Digital Manufacturing

A status update of the "Next Industrial Revolution"

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3D Printing is also called Additive Manufacturing

Subtractive manufacturing processes work by removing material by cutting, grinding, milling and other methods.

Additive manufacturing works in the opposite way, by adding material layer by layer.

Both are forms of Digital Manufacturing and both are used in Advanced Manufacturing
4 Primary Technologies

- VAT PHOTOPOLYMERIZATION
- MATERIAL EXTRUSION
- LASER SINTERING
- INKJET PRINTING
How is 3D printing used?

- Prototyping
- Short run production
- Surgical aids and implants
- Visualization
- Hyper customization
- Weight saving strategy
- Unique geometries
- Service Parts
- Fixtures
- Manufacturing aids
3D Printing in Manufacturing

Short run injection molds
- $40,000 vs $400
- Limited yield
- Actual production material

Complex Engineering
- 18 components vs 1 integrated part
- 25% weight reduction
- 20% fuel savings

Ricoh Replaces Metal Tooling with 3D Prints
- Ricoh custom fixture 98% cost savings
- Workstation customization addresses 6 key fundamentals of the Ricoh Way Production System
The $1.25B intra-oral scanning and braces company relies entirely on 3D Printing and Scanning.

Medical 3D printing saves $2700 per surgery

Published in the Journal of Children’s Ortopaedics, Rady Hospital’s study reduced surgery time by 25% by using 3D Printed surgical aids, for a cost savings of $2700 per surgery and improved patient outcomes.
Why is 3D Printing Important?

We see additive manufacturing as the next chapter in the industrial revolution. This new Industrial Revolution will rethink manufacturing all over the globe.
The next industrial revolution

1st Industrial Revolution
Age of Mechanization 1800
- Factory made vs. home made
- Favored innovation

2nd Industrial Revolution
Age of Mass Production 1900
- Factories operate 24/7
- Efficiency followed cheapest labor/materials

3rd Industrial Revolution
Age of Digital Manufacturing 2000
- Distributed, direct digital production
- Favors localized production

The Third Industrial Revolution requires a new kind of decentralized, Advanced Manufacturing that favors capital investment and skilled labor.
Why 3D Printing is important?

- Direct digital manufacturing: Design to production in one step
- Organic
- Complex
- Optimized

- Mass-customization
- Smarter design
- Enhanced performance, durability, economy

- Increase Domestic Manufacturing
- Decrease Supply Chain Costs/Waste
- Bespoke, on-demand production

VS.

INDIVIDUAL

HYPER LOCAL
Global AM Demand Outlook

Adoption Timeline

Install Base of Industrial Machines

Adoption by Industry

Machine sales are being driven by successful adoption into wider range of industries
Benefits of AM adoption

Measurable benefits of AM use leads to services growth due to barriers to adoption

- 10x time savings in product development
- 88% cost savings on custom fixtures/jigs
- 20% efficiency gain on complex engineering
- Physical planning tool for improved outcomes
- Opens new markets with new products
- Quick production of low demand product
Barriers to Adoption

The adoption of AM faces challenges that traditional manufacturing has already overcome:

Will the product meet industry standards?

Will the quality be accepted by the customer?

Will insurance cover new risk exposure?
Barriers to Adoption

Conformity Assessment is the demonstration that the technical requirements of production are fulfilled.

Conformity Assessment Areas

Organizational Considerations

- Inspection
- Testing
- Audit
- Evaluation
- Examination
- Assessment

WORK PROCESS

GOVERNANCE SYSTEM

PARTS & PRODUCT

TRAINING
Successful AM growth requires a properly trained workforce

However the global workforce is not prepared to meet these needs
Barriers to Adoption

Existing training infrastructure Unequipped

- Unique design guidelines for components & assemblies
- Interactions between AM & conventionally manufactured parts
- Additional design specification requirements
- Management of interoperability between CAE systems
- New advanced tools

- Multiple technologies with different behaviors
- Unique environmental, software, consolidation, build volume, mechatronic, support & other factors affecting part performance precision

- Different behaviors between AM & conventional materials
- Unique environmental, physical, chemical & other factors affecting part performance precision
- Unique interactions among design, materials & process factors

- Multiple post-processing techniques for finished parts
- Unique effects of techniques on part-performance
Call to Action: What Educators need to do:

- Access
- Integrate
- Innovate
- Engage
- Enhance
- Excite
RICOH’s Approach

Consultative Services
for the growth of
Advanced Manufacturing

Managed Services
for Additive and
Digital Manufacturing

Production Services
that support and enhance
a services-based approach

Distributed Manufacturing
position Ricoh as the global leader
in enabling the emergence of
the new manufacturing model
Thank you!