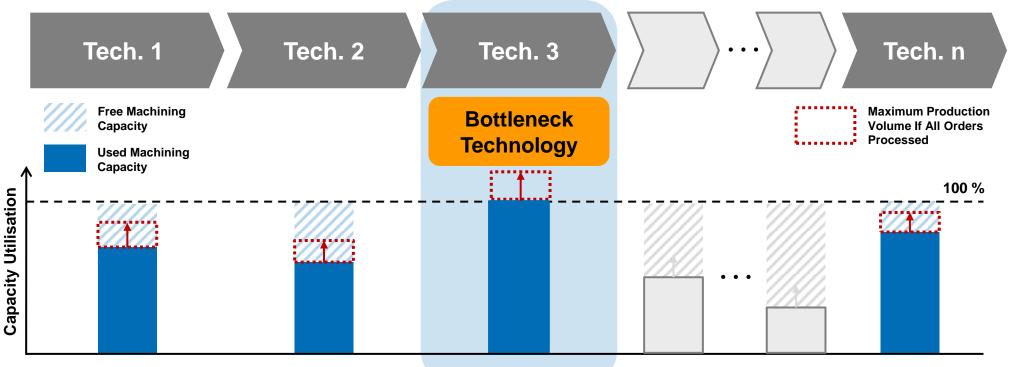




## Bottlenecks have to be eliminated by investing in machinery in order to improve the production capacity



Explanation of Technology Roadmap & Investment Advice



Great potential to create additional value-added in preceding and following manufacturing processes because of inefficient capacity utilisation

The bottleneck technology restricts the possible production capacity of the whole manufacturing chain

Source: Information concerning Bottlenecks was given by the TR's via the benchmarking sheet (by Fraunhofer IPT)

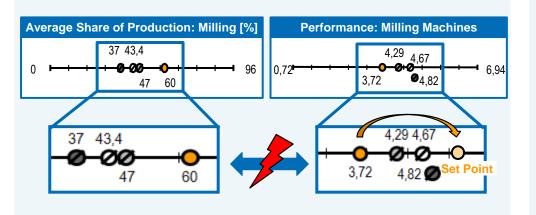




## Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness

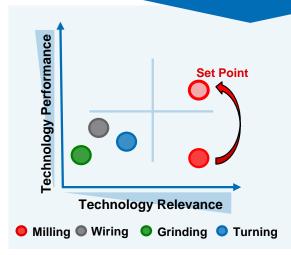


Explanation of Technology Roadmap & Investment Advice



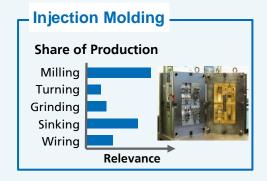


The investment recommendation consists of a replacement of the two old sink-EDM machines, as well as milling, and turning machines



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.

#### **Application Examples**



© WZL/Fraunhofer IPT





## Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The *5S-Method* helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



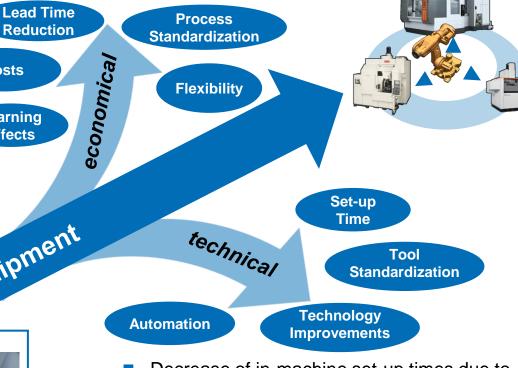
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



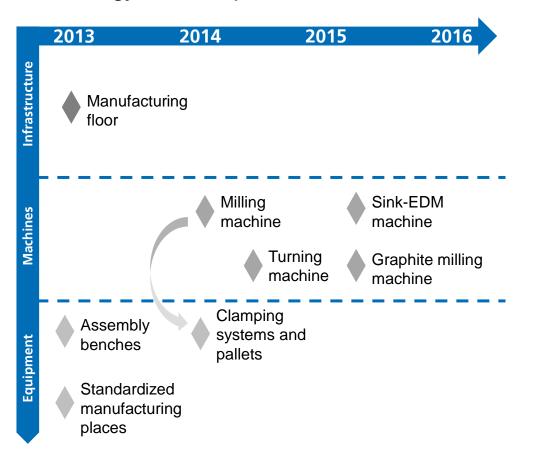


Assembly benches

## Since the infrastructure is an intregal factor for tool rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
  - Renewal of old manufacturing and assembly floors
  - Use of standardized assembly benches with defined equipment (Hammer, file etc.) and a visible order
  - Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Machines
  - Medium-sized CNC milling machine (Hermle C30, DMU 50 and comparable) with a high accuracy and automated tool changer in order to ensure later automation measures.
  - Replacement of the two old sink-EDM machines with one new machine (AgieCharmille FO 550SP, FORM 200, 300 and comparable). The machine should be well suited for graphite electrode sinking as this process has to be implemented in the near future
  - CNC Turning machine with medium precision and a siuted size, as the it should be applied for wide range of products but must also fit to the accuracy requirements
  - Graphite electrode milling machine (Exeron HSC 500, OPS Ingersoll 550 and comparable)
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





### Measures for bridging the gap between that status quo and the target state with regard to technology



#### Advice Technology

**Short-Term Measures** 

Target: Reduction of manufacturing equipment in order to increase the standardization degree

> Standardization of all relevant manufacturing resources

Result: Number of milling tools, clampings etc. are significantly reduced and documented

Target: Reduction of set-up times

SMED Workshop

Result: Action plan for efficiency improvements within the manufacturing department

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

Target: Efficiency improvements by reduction of electrode milling and sink-EDM machining time

Implementation of graphite electrodes

Result: Switch from copper to graphite electrodes successfully accomplished

**Proposed Project** 

SMED Workshop

**Duration:** 

Man days:

Support:

6 months

20

WZL/ WBA/ IPT





## Measures for bridging the gap between that status quo and the target state with regard to organisation



#### Advice Organisation

**Short-Term Measures** 

**Target:** Establishment of milestone process for the entire order fulfillment process

Design of structured milestone process for order processing

Result: Structured process with detailed milestones for increased process quality

Target: Market exposure about competence over the entire process chain for injection molding tools

Sharpen market exposure of manufacturing competencies

**Result:** Reputation on market as specialist for injection molding tools over its entire process chain

#### **Long-Term Measures**

**Target:** Planning and control of manufacturing of tools

Set-up of a planning and control routine for the entire order fulfillment process

Result: Infrastructure for sustainably lower lead times and enhanced due date reliability

Target: Higher margins for differentiating competence in injection molding

Set-up clear billing positions for all services and processes offered to the customer

**Result:** Increased profitability of manufacturing department

#### **Proposed Project**

Design of a structured milestone process for order processing

**Duration:** 

Man days:

Support:

2 weeks

20

WZL/WBA/IPT





## Measures for bridging the gap between that status quo and the target state with regard to training



#### Advice Training

**Short-Term Measures** 

**Target:** Identify potential for establishing connection

Identification of potential for linking the manufacturing competencies and the course offerings

Result: Basis for synergies in tool manufacturing and training

#### **Long-Term Measures**

Target: Curriculum specifically addressing the field of injection molding tools

> Design of a curriculum for courses that transport the in-depth knowledge on injection molding tools to students

Result: Competitive edge in training for field of competence as basis for future development and innovative progress

Target: Initiatives for balancing capacity utilization of training resources over the entire calendar year

Design of an action plan structuring course offerings in order to balance capacity utilization

Result: Action plan for balanced capacity utilization of training resources of the entire calendar year

#### **Proposed Project**

Design of course offerings for specific contents on injection molding tools

**Duration:** Man days:

2 weeks 20

Support:

WZL/WBA/IPT





### Overview of the results of the analysis and the proposed next steps towards the target state



#### Summary

#### Strength

Availability of entire process chain

Strategic focus on injection molding tools

Expansion of facilities for increased intake capacity

#### **Potential**

Low exploitation of machine potentials

Low process quality

Missing link between training and manufacturing focus



#### **IGTR Ahmedabad Vision**

Be a **center of competence** for **manufacturing** and **innovation** for the entire process chain of **injection molding tools**. Excel as a **training leader** for the tool making process chain with **focus** on **injection molding** 

#### **Technology Project Proposal (20 man days)**

Enlargement of machine capacity by SMED

#### **Benefit**

Significant reduction of set-up times (up to 70%) resulting in much higher machine capacity

#### **Organisation Project Proposal (20 man days)**

Design of a structured milestone process for order processing

#### **Benefit**

Simplification of order processing, shortened lead times and improved due date reliability

#### **Training Project Proposal (20 man days)**

Design of course offerings for specific contents on injection molding tools

#### **Benefit**

Becoming a leader in training for injection molding tool manufacturing





#### **Contact Information**









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### Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps IGTR Aurangabad







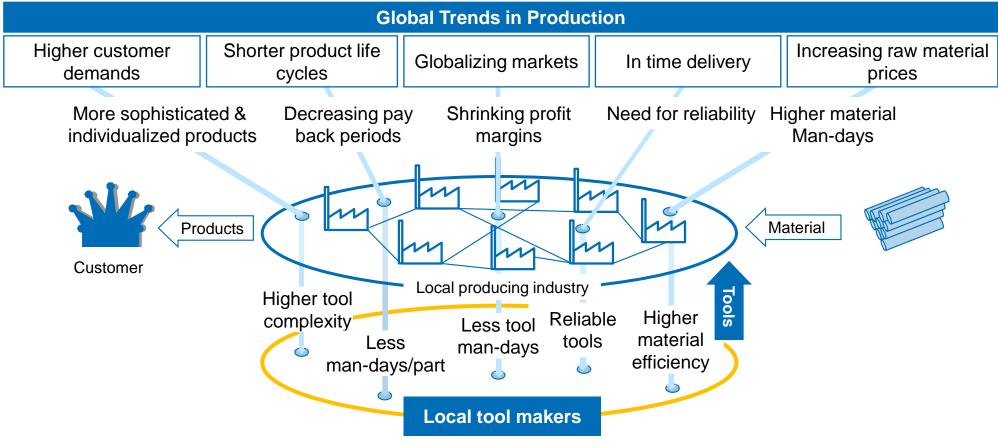
Delhi, 01.-02. November 2012





# Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





## Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

### Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

#### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### Goals of Production

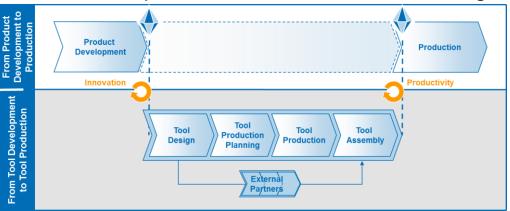
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





### A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



#### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

#### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



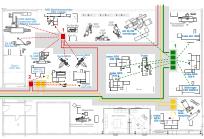


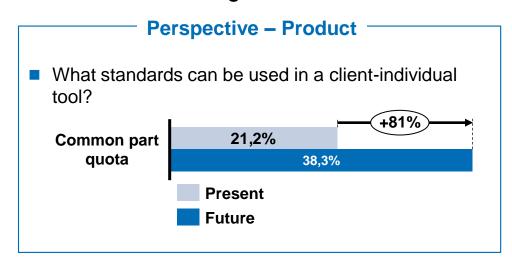
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

### **Perspective- Order Processing**

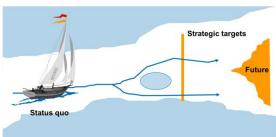
Which standards in order processing enable unique tooling?





### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

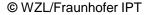


### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

#### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

#### Day II

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





# The IGTR Aurangabad has a strong focus on creating revenue with its tool manufacturing division



Introduction



»We stand for advanced solutions for press tools, die casting, and injection molding tools«

Aurangabad (Maharashtra) Market

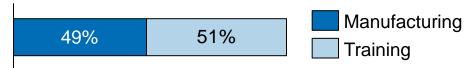
Now: Strong industrial production with focus on the automotive sector

Future: Automotive sector is the strongest in industrial production

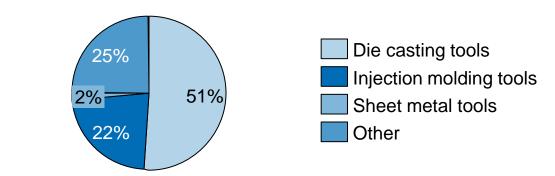
Customer Industries
 Aerospace, automotive, electrical, general engineering, medical

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

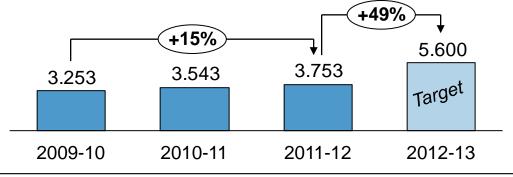


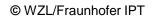


### Manufacturing



Training [Trainees Trained]



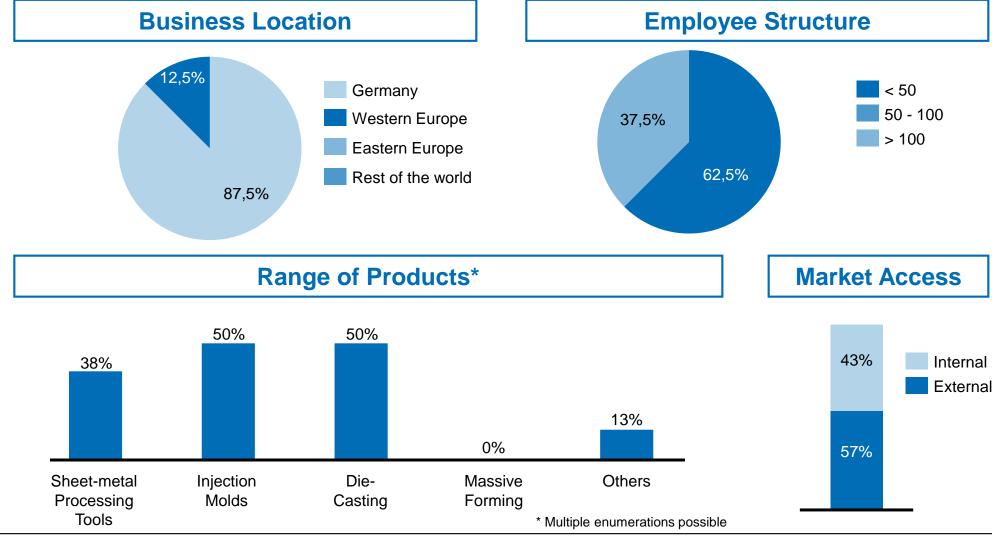






# The reference group contains companies which are comparable to the tool room





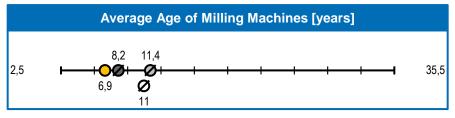


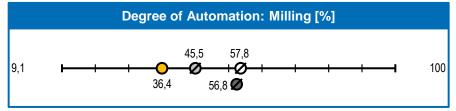


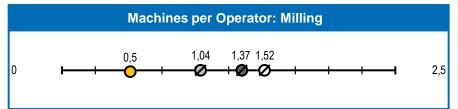
## Technological resources are the enabling factors of a successful tool room

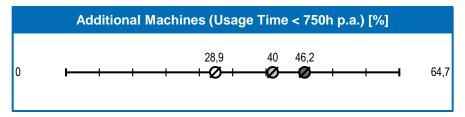


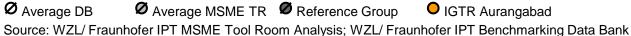
### Analysis Technology (I/IV)





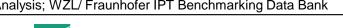






### **Findings**

- The milling machinery is characterized by modern machines and a comparatively low automation degree
- A multiple machine work is not accomplished, the machines are charged by two operators
- Figures regarding the number of unproductive machines are not available, but the visit showed that the this number is on an average level



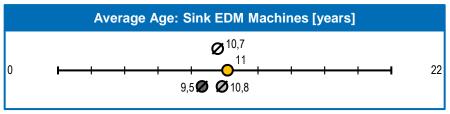


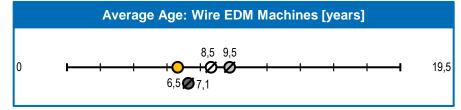


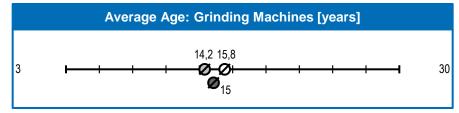
### Technological resources are the enabling factors of a successful tool room

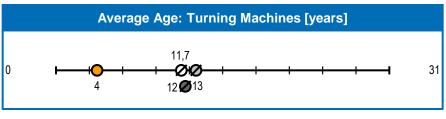


Analysis Technology (II/IV)



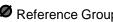


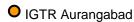












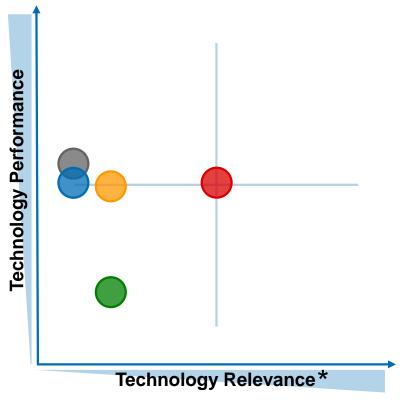




# The economic application of technological resources is described with the technology organization



Analysis Technology (III/IV)



**Sinking** 

### **Findings**

- The performance values are the highest of all visited tool rooms and fit to the requirements of the products (apart from the grinding machines)
- Especially with regard to the production of sheet metal forming tools an upgrade of grinding machines is necessary

Machinery in Aurangabad is comparable to tool rooms in Western Europe

**Turning** 

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

Wiring



Grinding



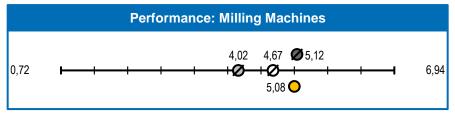
Milling

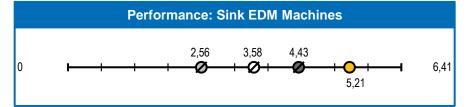
\*estimated

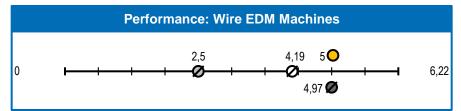
## **Additional Information:** Data for machine performance analysis

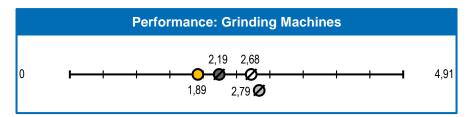


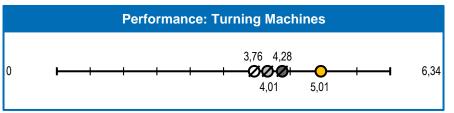
### Analysis Technology (IV/IV)



















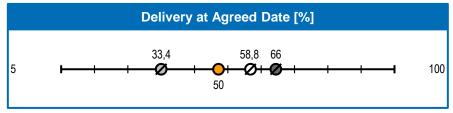


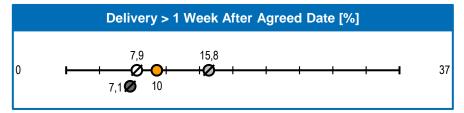


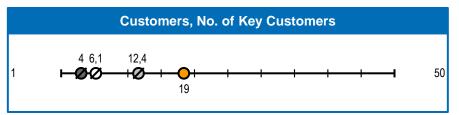
# The organisational capabilities are the key to process efficiency and sustainable development of a tool room

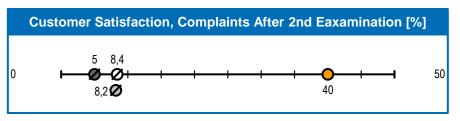


Analysis Organisation (I/II)









### **Findings**

- Due date reliability is representative of the organisational know-how
- In comparison to tool rooms of high international standards Aurangabad has to upgrade its capabilities further
- A very large variety of different customer groups requires enhanced organisational flexibility
- The relatively good due date reliability is being exchanged for product quality
- Customer portfolio requires a more precise focus in order to establish a customer oriented tool making process

Ø Average DB Ø Average MSME TR Ø Reference Group ☐ IGTR Aurangabad

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

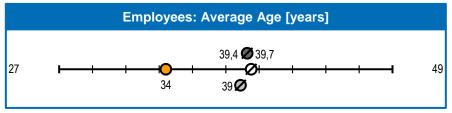


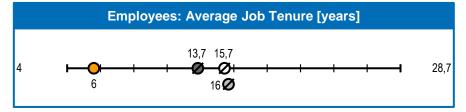


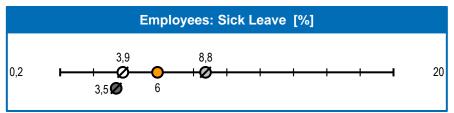
### The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)







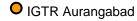
### **Findings**

- The structure of employees is set-up for a longterm development in comparison to all reference groups
- A shorter job tenure goes hand in hand with the low average age
- Limited experience of employees require a higher standard of organisational structure
- The percentage of days missed on sick leave is an indicator for employee satisfaction
- Employee satisfaction is higher than the reference group of all analyzed tool rooms

IGTR Aurangabad possesses organisational capabilities that set an example for MSME Tool Rooms – The next steps have to be undertaken to close the gap to the highest international standard

Average DB

Average MSME TR Reference Group



Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank





# Education is the backbone for the upgrade of capabilities and future innovation and development



### Analysis Training



General Finding: Lack of advanced training



**General Finding:** Lack of process-orientation

### **Findings**

- Trainers that are also working in production are crucial to the training process and its immediate relevance for the industry
- A link between the very good organisational capabilities and the training has to be established
- The upgrade of resources for training has to be continued to cope with the demands of a growing student body
- Training on automation and transfer system has to be launched in close cooperation with other MSME Tool Rooms that have already undertaken the first steps
- All groups from students to industry practitioners are being addressed by the training portfolio





# Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

- Very high machine performance values
- Infrastructure fits to the requirements of modern production

### **Organisation**

- High know-how of the entire tool making process
- Good customized production planning and control systems
- Order and structure on shop floor due to low-paper system

### **Training**

- Good use of employees from production
- Course offering for all customer groups

Technology Potentials

- Old machinery for grinding technology
- Important production figures are not available

### **Organisation**

- High complexity of order processing through product and customer portfolio
- Post calculation limits lacking transparency
- Lack of order and tidiness

### **Training**

 Missing link between strengths in tool making and the course offerings





# The target state serves as reference point for the orientation of the next development steps



Target State



### **IGTR Aurangabad Vision**

Be an **organisational leader** for the entire process chain with focused **core technologies** of international standard. Stable enhancement of intake capacity while developing a **link between training and production competencies**.

### **Mission Technology**

 Target-oriented investments and disinvestments guarantee a high performance of our machinery

### **Mission Organisation**

- Establishment of a focus group for products and customers
- Integration of customer values to increase satisfaction
- Implementation of a standard for cleanliness and order as prerequisite for high quality tool making

### **Mission Training**

- Establishment of a strong link between competencies in production & training
- Interaction with MSME network to share existing knowledge
- Refinement of course offerings for customer groups

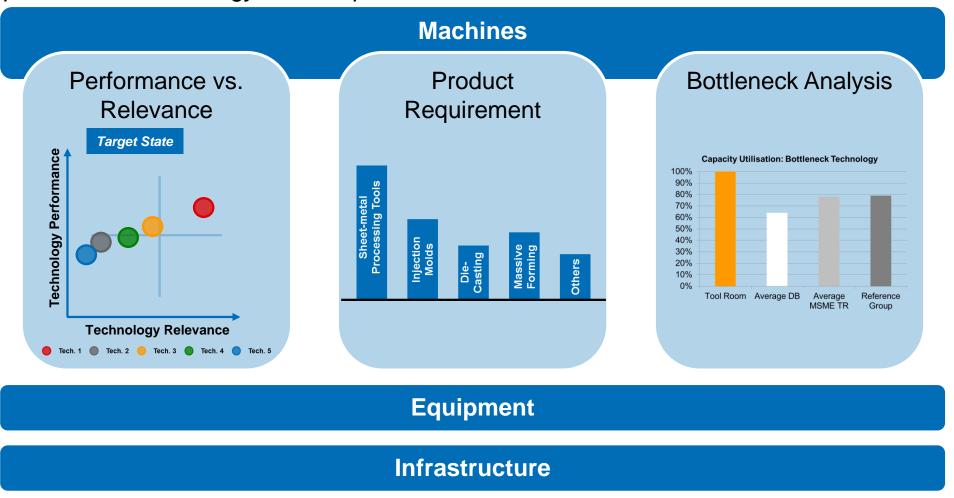




# Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

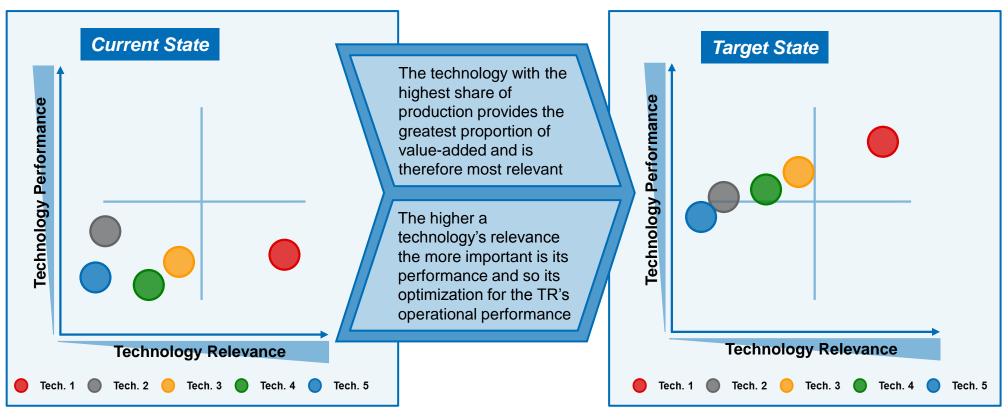




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

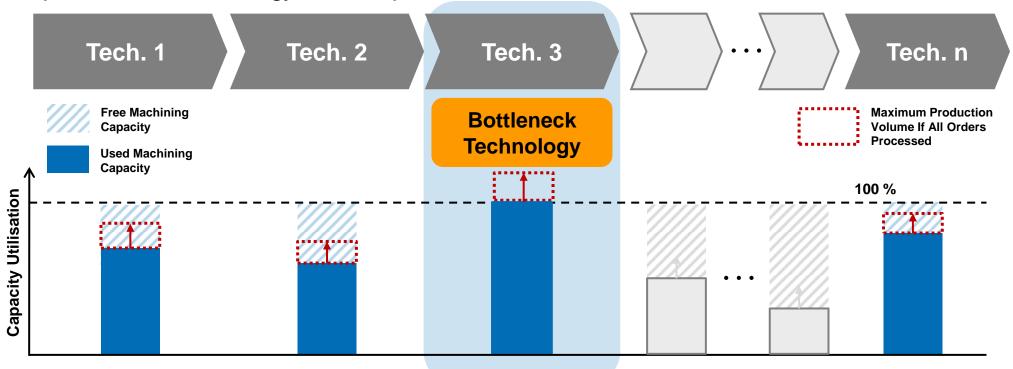




# Bottlenecks have to be eliminated by investing in machinery in order to improve the production capacity



Explanation of Technology Roadmap & Investment Advice



Great potential to create additional value-added in preceding and following manufacturing processes because of inefficient capacity utilisation

The bottleneck technology restricts the possible production capacity of the whole manufacturing chain

Source: Information concerning Bottlenecks was given by the TR's via the benchmarking sheet (by Fraunhofer IPT)

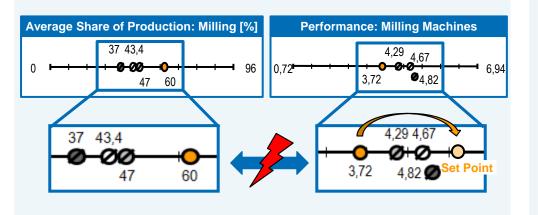




# Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness



Explanation of Technology Roadmap & Investment Advice

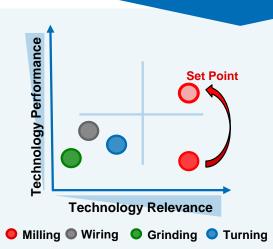






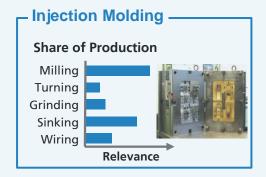


The investment recommendation consists of a surface grinding machine, a cylindrical grinding machine and a medium-sized 5-axis milling machine



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.

### **Application Examples**









# Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The 5S-Method helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



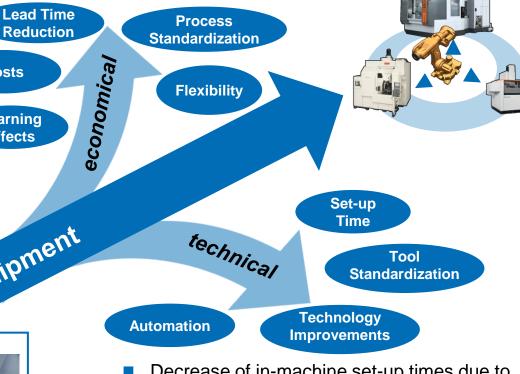
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



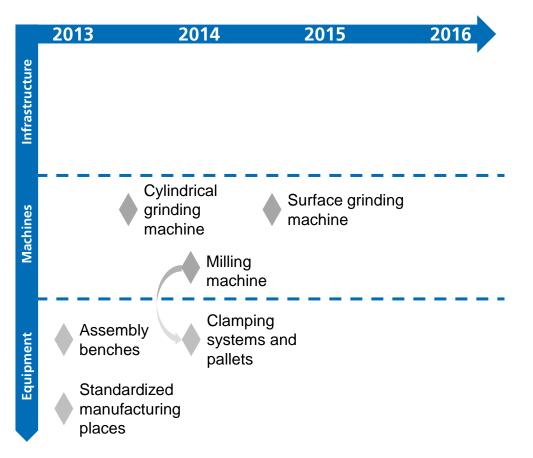


Assembly benches

# Since the infrastructure is an intregal factor for tool rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
- Use of standardized assembly benches with defined equipment (Hammer, file etc.) with a defined order
- Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Machines
  - Surface grinding machine with high precision in order to guarantee the precision difference to milling processes (Blohm Vario and comparable)
  - Conventional cylindrical grinding machine (Studer S21 and comparable)
  - Medium-sized 5-axis CNC milling machine (Hermle C30, DMU 50 and comparable) in order to ensure the continuous enhancement of technological capabilities and to rationalize manufacturing processes by strengthening the milling processes. High precision is necessary.
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





# Measures for bridging the gap between that status quo and the target state with regard to technology



### Advice Technology

**Short-Term Measures** 

Target: Reduction of manufacturing equipment in order to increase the standardization degree

> Standardization of all relevant manufacturing resources

Result: Number of milling tools, clampings etc. are significantly reduced and documented

**Target:** Reduction of set-up times

SMED Workshop

Result: Action plan for efficiency improvements within the manufacturing department

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

Target: Efficiency improvements by reduction of electrode milling and sink-EDM machining time

Implementation of graphite electrodes

Result: Switch from copper to graphite electrodes successfully accomplished

**Proposed Project** 

> SMED Workshop

**Duration:** 

Man days:

Support:

6 months

20

WZL/WBA/IPT





# Measures for bridging the gap between that status quo and the target state with regard to organisation



### Advice Organisation

**Short-Term Measures** 

Target: Definition of competence fields with regard to customer and product portfolio

Development of a competence portfolio in alignment with boundary conditions and future orientation

Result: Sound competence fields for future target-oriented development and organisational upgrade

Target: Development of standard for tidiness and order in all departments

Implementation of tidiness and order

Result: Increased process efficiency through clean and structured workplace environment

### **Long-Term Measures**

**Target:** Adjustment of organisational structure to be aligned with the customer requirements

Integration of customer values into the process routine

Result: Enhanced process capability and subsequent growth in profitability through fit with customer requirements

Target: Establishment of 6S Routine

Set-Up of a 6S Routine

Result: Sustained process efficiency and increased duration of life cycle of resources

#### **Proposed Project**

Development of competence fields and design of process structure to increase the value added of tool making Duration: Man days: Support:

2 weeks 20 WZL/ WBA/ IPT





# Measures for bridging the gap between that status quo and the target state with regard to training



### Advice Training

**Short-Term Measures** 

Target: Offering of a course on production planning and control in tool making

Design and Implementation of course on production planning and control in tool making

Result: Course on production planning and control in tool making

Target: Acquisition of knowledge on current trends in training of other MSME Tool Rooms

> Exchange of information on latest developments in training among MSME Tool Rooms

Result: Unified knowledge of status quo of future plans with regard to the orientation course offerings

#### **Long-Term Measures**

Target: Definition of long-term plan for increase in intake capacity

Set-up of long term development plan for intake capacity according to boundary conditions and Ministry targets

Result: Detailed plan for future intake development and required enhancement of training capacities

Target: Exposure of the students to latest innovation and trends in tool and die making

Set-Up of a course on trends and innovation in tool and die making

**Result:** Empowerment of students for innovation based on the latest state-of-art development in the industry

#### **Proposed Project**

Set-up of a curriculum for a course with focus on production planning and control in tool making **Duration:** 

Man days:

**Support:** 

1 week

10

WZL/ WBA/ IPT





## Overview of the results of the analysis and the proposed next steps towards the target state



### Summary

#### **Strength**

High performance of machines overall

High know-how of tool making process

Good use of employees from production

#### **Potential**

Low performance level in grinding specifically

Missing post calculation & cleanliness and order

Missing link between curriculum and manufacturing



#### **IGTR Aurangabad Vision**

Be an organisational leader for the entire process chain with focused core technologies of international standard. Stable enhancement of intake capacity while developing a training link to the production competencies

### **Technology Project Proposal (20 man days)**

Enlargement of machine capacity by SMED

#### **Benefit**

Significant reduction of set-up times (up to 70%) resulting in much higher machine capacity

#### **Organisation Project Proposal (20 man days)**

Development of competence fields and design of process structure to increase the value added of tool making

#### **Benefit**

Improved competitiveness and shortened lead times

### **Training Project Proposal (10 man days)**

Set-up of a curriculum for a course focusing on production planning and control in tool making

#### **Benefit**

Upgrading the training portfolio with courses for modern production organizations





### **Contact Information**









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## Initial Analysis of Seven MSME Tool Rooms

Milestone Workshop

Analysis and Further Steps CTTC Bhubaneswar







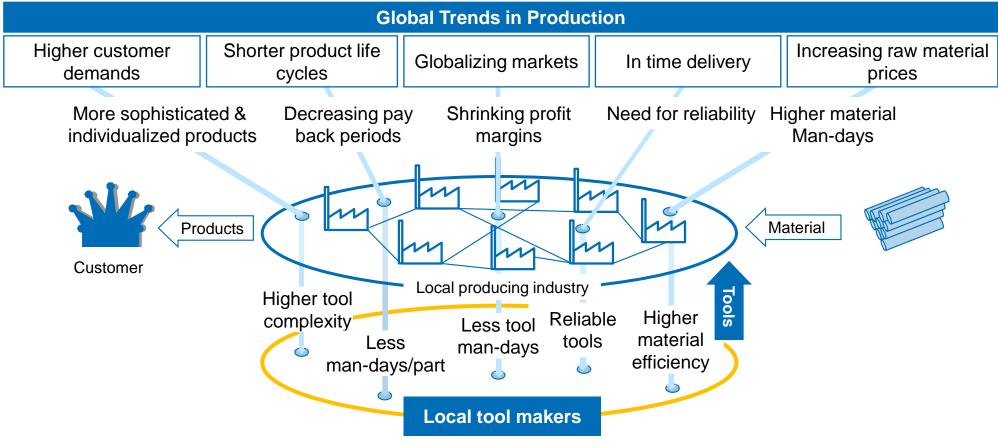
Delhi, 01.-02. November 2012





# Global trends in production translate into adapted manufacturing processes and altered demands for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making



The tool and die industry is the key partner for the international manufacturing industries





# Its crucial position in the value chain results in multiple requirements for the tool and die industry

Technological and Organisational Capabilities in Tool and Die Making

From Product Development to Production

Product Development

Production

## Goals of Product Development

- High amount of standards in design and planning
- Focus on innovation
- Short lead times in procurement
- Adherence to planned man-days

### Main goals of value chain

- High flexibility and production quality
- Short and reliable lead times
- Adherence to competitive man-days structure

Overall optimum per produced part or Total Cost of Ownership

#### **Goals of Production**

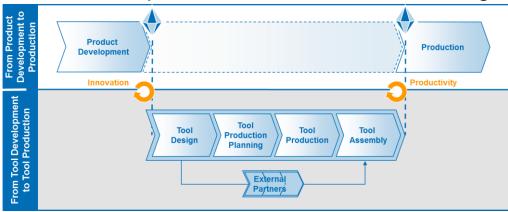
- Robust processes with high quality and less breakdowns
- Automation in production and assembly
- First-time-right during run up
- Little expenses for maintenance and repair





## A successful toolshop enables both: Innovation in development and productivity in production

Technological and Organisational Capabilities in Tool and Die Making



### Enabling Innovation in Development through ... ¬

- ... Definition of a set of core competencies
- Adherence to high quality requirements throughout the employees
- ... Early integration into product development
- ...Improving its own product- and process knowhow constantly

### **Enabling Productivity in Production through ...**

- Use of modular, standardized components
- ... High quality tools
- Internal process orientation to guarantee shortest lead times with high adherence to delivery dates
- Continuous improvement by constant exchange with the tool operating in production



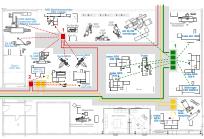


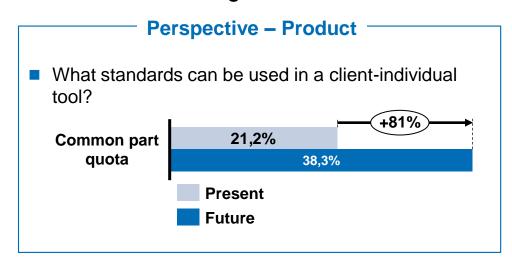
### A successful tool room is much more than the sum of its machinery

Technological and Organisational Capabilities in Tool and Die Making

### **Perspective- Order Processing**

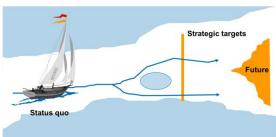
Which standards in order processing enable unique tooling?





### **Perspective – Strategy**

What are the core competencies of the tool room that enables it to outperform its competitors globally?

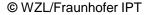


### **Perspective – Process Chains**

What technological process chains support the tool room's core competencies in the best way?











# A sound understanding of all relevant aspects of technological and organisational capabilites is the key to successful tool and die making

Technological and Organisational Capabilities in Tool and Die Making

#### **Project Proposal**

Technological and Organisational Capabilities in Tool and Die Making **Duration:** 2 days

Man days: 4 (chief

Support:

WZL/ WBA/ IPT

engineers)

#### Day I

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Trends in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Classical Production Technologies at a Glance



- 12:30 14:00: Lunch
- 14:00 15:30: Standardization of Product and Order Processing
- 15:30 15:45. Break
- 15:45 17:00: Synchronization of Order Processing
- 17:00 17:30: Wrap Up

#### Day II

#### Dr. K. Kuhlmann & K. Arntz

- 09:30 10:00: Welcome
- 10:00 10:45: Successful Strategies in Tool and Die Making
- 10:45 11:00: Break
- 11:00 12:30: Development of Efficient Process
   Chains for Tool and Die Making
- 12:30 14:00: Lunch
- 14:00 15:30: Process Chains "of tomorrow" for Tool and Die Making
- 15:30 15:45: Break
- 15:45 17:00: Final Discussion on Capabilities in Tool and Die Making
- 17:00 17:30: Wrap Up





# The CTTC Bhubaneswar has superior training capacities and capabilities in machining of precision components



Introduction



»Leader in training and supply of high-precision components to aerospace and defense«

Bhubaneswar (Orissa) Market

Now: Limited production industry and

trade constraints to neighbors

Future: Growth of market may strengthen

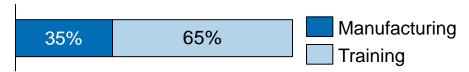
local production industry

Customer Industries

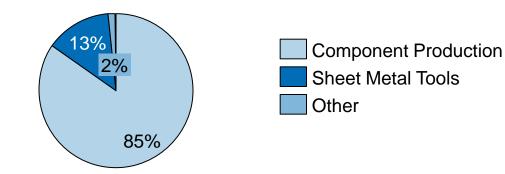
Aerospace, automotive, defense, packaging

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis

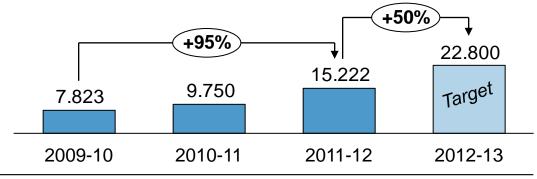




### Manufacturing



Training [Trainees Trained]



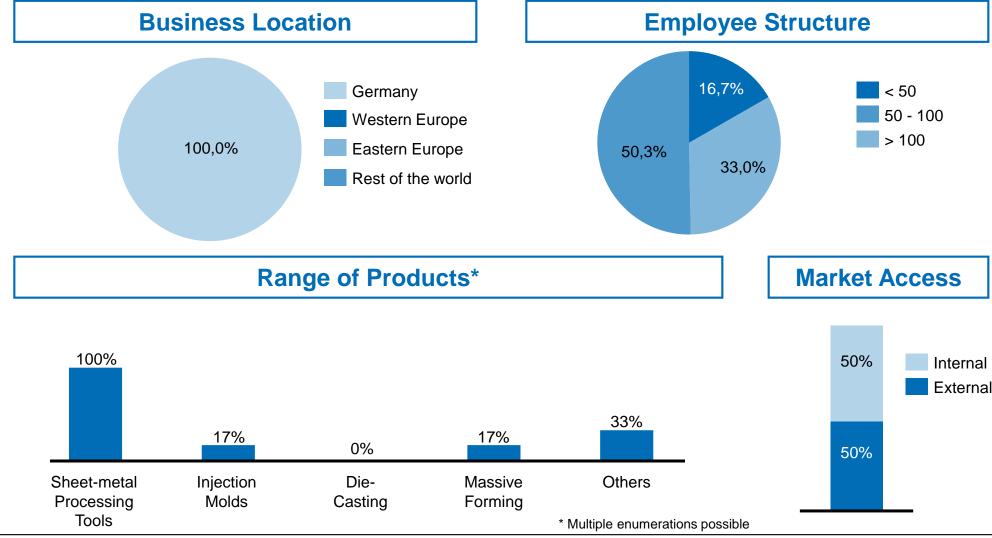
© WZL/Fraunhofer IPT





# The reference group contains companies which are comparable to the tool room





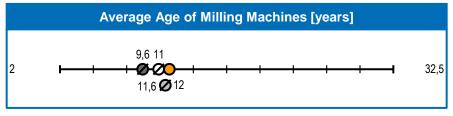


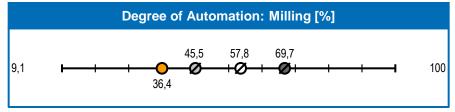


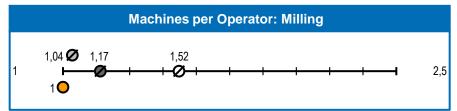
### Technological resources are the enabling factors of a successful tool room

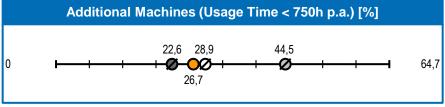


### Analysis Technology (I/VIII)











Average MSME TR Reference Group

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



OCTTC Bhubaneswar



The average milling machine age is a bit higher compared to the reference

accomplished leading to potentials in

Multiple machine work is not

The last figure confirms the first

impression during the visit that the

number of unproductive machines is significantly lower compared to other

**Findings** 

groups

productivity

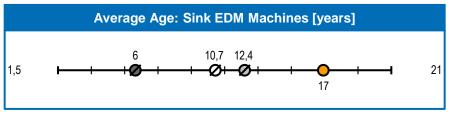
MSME tool rooms

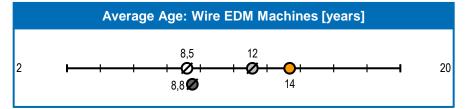
Average DB

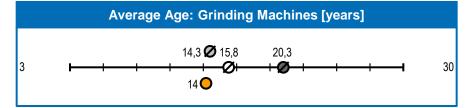
## Technological resources are the enabling factors of a successful tool room

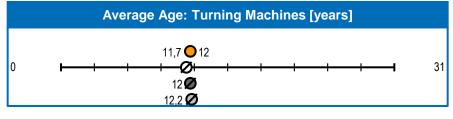


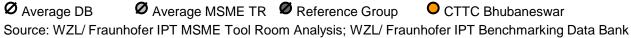
### Analysis Technology (II/VIII)

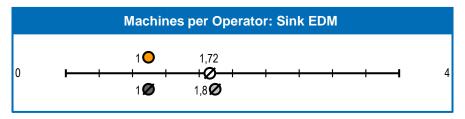


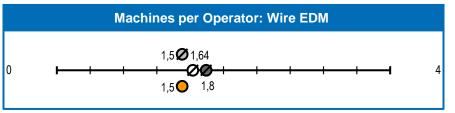


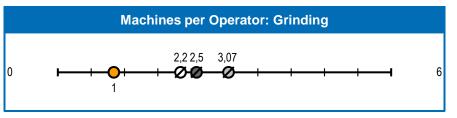


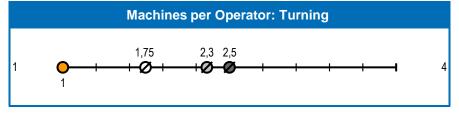












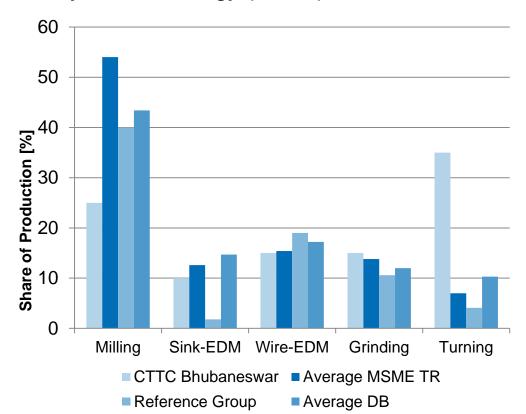


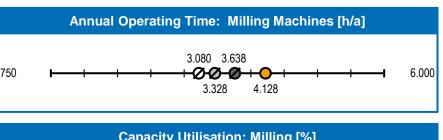


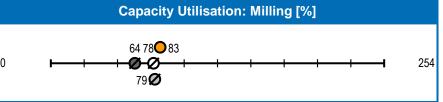
# The economic application of technological resources is described with the technology organization

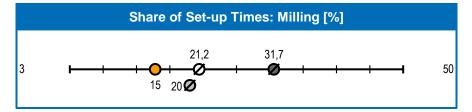


Analysis Technology (III/VIII)









The share of set-up times is conspicuously low and is therefore subject to review

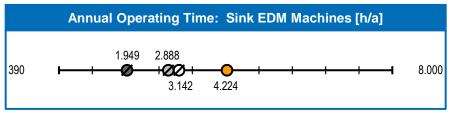
Fraunhofer

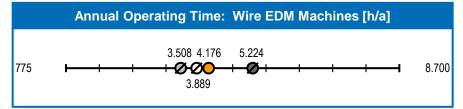


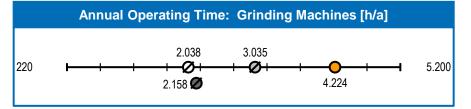
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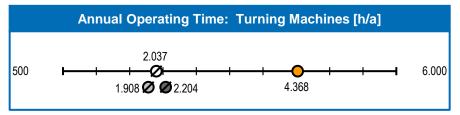


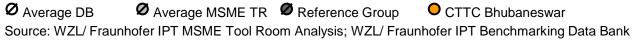
Analysis Technology (IV/VIII)

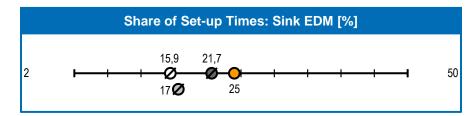


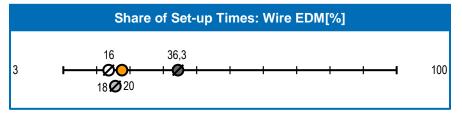


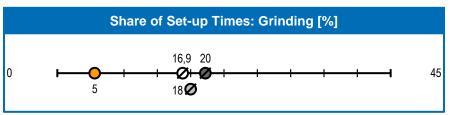


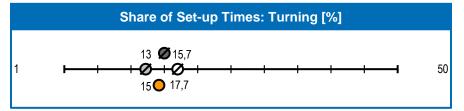












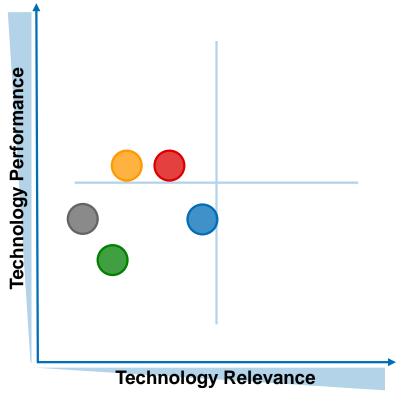




## The economic application of technological resources is described with the technology organization







**Sinking** 

### **Findings**

- The technology performance is significantly higher in contrast to other visited MSME tool rooms and reaches values of good tool rooms located in Germany
- The technology relevance distribution is different to the other tool rooms as the turning technology is an important technology for the component production
- The grinding technology shows potential for higher performance particularly with regard of high precision machining for aeronautical components

The technology analysis shows a machinery characterized by a high machine performance

**Turning** 

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

Wiring



Grinding

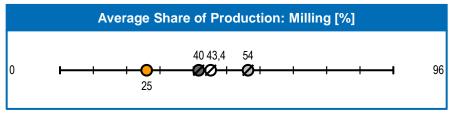


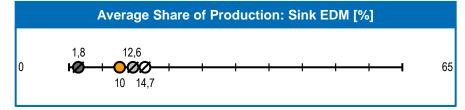
Milling

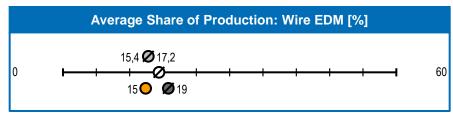
## **Additional Information:** Data for machine performance analysis

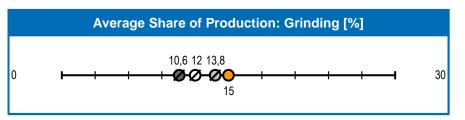


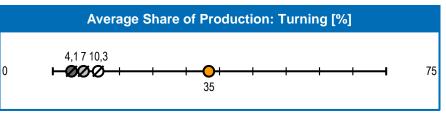
Analysis Technology (VI/VIII)











Average DB

Average MSME TR Reference Group

OCTTC Bhubaneswar

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

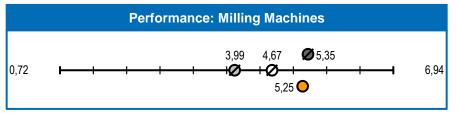


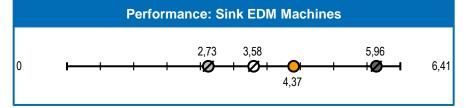


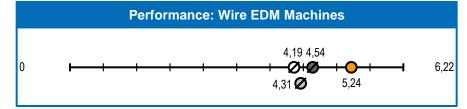
## **Additional Information:** Data for machine performance analysis

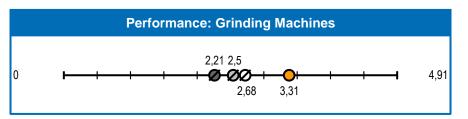


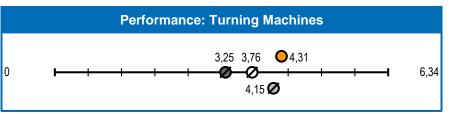
## Analysis Technology (VII/VIII)











Average DB

Average MSME TR
Reference Group

CTTC Bhubaneswar

Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

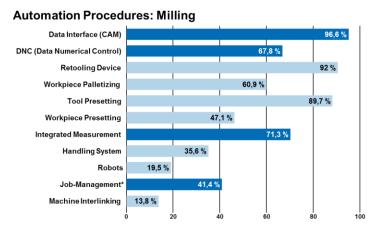


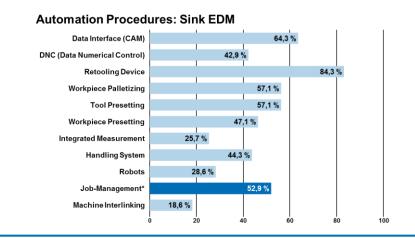


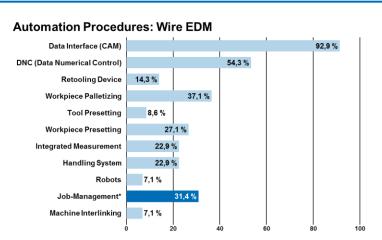
## Tool-oriented and workpiece-oriented automation differs between countries and depends on the wage level

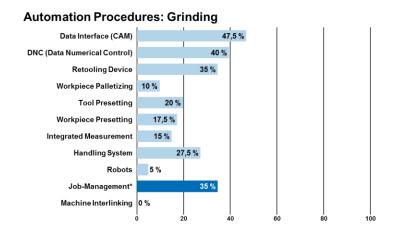


Analysis Technology (VIII/VIII)





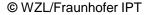




Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



MSME Bhubaneswar 2011



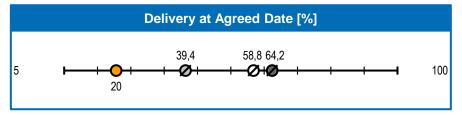


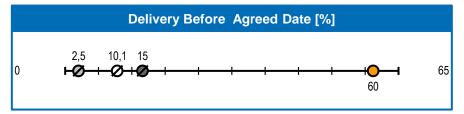


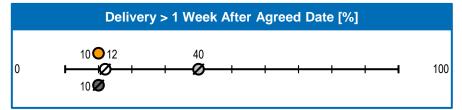
## The organisational capabilities are the key to process efficiency and sustainable development of a tool room

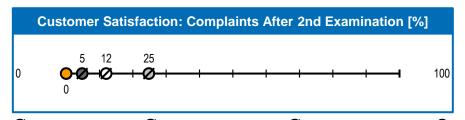


Analysis Organisation (I/II)









### **Findings**

- The reliability of delivery dates given to the customer is very low
- Towards the customer this is compensated by a large portion of products being delivered early – 4 out of 5 orders will reach the customer on time
- Early deliveries are at the expense of CTTC Bhubaneswar and have to be planned and controlled better
- Late orders occur infrequently and are in line with the international competitive standard
- The experience, process quality, and customer focus is also represented by high customer satisfaction

Ø Average DB Ø Average MSME TR Ø Reference Group ○ CTTC Bhubaneswar Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank

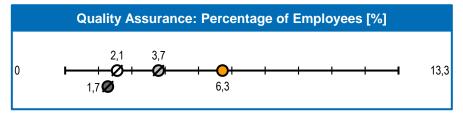


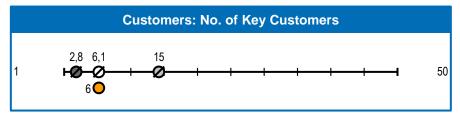


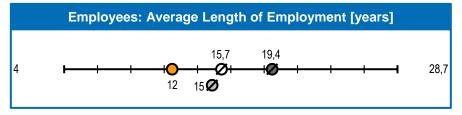
## The organisational capabilities are the key to process efficiency and sustainable development of a tool room



Analysis Organisation (II/II)







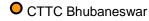
### **Findings**

- High manpower in the quality management department ensures the high quality of the products
- Quality assurance is also exercised by the departments individually to operate with process orientation
- The customer group can be considered focused by the standard of the other MSME tool rooms
- A short average job tenure is an indicator for future sustainability and a stable process structure

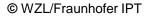
CTTC Bhubaneswar successfully exploits the benefits of customer focus and product portfolio – The next step has to be undertaken by adding an electronic planning and control system

Average DB

Average MSME TR Reference Group



Source: WZL/ Fraunhofer IPT MSME Tool Room Analysis; WZL/ Fraunhofer IPT Benchmarking Data Bank



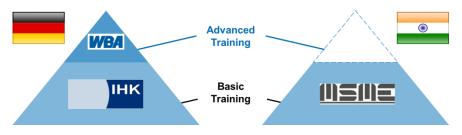




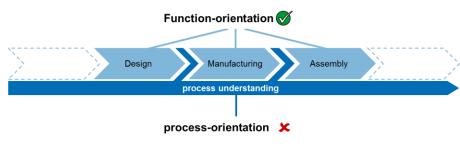
## Education is the backbone for the upgradation of capabilities and future innovation and development



## Analysis Training



General Finding: Lack of advanced training



**General Finding:** Lack of process-orientation

### **Findings**

- Most developed campus structure of all seven visited tool rooms
- The development of further courses on automation and systems should be continued
- Even though an advanced process understanding is existent in manufacturing it is not sufficiently transferred to training
- The analyzed courses comprehensively attend to the necessary key know-how of machine operators, programmers, and designers in the midterm format

#### Courses analyzed:

- > Certified Course in Machine Operation (1 Year)
- Post Diploma in CAD/CAM (1 Year)





## Overview of the findings in the three areas analysed with regard to their respective capability



Key Findings



### **Technology**

- Very high manufacturing technology performance
- Limited number of unproductive machines

### **Organisation**

- Strategic focus on component manufacturing and selected tooling
- High process quality for tool making and component manufacturing

### **Training**

- Good cooperation with other training institutions
- Inclusion of social training of students



### **Technology**

- Average age of the machines
- Lack of use of graphite electrodes

### **Organisation**

 Early finishing dates are an indicator for further potential of planning

### **Training**

 Lack of link between course offerings and competencies in manufacturing





## The target state serves as reference point for the orientation of the next development steps



Target State



#### **CTTC Bhubaneswar Vision**

Develop towardes a **flagship organization** for small-batch **component manufacturing** and **selected tooling** solutions. Continue to **develop stable structure** for the proper **management of increasing intake capacity** 

### **Mission Technology**

- Holding the high machinery performance level with the help of machine investments
- Rationalization of manufacturing processes

### **Mission Organisation**

- Refinement of manufacturing process
- Establishment of functional requirements of a system support for planning and control
- Selection and implementation of the selected system

### **Mission Training**

- Development of a modular course structure for advanced training of industry personnel
- Development of link between course offerings and manufacturing competence

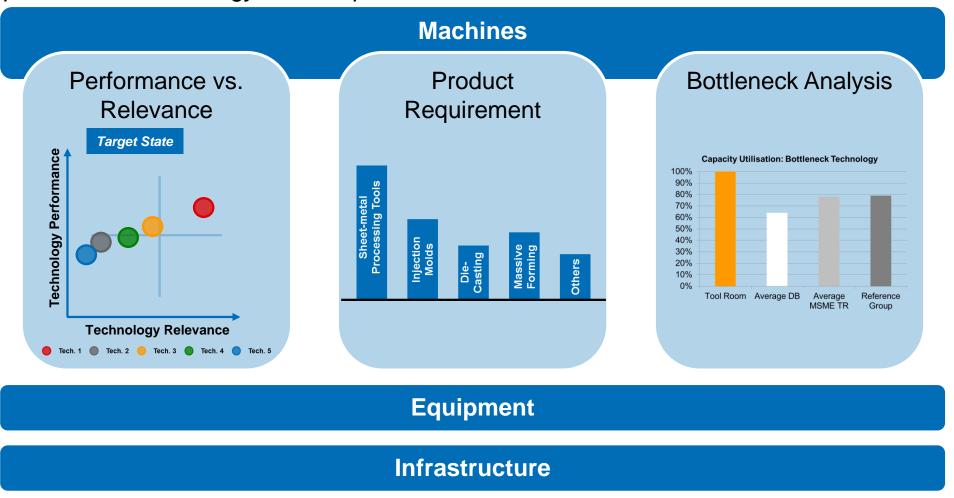




## Technology roadmap and investment advice: improvements in the fields of machines, equipment and infrastructure



Explanation of Technology Roadmap & Investment Advice

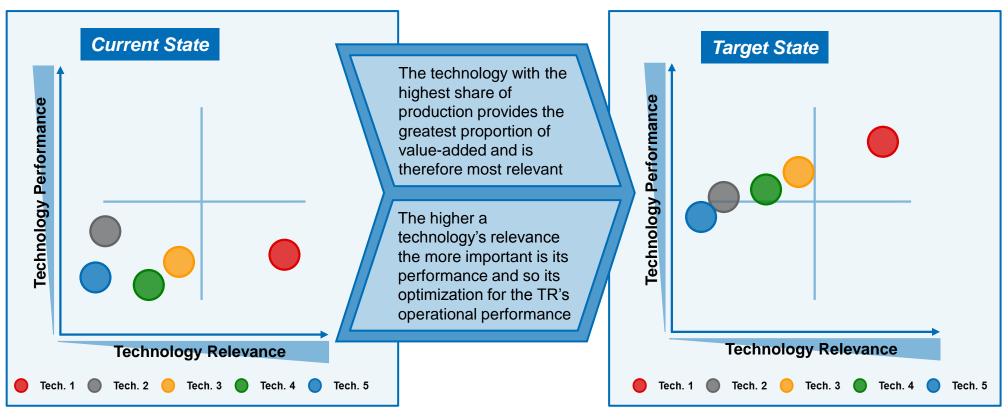




# The most relevant technologies need the highest performance to increase production efficiency



Explanation of Technology Roadmap & Investment Advice



In order to increase value-added in the most efficient way the TR has to focus on its core technologies and to improve their performance as they have the highest impact on the overall operational result

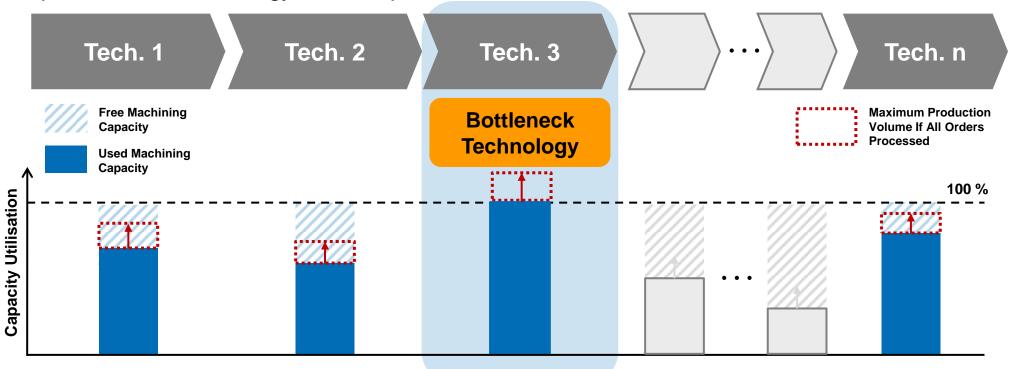




## Bottlenecks have to be eliminated by investing in machinery in order to improve the production capacity



Explanation of Technology Roadmap & Investment Advice



Great potential to create additional value-added in preceding and following manufacturing processes because of inefficient capacity utilisation

The bottleneck technology restricts the possible production capacity of the whole manufacturing chain

Source: Information concerning Bottlenecks was given by the TR's via the benchmarking sheet (by Fraunhofer IPT)

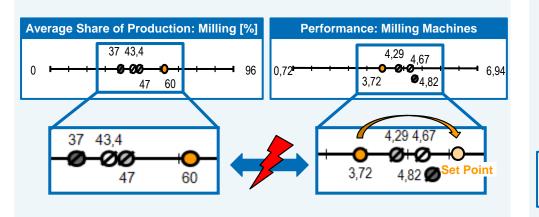




## Investments in machinery that focus on TR's specific core technologies highly increase its product competitiveness

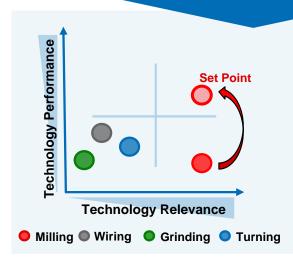


Explanation of Technology Roadmap & Investment Advice

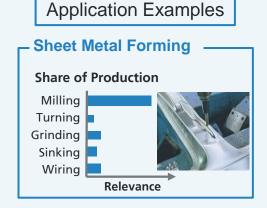




The investment recommendation are large-sized milling machines and a grinding machine



The technological performance has to increase with ascending technology relevance, as those technologies create the highest value add.



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## Applying the principles of the 5S-Method leads to a work space that is organized for highest efficiency and effectiveness



Explanation of Technology Roadmap & Investment Advice



Not every tool room which maintains a clean and tidy workplace is good, but every **good tool room** operates in a **clean and tidy workplace**.



Seiri Sort out Seiton Getting organized 5S-Method Seiso Clean up Seiketsu Standardization Secure and Shitsuke constantly improve

The *5S-Method* helps to create a save, clean and tidy workplace.





# A standardized and efficient tool production can be achieved by investing in modern high-performing machining equipment



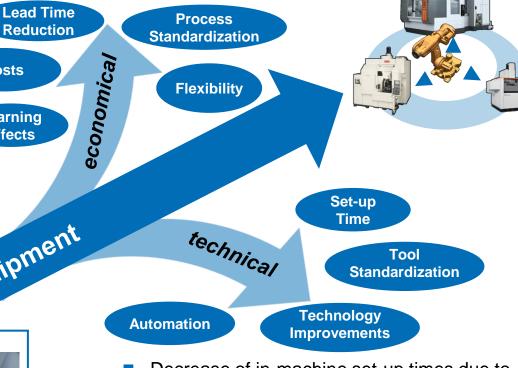
Explanation of Technology Roadmap & Investment Advice

- Standardized assembly benches lead to maximized learning effects and rationalized processes as process standardization is improved
- Improving and modernizing peripheral equipment results in lower production costs due to lead time reductions and rationalization









- Decrease of in-machine set-up times due to automated and standardized tool change procedures
- Technical equipment enhances machining capacity as both processing time and non productive times are reduced



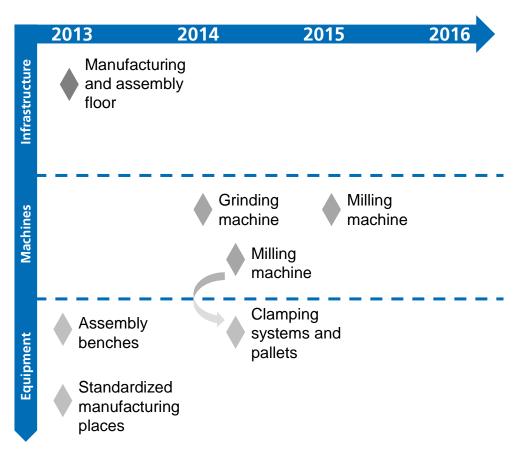


Assembly benches

# Since the infrastructure is an intregal factor for the Tool Rooms, this dimension is covered by the roadmap



Technology Roadmap & Investment Advice



#### Investment recommendations

- Infrastructure
- Renewal of old manufacturing and assembly floors
- Use of standardized assembly benches with defined equipment (hammer, file etc.) and a visible order
- Use of manufacturing work places with standardized equipment (clampings etc.) and a defined order
- Machines
  - 2 large- sized CNC milling machine (Hermle C42, DMU 70 and comparable) in order to replace old Mikrons.
     Precision should be high as the machines should be used for a wide range of product. Automation can be on a lower level
  - Cylindrical Grinding machine (Studer S21 and comparable). The machine can be a conventional machine but the machine must be able to manufacture very high precision
- Manufacturing equipment
  - Zero-point clamping system (3R etc.)
  - Pallets





## Measures for bridging the gap between that status quo and the target state with regard to technology



## Advice Technology

**Short-Term Measures** 

Target: Reduction of manufacturing equipment in order to increase the standardization degree

Standardization of all relevant manufacturing resources

Result: Number of milling tools, clampings etc. are significantly reduced and documented

#### **Long-Term Measures**

Target: Reduction of in-machine set-up times

Implementation of zero-point clamping systems and pallets

Result: The process uses zero-point clamping systems and in-machine set-up times are reduced

Target: Efficiency improvements by reduction of electrode milling and sink-EDM machining time

Implementation of graphite electrodes

Result: Switch from copper to graphite electrodes successfully accomplished

#### **Proposed Project**

> Standardization of all relevant manufacturing resources

**Duration:** 

Man days:

Support:

10 months

20

WZL/ WBA/ IPT





## Measures for bridging the gap between that status quo and the target state with regard to organisation



## Advice Organisation

**Short-Term Measures** 

Target: Definition of requirements for improving planning and control of the order fulfillment process

> Development of the functional requirements for an electronic planning and control system

Result: Detailed list of functional requirements for the selection of an electronic planning and control system

#### **Long-Term Measures**

Target: Selection of a suitable electronic planning and control system

Evaluation of available solutions for planning and control systems

**Result:** One planning and control system most suitable for the implementation at CTTC Bhubaneswar

Target: Implementation of the selected planning and control system

Implementation of the selected planning and control system

Result: Increased process quality with a running electronic planning and control system

#### **Proposed Project**

Evaluation and selection of an electronic planning and control system

Duration: Man days:

4 weeks 15

Support:

WZL/ WBA/ IPT





## Measures for bridging the gap between that status quo and the target state with regard to training



## Advice Training

**Short-Term Measures** 

Target: Development of a link between manufacturing competencies and course offerings

Set-up of course offerings addressing organizational capabilities and component manufacturing

Result: Sound course offerings including existing competencies with regard to organization and comp. manufacturing

#### **Long-Term Measures**

**Target:** Establishment of modular course structure for advanced training of industry professionals

Design of modular course structure for advanced training of industry professionals

Result: Modular course system and offering of advanced extra-occupational training

#### **Proposed Project**

Design of modular course structure for advanced training of industry professionals **Duration:** 

1 week

Man days:

Support:

10

WZL/ WBA/ IPT





## Overview of the results of the analysis and the proposed next steps towards the target state



## Summary

### Strength

High manufacturing technology performance overall

Strategic focus on components and selected tooling

Extensive intake capacity and capable structure

#### **Potential**

Lack of use of graphite electrodes

High percentage of early delivery dates

Missing link between training and manufacturing



#### **CTTC Bhubaneswar Vision**

Develop towardes a **flagship organization** for **precision component manufacturing and assembly for aerospace** as well as **selected tooling** solutions. Continue to **develop stable structure** for the proper **management of increasing intake capacity** 

### **Technology Project Proposal (20 man days)**

Standardization of all relevant manufacturing resources

#### **Benefit**

Rationalization of processes resulting in higher machine runtimes & shorter lead times

#### **Organisation Project Proposal (15 man days)**

Development of competence fields and design of process structure to increase the value added of tool making

#### **Benefit**

Improved competitiveness by unique selling points, and shortened lead times

### **Training Project Proposal (10 man days)**

Design of a road-map for further development of know-how and teaching on automation and systems

#### **Benefit**

Enlargement of training portfolio aligned with core competencies





### **Contact Information**









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