Diginova

Innovation for Digital Fabrication

SEVENTH FRAMEWORK PROGRAMME

Grant agreement nr. 290559 – CSA project

theme NMP.2011.2.3-3

[Networking of materials laboratories an innovation actors in various sectors for product or process innovation]

Marcel Slot, Océ-Technologies B.V.

océ
A CANON COMPANY

Diginova project results

Presentation outline

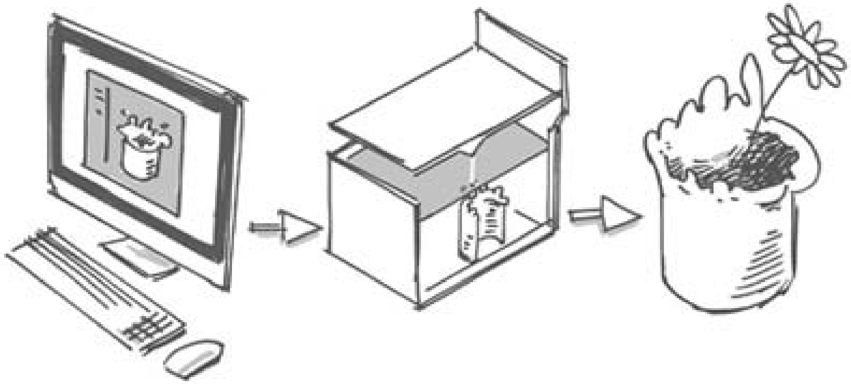
- **Diginova project: introduction & overview**
  - *Digital Fabrication – definition, technologies*
  - *Scope, objectives, vision*
  - *Impact and characteristics of Digital Fabrication*
  - *Paradigm shift in manufacturing*

- **Most promising applications & stakeholder views**

- **Key Technology Challenges & Business Drivers**
- **Recommendations for research**

End result: Roadmap for Digital Fabrication

Digital Fabrication definition



A **new industry** that uses **computer controlled** tools and **processes** to **transform digital designs** directly **into useful physical products**.

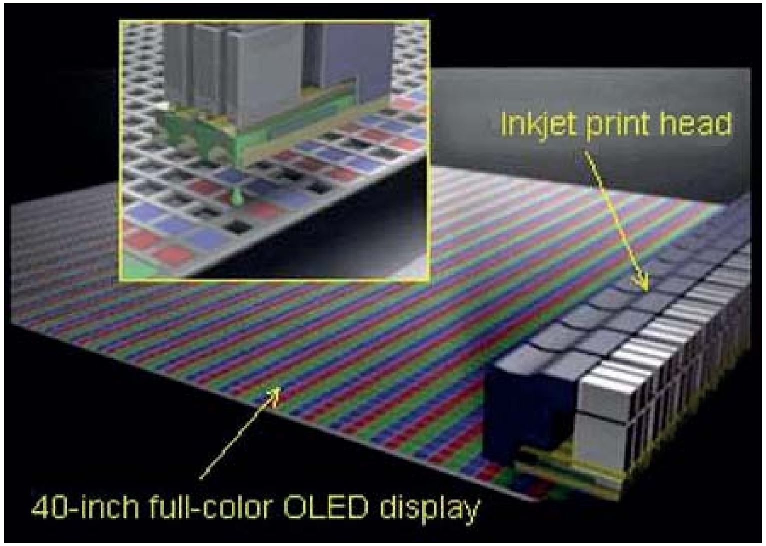
Development of well matched combinations of advanced new material deposition tools, processes and materials emerged as a key success factor for Digital Fabrication.

Digital Fabrication technologies

- **2D digital printing & patterning**
- **3D printing / Additive Manufacturing**
- ***Additive* instead of *substractive* technologies**

'Printing' in this context:
a digital material deposition technology

A versatile manufacturing technology



Diginova: Coordination & support action

Objectives

Determine current status, assess and promote the potential of Digital Fabrication

Impact on:

- *Manufacturing*
- *Materials*

Deliver a Digital Fabrication roadmap

- *clarify potential contribution to a sustainable European manufacturing industry*

20 parties

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Diginova partnership

imaging.org

Society for Imaging Science and Technology

Vision and ideas that led to Diginova

As the digital age advances, industries & society need to adapt

- **Digital technology has impacted whole industries, consumer behaviour & supply chains**
  - *Music industry*
  - *Photography*
  - *Printing*
  - *Communication*
  - *….*

- **Impact on Manufacturing & Materials?**

Vision and ideas that led to Diginova

- **We have had an industrial revolution …**
- **We have had a digital revolution …**
- ***Now is the time for a digital industrial revolution***

Impact and characteristics of Digital Fabrication

Paradigm shift in manufacturing:

design, manufacturing, materials, supply & demand, …

Because of the following DF characteristics:

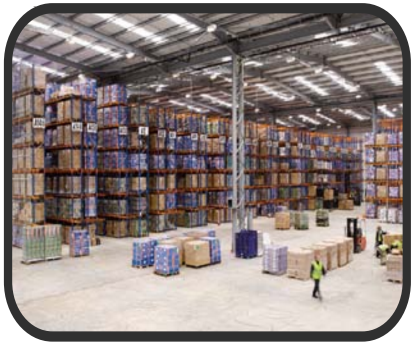
short runs, on-demand, customized, personalized, zero-waste, no stock, decentralized, fast turnaround, distribute & manufacture (instead of manufacture & distribute), clean & green, ease of use, user-centric design, …

Paradigm shift in manufacturing

Mass manufacturing

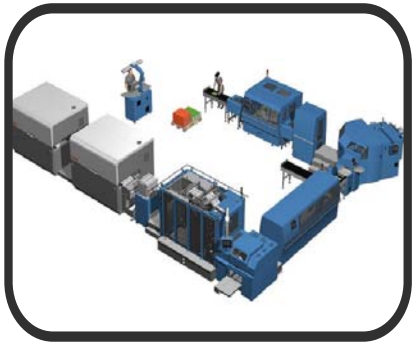
Mass production

(intercontinental) transport



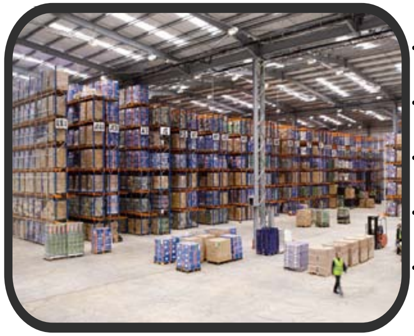
Local distribution centres

Digital fabrication



Local production sites

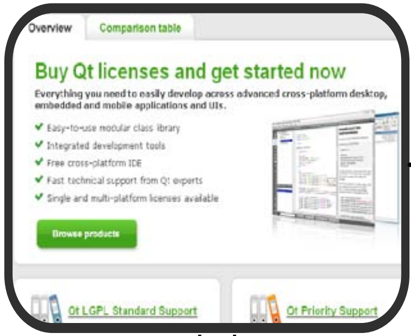
Push model



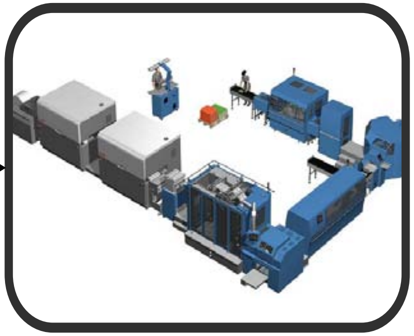
Distribution centres

Huge shopping malls

Production on demand



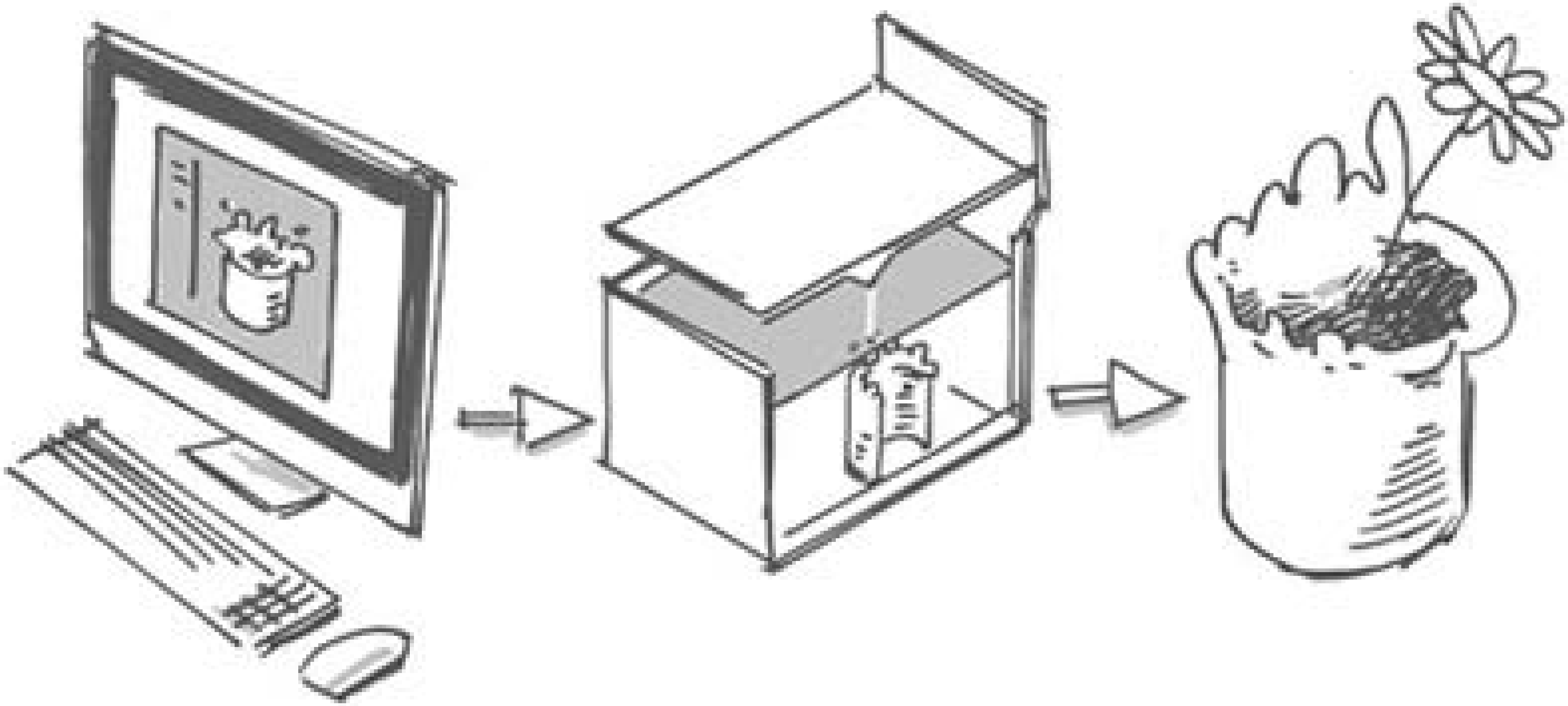
Webshops



Local production sites

Intermezzo 1

Concept of Digital Fabrication … a peek into the future



Digital Fabrication: the promise

- ***Matching manufacturing*** technology and ***key new materials***
- ***On-demand manufacturing*** for ***customized products*** with ***potential for short production series*** (down to 'series-of-one')
- ***Shortening change-over times*** to accommodate ***flexible production***
- Using ***additive manufacturing*** methods to enable production of products comprising of more than one material using ***minimal resources*** with ***no waste***
- Exploiting the ***inherent freedom of design*** in both geometry and material composition to produce ***products optimized for functional performance*** and not hampered by limitations imposed by manufacturing processes

Examples of ‘Freedom of Design’

From *Design for Manufacturing*

to

Manufacturing for Design

What we have done

Through coordinating actions:

- Clarify economic & societal **relevance of 'Digital Fabrication'** for Europe
- Pointed out ways **towards** sustainable economic **growth**
- Emphasized both **business value and technology**

Through networking actions:

- Engaged with different stakeholder communities
- Input for EU programs, research agendas, roadmaps
- Initiated creation of innovation networks

What we have done

- Identified most promising opportunities / applications
- Identified Key Technology Challenges & barriers
- Created the first roadmap for Digital Fabrication

The Diginova Roadmap for Digital Fabrication will be available for download from http://www.diginova-eu.org/ within the 2 weeks

Will our story be heard?

"Print me a Stradivarius"

How a new manufacturing technology will change the world

Coverstory , February 2011

http://www.economist.com/node/18114327

"The printed world"

“Print me a phone”

- *New techniques to embed electronics into products*
- *Convergence of printed electronics & 3D printing*

July 28th, 2012

http://www.economist.com/node/21559593

“The third Industrial Revolution”

“The digitisation of manufacturing will transform the way goods are made—and change the politics of jobs too”

Coverstory, April 2012

http://www.economist.com/node/21553017

Digital Fabrication: raising the bar in the US

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3D printing the 'next revolution' in manufacturing: President Obama

By Joe McKendrick | February 12, 2013, 7:01 PM PST

17 Comments

In his State of the Union address Tuesday night, U.S. President Barack Obama acknowledged the revival of the long-suffering U.S. manufacturing economy, and points to 3D printing as the technology that will create even more manufacturing opportunities.

Here is an excerpt of the speech:

"Our first priority is making America a magnet for new jobs and manufacturing. After shedding jobs for more than 10 years, our manufacturers have added about 500,000 jobs over the past three. Caterpillar is bringing jobs back from Japan. Ford is bringing jobs back from Mexico. After locating plants in other countries like China, Intel is opening its most advanced plant right here at home. And this year, Apple will start making Macs in America again.

"There are things we can do, right now, to accelerate this trend. Last year, we created our first manufacturing innovation institute in Youngstown, Ohio. A once-shuttered warehouse is now a state-of-the art lab where new workers are mastering the 3D printing that has the potential to revolutionize the way we make almost everything. There's no reason this can't happen in other towns. So tonight, I'm

11

+1

Original visual illustrating 'starting vision' of Diginova project

Vision: transform EU industries from their 20th century analog roots to their 21st century digital future

Interchangeable Parts

1798

Eli Whitney produced 10.000 muskets for $13.40 each

Mass Production

1908-1916

Assembly Time
14 hrs to 1.5 hrs

Statistical Process Control

Total Quality Management

1950-54

Japan Quality went from
"World's Worst"
To "World's Best"

Lean Manufacturing

Six Sigma

1955-1990

Companies Improve
20-30%

Computer Numerical Controlled Machines

1995

Greater Manufacturing Flexibility

Digital Manufacturing & Engineering

21st century

European Manufacturing as benchmark for the world

We identified the most promising applications

As well as key challenges ....

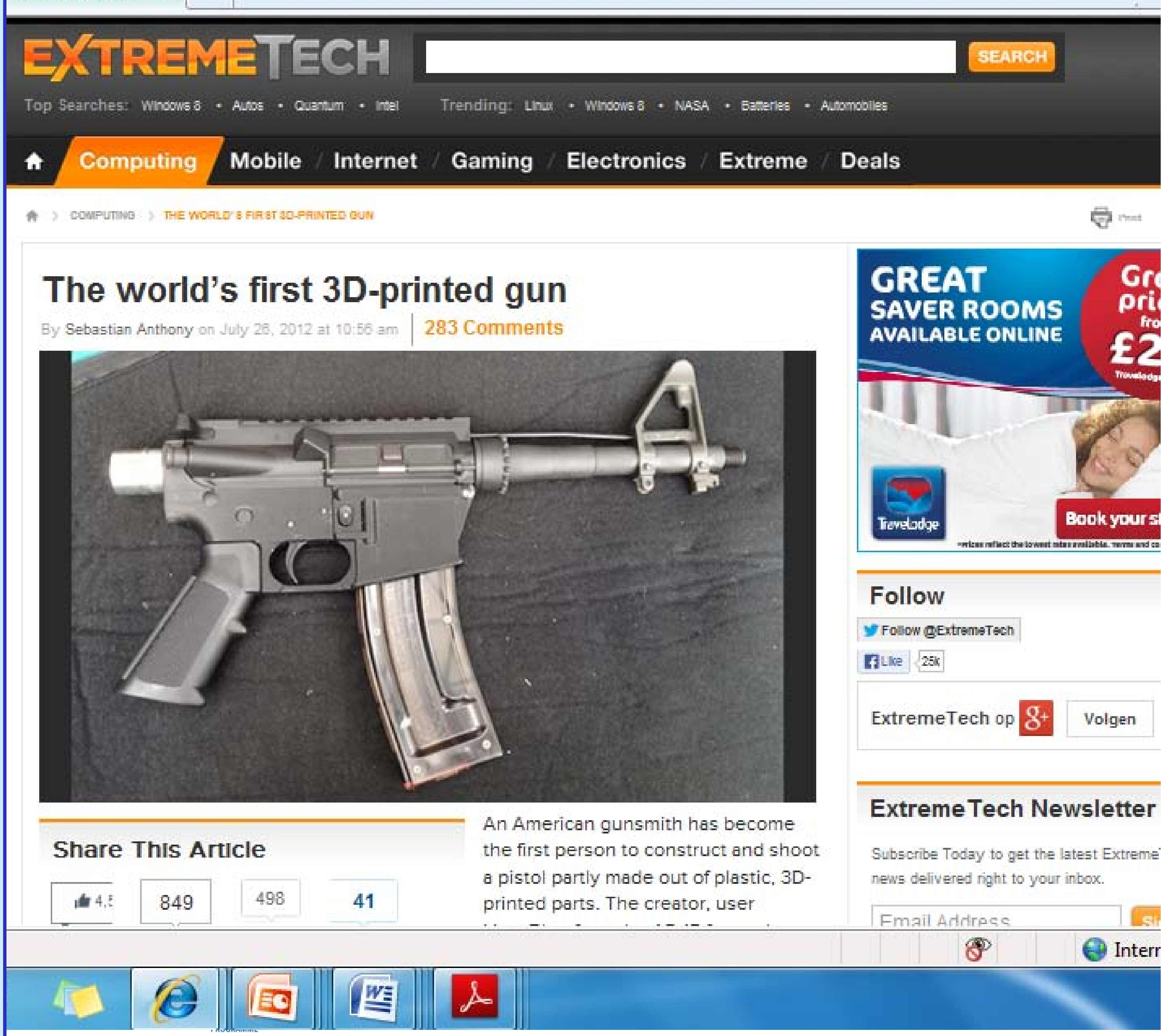
Intermezzo 2:

food for thought …

Many opportunities for Digital Fabrication…

Including meaningful ones…

This?



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Top Searches: Windows 8 • Autos • Quantum • Intel
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COMPUTING > THE WORLD'S FIRST 3D-PRINTED GUN
The world's first 3D-printed gun
By Sebastian Anthony on July 26, 2012 at 10:56 am
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An American gunsmith has become the first person to construct and shoot a pistol partly made out of plastic, 3D-printed parts. The creator, user
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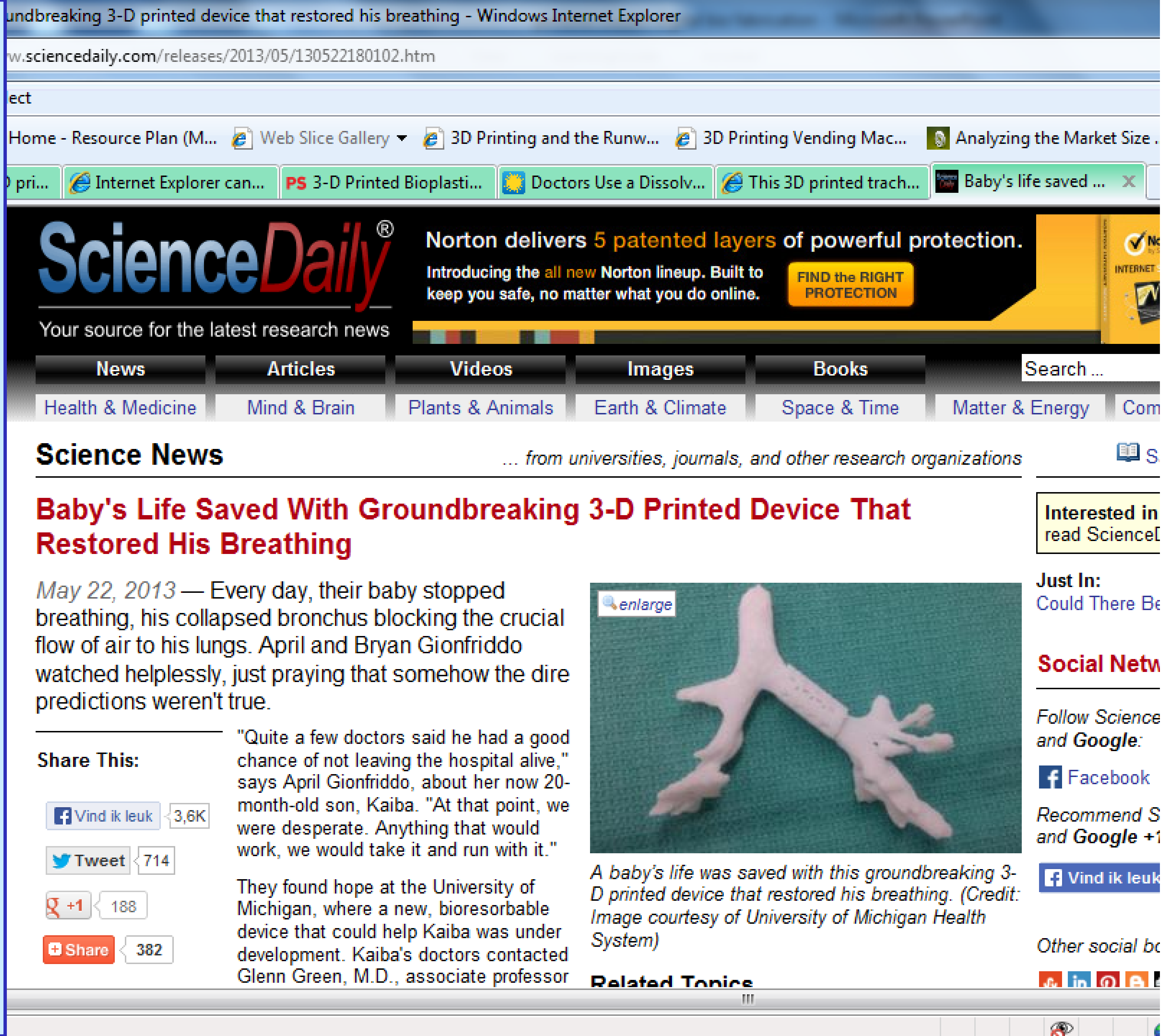

undbreaking 3-D printed device that restored his breathing - Windows Internet Explorer

w.sciencedaily.com/releases/2013/05/130522180102.htm

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Science News

... from universities, journals, and other research organizations

Baby's Life Saved With Groundbreaking 3-D Printed Device That Restored His Breathing

May 22, 2013 — Every day, their baby stopped breathing, his collapsed bronchus blocking the crucial flow of air to his lungs. April and Bryan Gionfriddo watched helplessly, just praying that somehow the dire predictions weren't true.

"Quite a few doctors said he had a good chance of not leaving the hospital alive," says April Gionfriddo, about her now 20-month-old son, Kaiba. "At that point, we were desperate. Anything that would work, we would take it and run with it."

They found hope at the University of Michigan, where a new, bioresorbable device that could help Kaiba was under development. Kaiba's doctors contacted Glenn Green, M.D., associate professor

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enlarge

A baby's life was saved with this groundbreaking 3-D printed device that restored his breathing. (Credit: Image courtesy of University of Michigan Health System)

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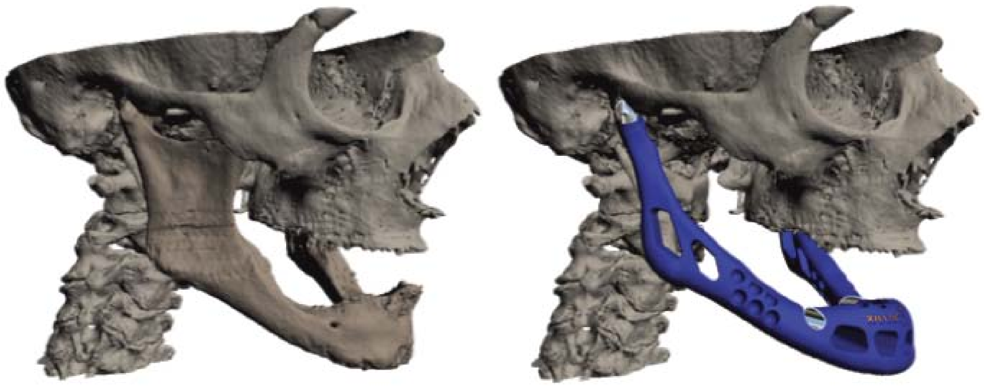
"Printing a 3D jaw and successfully implanting it, is like putting the first man on the moon.."



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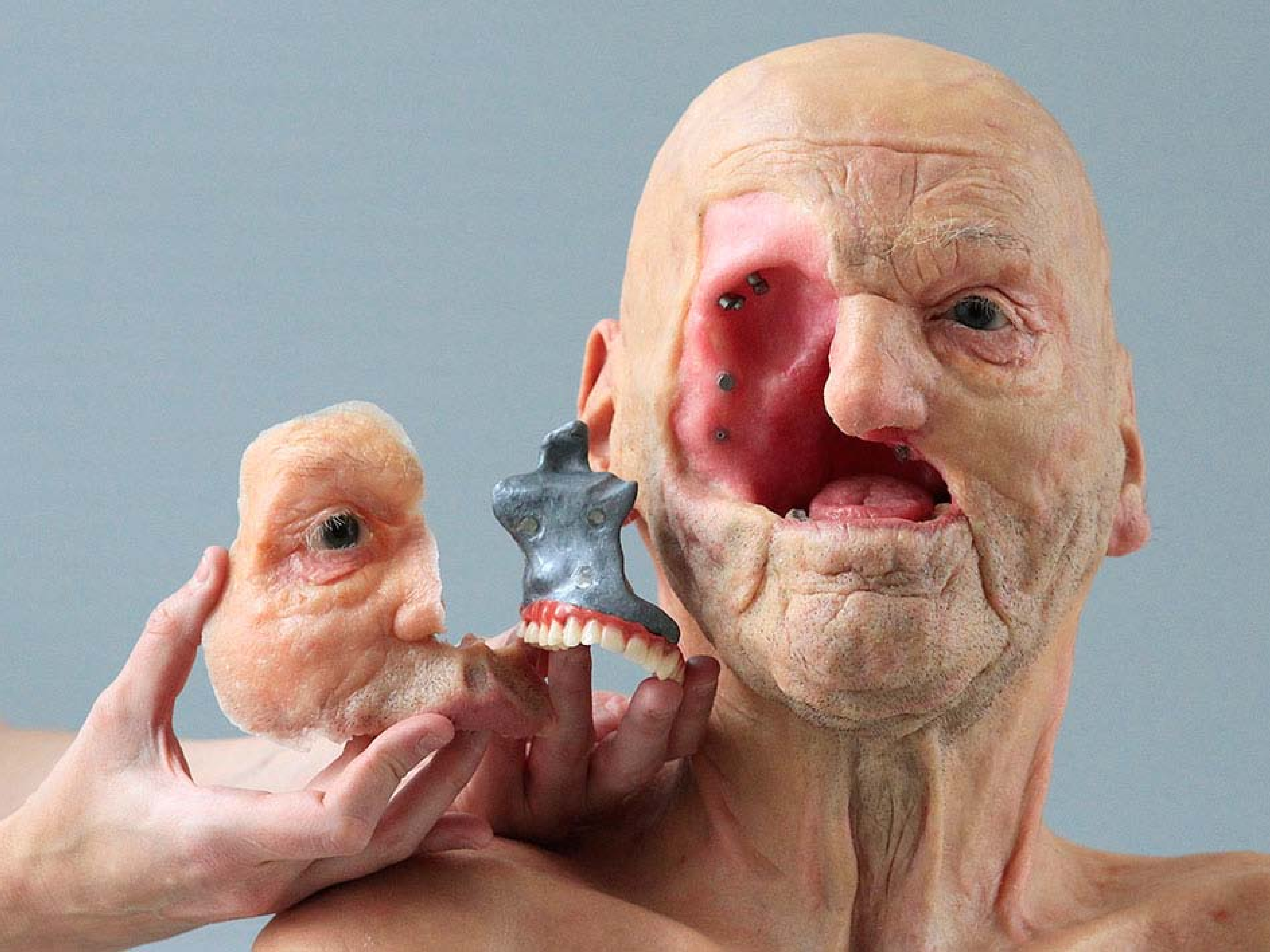
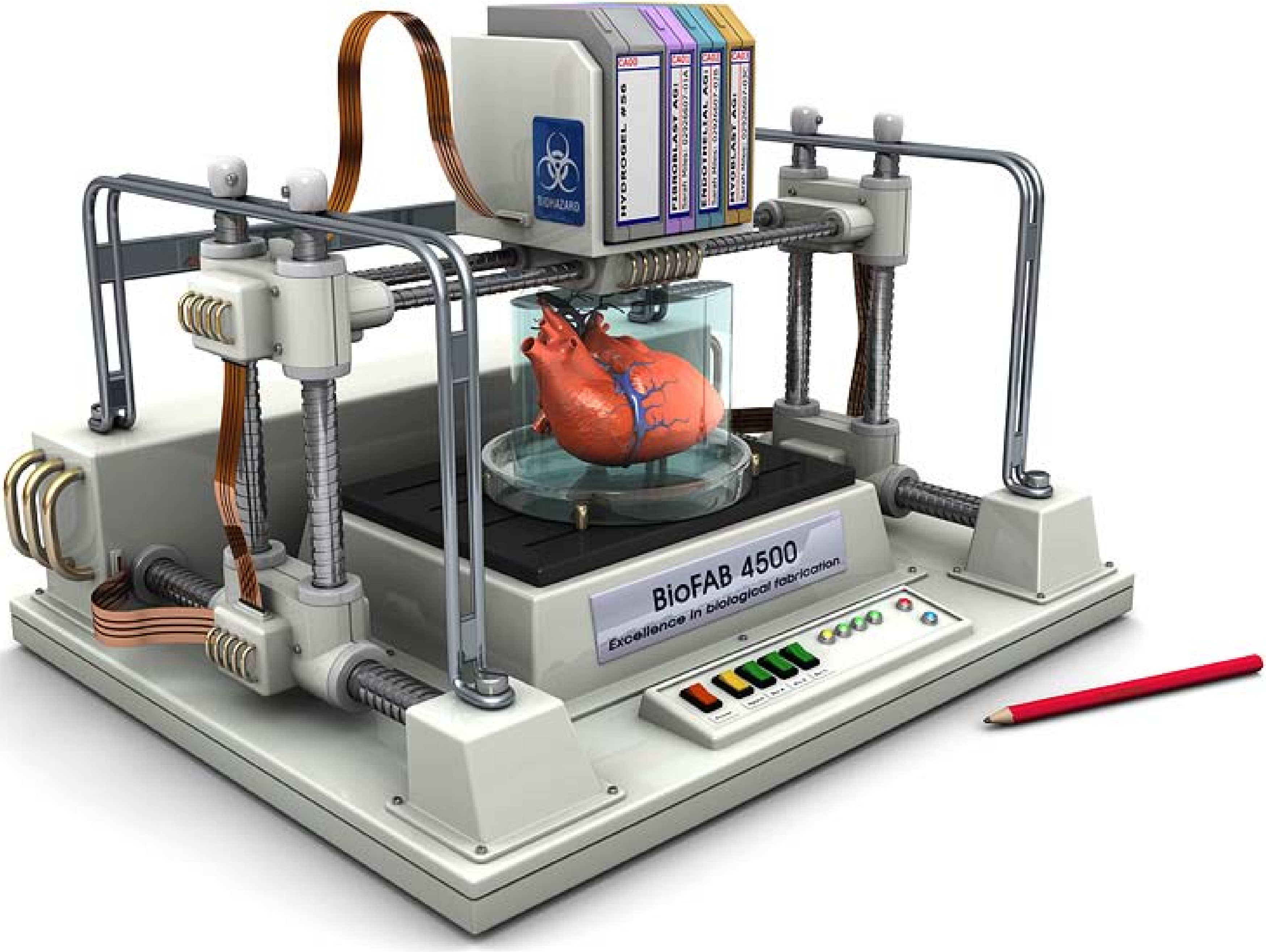
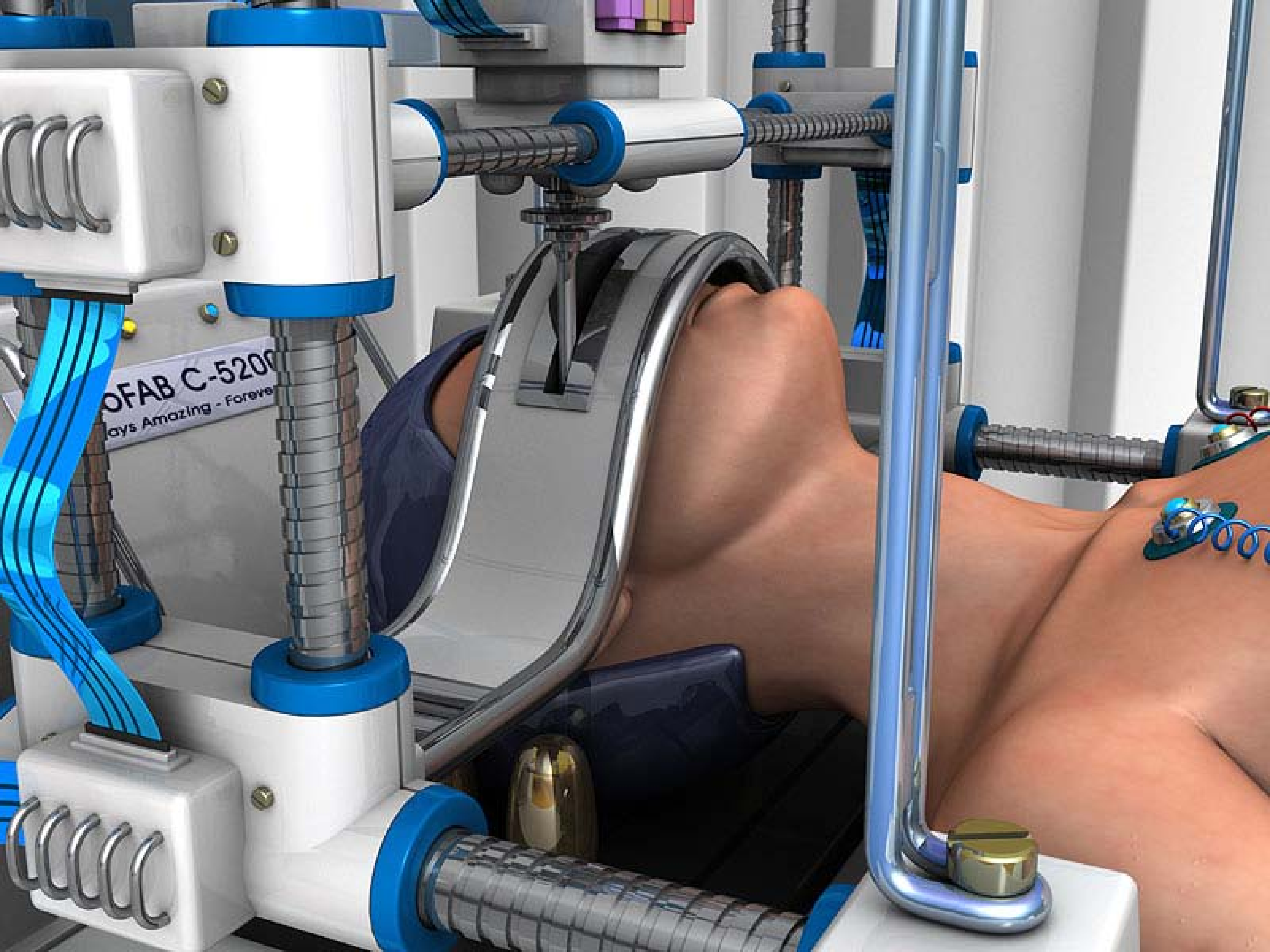



BioFAB 4500
Excellence in biological fabrication


oFAB C-5200
ays Amazing - Foreve

We cannot predict the future .. but we can invent it !

Diginova

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[Networking of materials laboratories an innovation actors in various sectors for product or process innovation]

Most promising opportunities/applications for DF and stakeholder views

Most promising opportunities

Exploring Opportunities

80

Step 1

1. Scoping & context
2. Develop long list
3. Assessment criteria

Prioritising Opportunities

20

Step 2

Assessment using defined evaluation criteria

Ranking Top Opportunities

10

Step 3

Systematic ranking to select top priorities

Identification of top opportunities for DF

Step 1

//Exploring of Opportunities

Step 1: Exploring opportunities

Agreeing on the definition & scope of Digital Fabrication

Guiding criteria for the selection of top opportunities

- New Materials
- Fit with Digital Fabrication Paradigm
- Sustainability
- Market Potential
- Developmental Compatibility
- Feasibility
- Viability
- Human Betterment

Step 1: Exploring opportunities

Categorization of explored opportunities in application domains

Digital Printing	3D printing	Printed Electronics	Human Applications
26	15	19	18

Identification of top opportunities for DF

Step 2

//Prioritizing Opportunities

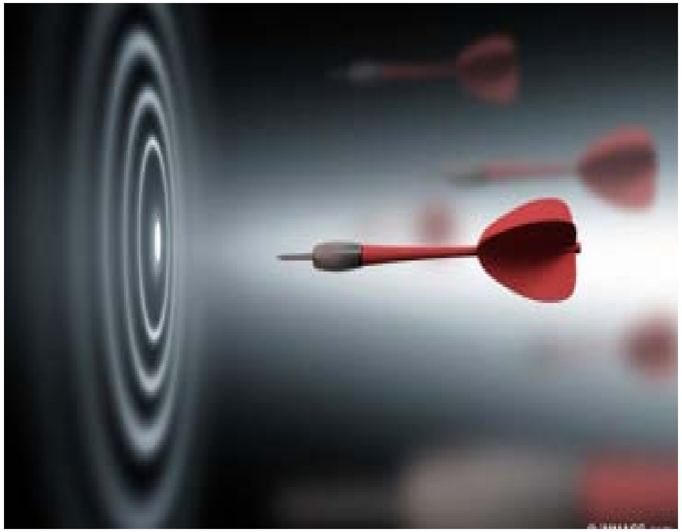
Step 2: Prioritizing opportunities

Utilization of the assessment criteria as a guiding resource to select 20 opportunities

- New Materials
- Fit with Digital Fabrication Paradigm
- Sustainability
- Market Potential

- Developmental Compatibility
- Feasibility
- Viability
- Human Betterment

Top ranked opportunities for DF



Step 3

//Selecting Top Opportunities

TOP 10 Opportunities in roadmap

Potential

Desciption of opportunity

Lifespan

Challenges

Fit with Digital Fabrication paradigm

Stakeholder engagement activities of Diginova allowed for a two-way dialogue between the consortium and relevant stakeholders. Both parties learned from eachothers experience and knowledge

Bridging Events

Access to Stakeholders
&
Exchange of view points

Stakeholder Survey

Survey Time to Market of 20 Opportunities
&
Systematic understanding of expectations and needs

Stakeholder Engagement Activities

Orchestrating Bridging Events

To enhance awareness on the possibilities of Digital Fabrication

To enable serious interaction on basis of substance

In total over 4000 potential stakeholders were reached. Key point was to create open and safe spaces for interaction. Such spaces then opened up the opportunity to receive stakeholder feedback.

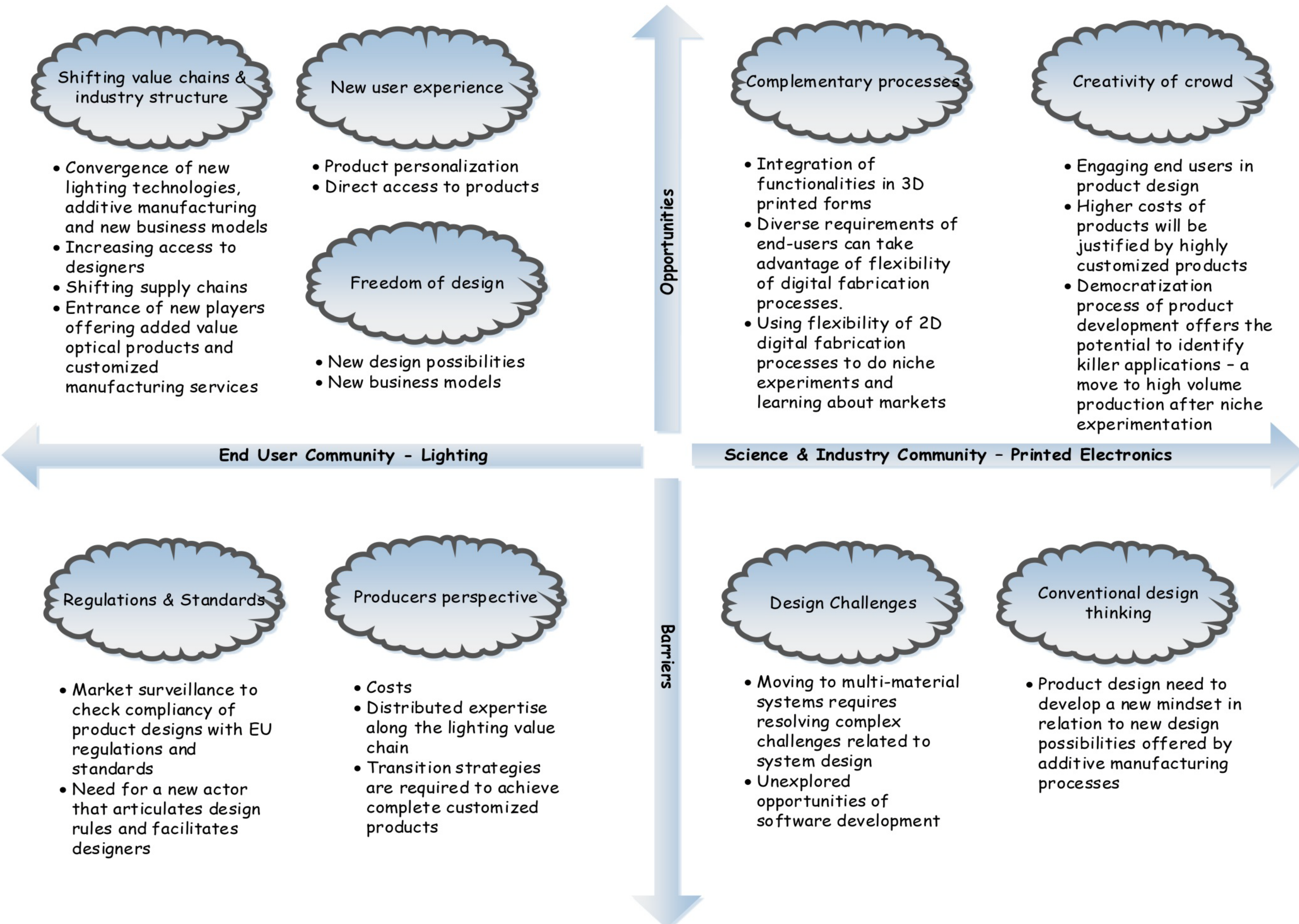
LOPE-C
Large-area, Organic & Printed Electronics Convention

ISFOE13

Digital Fabrication 2013

Smart Lighting May 2013 Germany **300**	LOPE-C June 2013 Germany **1800**	ISFOE July 2013 Greece **2000**	Digital Fabrication conference September 2013 USA **500**
User Community	**Scientific & Industrial Community**		

Summary of discussions during 3 bridging events



from the round table discussion

Vision of Digital Fabrication	**Critical problems & barriers to mass adoption** **High Material Costs** **Creation of Digital Files (costs of scanners & software)**
Opportunities	**The move towards using digital technologies for printing was acknowledged by the stakeholders. This move is stimulated by the market dynamics which points towards mass customization.**
Sustainability	**While new design opportunities, and production under ambient conditions can have significant positive impact, there is still little understanding on impact on TCO and energy usage. Hence, expectation management!!**

Stakeholder Survey

Survey Design

General Information	Vision of DF
Survey Questions	
Innovation	Commercialization

Data Collection

Between July – November 2013

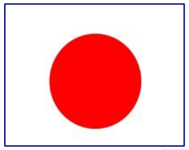
World wide stakeholder participation in Diginova survey from 26 countries

USA
27%

United Kingdom
16%

Germany
15%

The Netherlands
8%



Japan
6%

AUSTRIA	ITALY
BELGIUM	JAPAN
BRAZIL	KOREA
CANADA	NETHERLANDS
CHINA	NORWAY
CROATIA	PORTUGAL
DENMARK	ROMANIA
FINLAND	SLOVAKIA
FRANCE	SPAIN
GERMANY	SWEDEN
GREECE	SWITZERLAND
INDIA	UK
IRELAND	USA

Strikingly, when stakeholders were asked to position Digital Fabrication on the Gartner technology life cycle, responses covered the entire spectrum. This supports the need for anticipatory coordination activities, including development of research agendas and industry roadmaps.

Despite uncertainties, a striking finding is strong consensus of stakeholders when asked to specify expectations around a first set of applications and time frames in which these would enter the market.

TOP 5 product domains to be ready for market in the next 5 years:

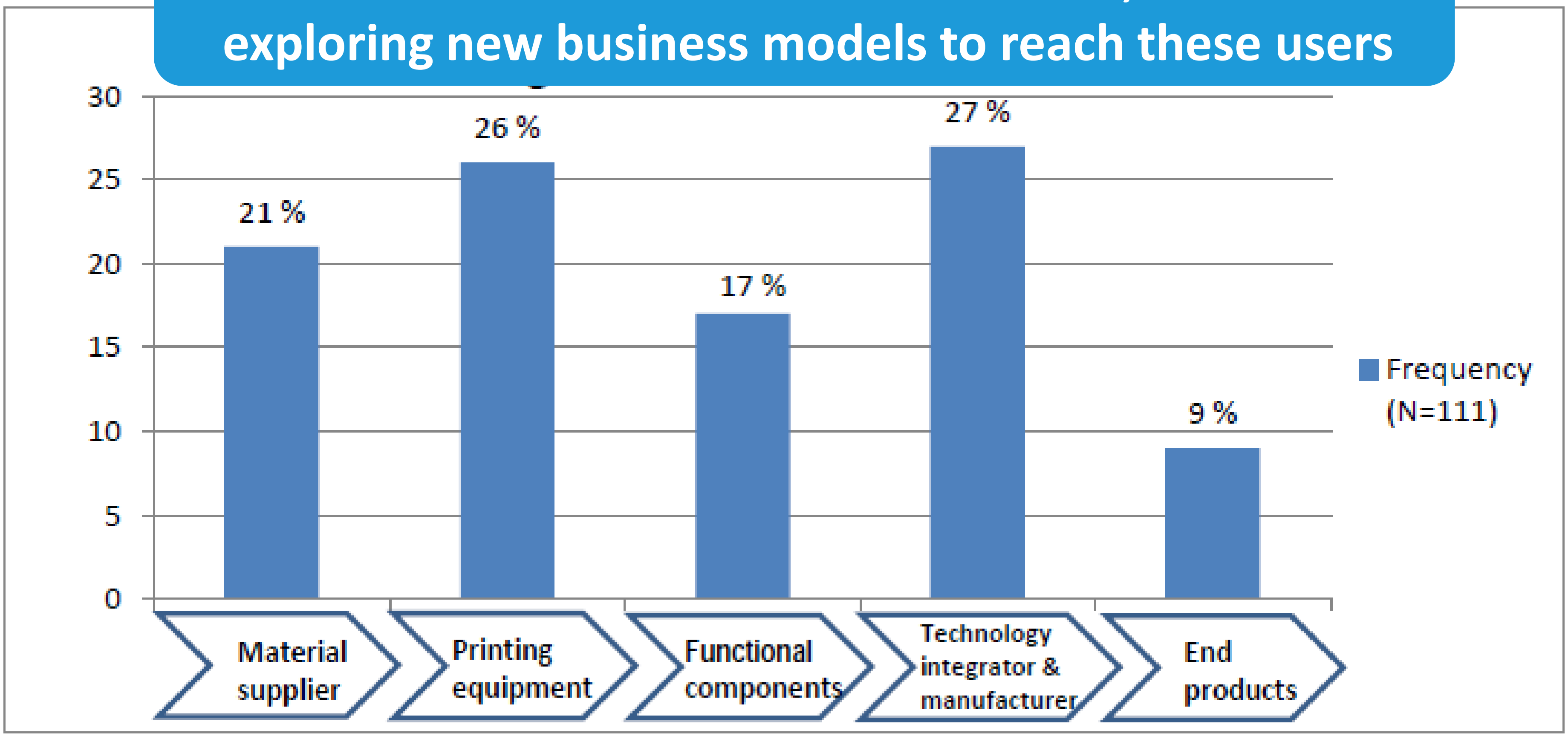
1. Decoration of Products & Surfaces (78%)
2. Digitalization of Traditional Printing (76%)
3. Textile Printing (75%)
4. Packaging (71%)
5. Display Graphics (66%)

Printed Sensors

Garments

Digital Fabrication: technology-linked relationships among actors dominate. B2B relationships are explored & new combinations are formed across traditional value chains.

Value Chain Dynamics
Businesses are still in search of users, and are exploring new business models to reach these users



Finally, stakeholder perceptions in relation to required business enhancing developments as well as support actions are in line with key technology barriers identified within Diginova

Stakeholders: Broad consent on future barriers

1) Wider choice of materials	(89%)
2) Improved material properties	(88%)
3) Greater accuracy	(83%)
4) Broadening of the product range	(83%)
5) Greater Repeatability	(82%)

Innovation for Digital Fabrication

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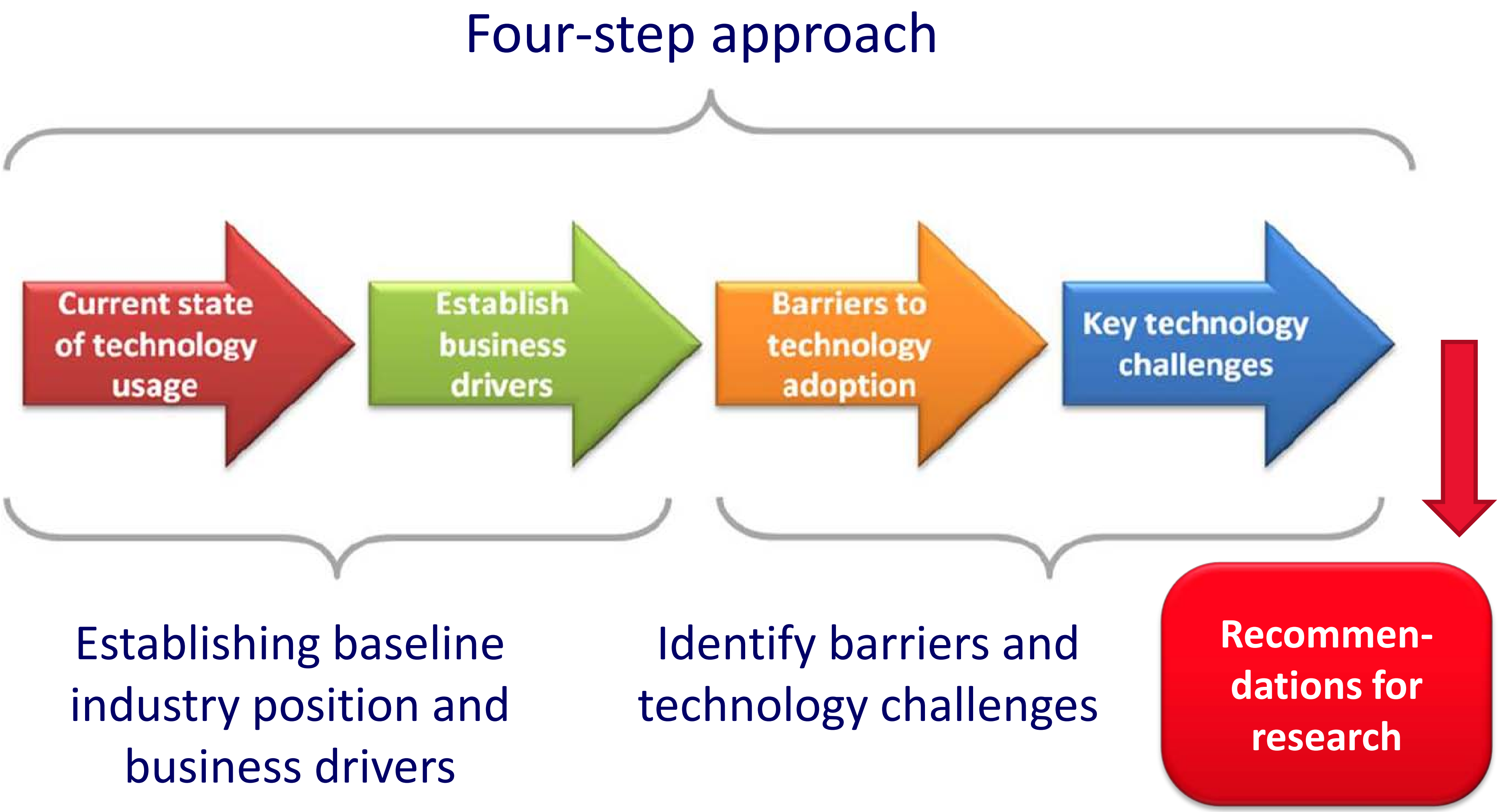
Key Technology Challenges & Business Drivers

Sequence of steps to identify key technology challenges and business drivers



Current state of Digital Fabrication Technology

- Data provided by Diginova consortium and established stakeholders base
- State of 2D and 3D digital fabrication technology:
  - 2D: Identified 37 commercial systems and 14 developmental systems
  - 3D: Identified 45 commercial systems and 11 developmental systems
- Identified technology classes:

2D

- Piezoelectric inkjet
- Electrostatic inkjet
- Thermal inkjet
- Laser inkjet
- Indirect inkjet
- Continuous inkjet
- Electrophotography
- Aerosoljet
- Laser ablation technology

3D

- Powder bed fusion
- Directed energy deposition
- Material jetting
- Binder jetting
- Material extrusion
- Vat photopolymerisation
- Sheet lamination

For which applications is Digital Fabrication currently used?

- Collected wealth of data on which technologies are used for which applications
- Most data was entered in large tables
  - Example: 3D printing technologies vs. applications

Classification	Material	Aerospace			Automotive		Medical								Energy		Creative Industries	Consumer goods					Defence			Electronics		Prototyping	Production aids, jigs, fixtures	Tooling and Casting	Comments
		Airframes	Power	Cabin	Road (consumer)	Sport	Orthopaedic	Prosthetic / Orthotic	Dental implants	Surgical guides	Organic materials / Tissue scaffolds	Drug delivery (implant)	Medical microfactories	Hearing aids	Generation	Storage	Artefacts and models	Jewellery	Toys and games	Clothes, shoes and fashion	Consumer electronics	Home products	Weapons	PPE and Armour	Logistics and support	Packaging	Sensing, logical elements				
Powder Bed Fusion	Metal	1	1	2	2	2	2	0	2	0	0	0	0	0	2	2	2	2	1	2	0	0	2	2	2	0	2	2	0	2	
	Polymer	0	0	2	2	2	2	2	2	2	0	0	0	2	0	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	
	Ceramic	0	2	0	0	0	2	0	2	0	0	0	0	0	0	2	1	0	0	0	0	2	0	2	0	0	2	2	0	2	
Directed Energy Deposition	Metal (powder feed)	2	2	0	2	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	2	0	2	
	Metal (wire feed)	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	2	0	2	
Material Jetting	Photopolymer	0	0	0	0	2	0	2	0	0	0	0	0	2	0	2	0	2	0	0	2	2	0	2	0	2	2	2	2	2	
	Wax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	
	Biological cells	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Metal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	Added to include Super-fine Ink Jets (Océ)
Binder Jetting	Metal	0	0	0	2	2	0	0	2	0	0	0	0	0	0	2	2	2	0	2	0	0	0	0	0	0	2	2	0	2	
	Polymer	0	0	2	2	0	2	2	0	2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	2	0	2	0	0	
	Ceramic	0	2	0	0	2	2	0	2	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	2	2	0	2	
Material Extrusion	Metal	2	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	
	Polymer	0	0	2	2	0	2	2	0	2	0	0	0	0	0	0	2	0	0	1	2	0	2	0	2	2	2	2	2	2	
[illegible]	Photopolymer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Current state of technology usage: main results

1. Data suggests that 2D digital fabrication is less widely adopted across applications than 3D digital fabrication
   - "Horses for courses"
   - Possibly earlier stage on the technology diffusion curve for some technologies

Note that these data are not a reflection of impact or economic value → it is a reflection of diversity in applications

2. Some technologies span different application families/domains
   - Piezoelectric jetting
   - Aerosol jetting
   - Powder bed fusion systems

→ 3D technology variants appear to typically span more applications than 2D technologies

Which business drivers are behind current DF technology usage?

- Various types of business drivers considered over the product life cycle:

1
- Raw material
- Raw material waste

2
- Design freedom
- Accuracy
- Materials
- Prod. economics
- Energy & water
- Lead time
- IP protection

3
- Short supply chains
- Decentralisation

4
- Customisation
- (Multi)-functionality
- High performance
- Graded materials

5
- Recyclability

Data on business drivers

- Repeating methodology for technology usage, collected a wealth of data on which business drivers relate to which applications
- Entered in large tables, applications X-axis, drivers on Y-axis
  - Example: 2D printing applications vs. drivers

Classification	Printed products (paper or paper-like substrate)						Printed products (other substrates)							Printed electronics (including consumer electronics)													Human applications and food products					Printed surface treatment			Comments
	Packaging / labels	Books	Newspapers, magazines, journals, collateral	Personalised products	Decorative printing on paper	Small volume printing, advertisements and signage	Printing on textiles	Printing on ceramic tiles	Security printing	Customised interior/ exterior design and décor	Identification markings	Direct printing on vehicles	Personalised products & gadgets	Displays, smart windows and tapestry	OLED Lighting	RFID tagging	Wireless devices	PCBs	Printed organic photo-voltaics	Thin batteries	Thin heating elements	Stretchable substrate drivers	Smart fabrics ("e-clothes")	Switching membranes	Transparent conductors	Printed thin and flexible sensors, "lab-on-a-chip"	Decorative / event specific printing on food items	Printed food products and proteins	Personalised food supplements	Personalised diagnostics, "organ-on-a-chip"	Personalised drugs	Printed surface treatment	Printed etch-masks	Nano-functionalised coatings	
Increased design freedom, including feature size	1	0	0	0	0	0	1	1	0	1	2	0	0	2	2	0	0	0	2	2	2	2	2	0	2	1	2	0	0	0	0	1	1	2	Does the technology's ability to create complex designs drive adoption in this sector? E.g. smaller feature size and more grey values (Océ).
Decreased deposition thickness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	Is the technology's ability to create very thin printed layers, compared to other processes, a driver of adoption?
Improved deposition accuracy	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	2	Is the technologies ability to precisely deposit material a driver for adoption?
Greater material range	2	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	1	0	1	Is the available build material range a driver for technology adoption? E.g. using copper instead of silver or food safe materials (Océ).
Freedom to print on non-planar surfaces	2	0	0	0	0	0	0	0	0	2	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Is the technology's ability to print on non-flat surfaces a driver for adoption? E.g. print the RFID directly on the product (Océ).
Ink / toner substitutability	1	0	0	0	2	2	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	1	Is digital printing's ability to switch from one ink / toner material to another without much reconfiguration a driver?
Substrate substitutability	2	2	0	0	0	1	1	1	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Is digital printing's ability to switch from one substrate material to another without much reconfiguration a driver?
Independence of economies of scale	1	2	1	0	2	2	1	2	0	2	0	0	0	1	1	1	0	2	0	1	0	0	0	0	0	1	2	2	0	0	0	1	2	1	Does the absence of large sunk costs for tooling motivate the adoption of digital printing?
Reduced raw material waste	1	2	2	0	2	1	2	2	0	1	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	2	0	Does a reduction of waste streams resulting from digital printing drive technology adoption? Elimination of stock to waste (Océ).
Supply chain consolidation	1	2	1	0	0	0	1	1	0	0	0	0	0	1	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	Is digital printing's ability to create near finished or near finished printed products in a single step a driver? E.g. manufacture without PCBs (Océ).

Main observations for the business drivers of Digital Fabrication

- “Fragmented” business drivers for 2D digital fabrication
- More uniform relevance of business drivers in application domains for 3D digital fabrication
- Independence of economies of scale is reported as a highly relevant business driver for both 2D and 3D

Main observations for the business drivers of Digital Fabrication

- Other business drivers reported as important:
  - Supply chain consolidation and decentralisation
  - Design freedom and customisation
  - Light weighting and optimisation

- Business drivers of smaller importance
  - Raw material / substrate related
  - End-of-life and recyclability

Identification of Key Technology Challenges

Identified barriers to technology diffusion

2D

- Relative process economics
- Core system compatibility (incl. printhead-material)
- Reliability, quality, robustness
- Process architecture, openness
- Jetting-head characteristics
- Inter-system compatibility, modularity

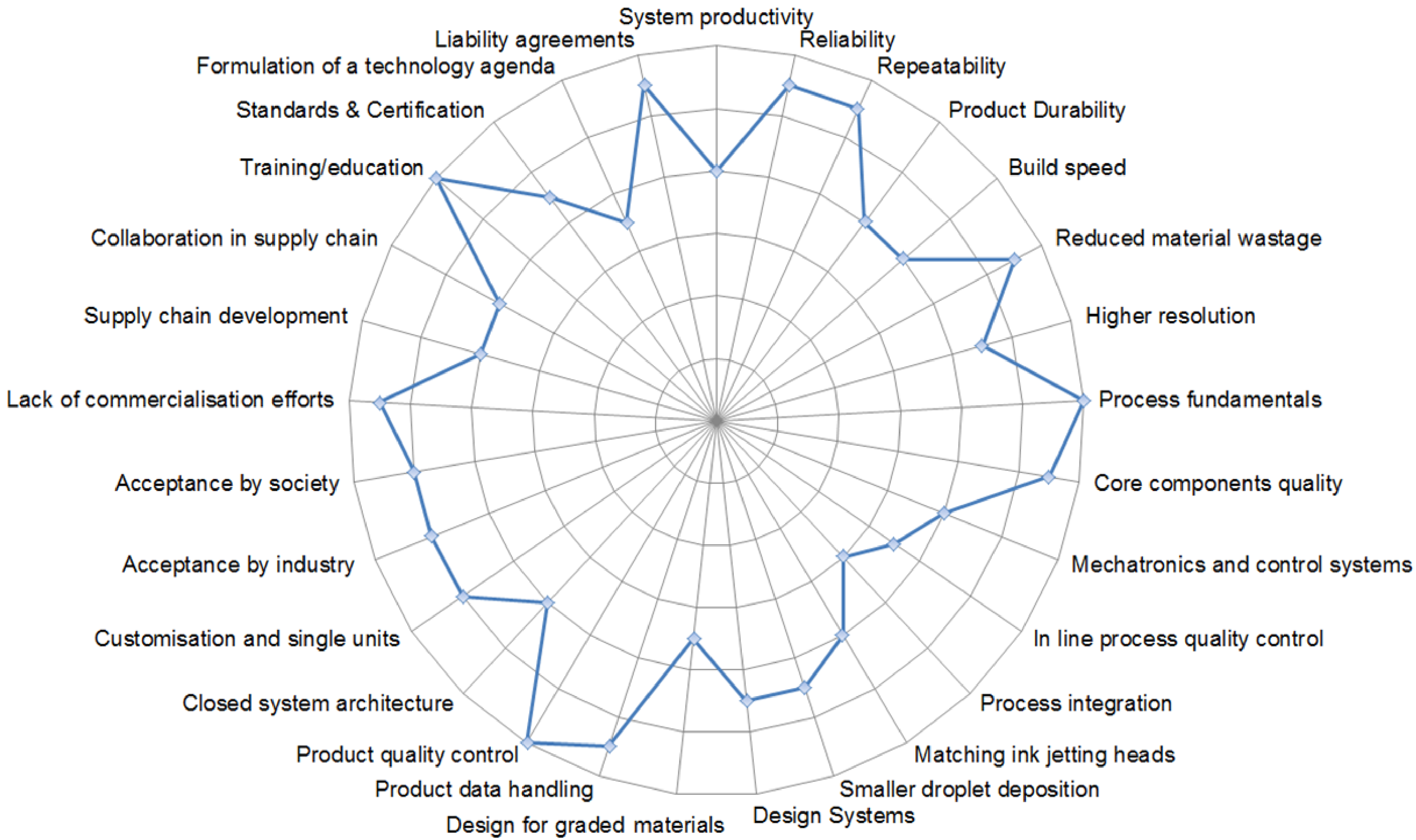
3D

- Relative process economics
- Productivity, capacity
- Reliability and quality
- Machine concept, openness of process architecture
- Ownership, liability, I.P., and standardisation
- Finance & skills base
- Design, tools and methods
- Acceptance in industry and society

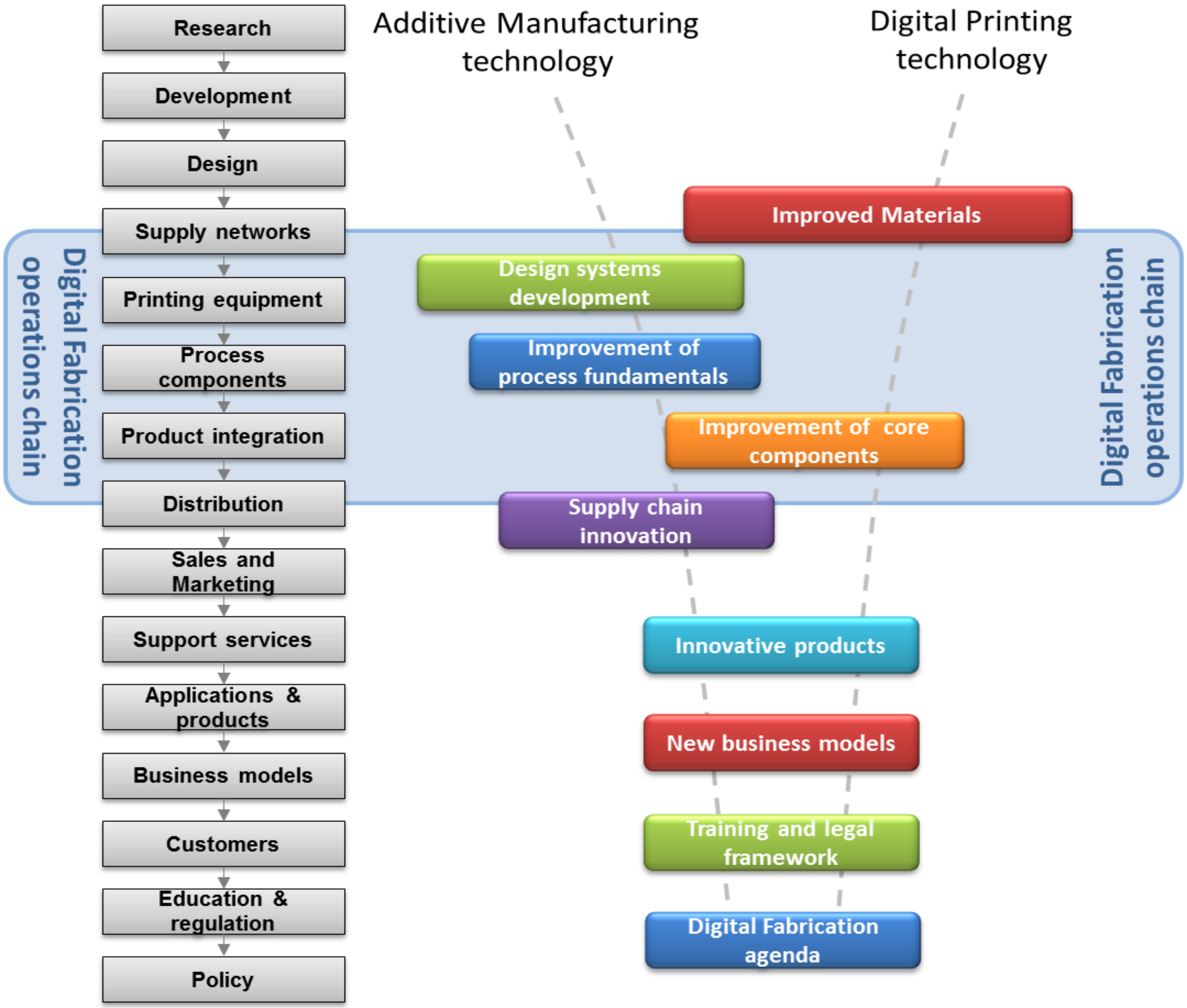
Identification of Key Technology Challenges

- Identified KTC's on the basis of barriers
  - *By pairing up the causes and possible solutions to each technology barrier*
- Analyzed the relative urgency barriers across 20 important application fields in 4 'domains':
  - *Digital Printing*
  - *Additive Manufacturing*
  - *Printed Electronics*
  - *Human Applications*

Identified Key Technology Challenges & relative urgency

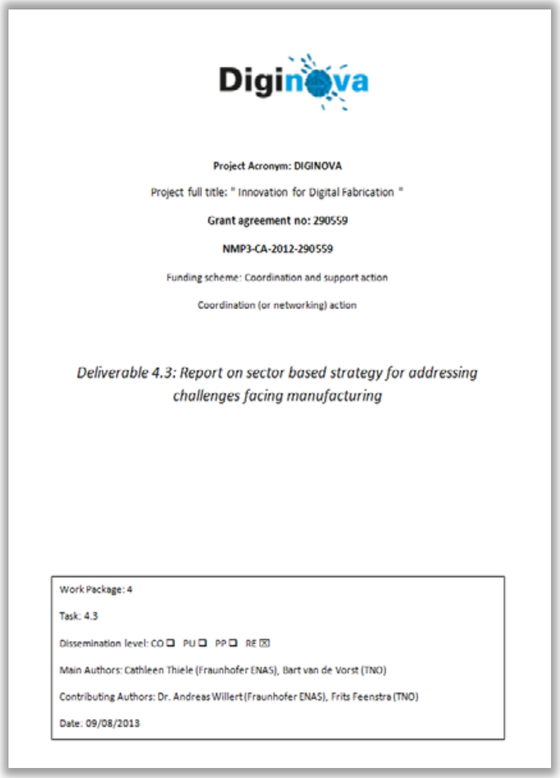


Areas of technology challenges & technology convergence



Recommendations for research

- Addressing each Key Technology Challenge, a comprehensive list of research recommendations was created
- Separate recommendations for research for 2D and 3D Digital Fabrication technologies
- Extensively reported in deliverable D4.3
  "Report on sector based strategy for addressing challenges facing manufacturing"
- **Summarized in the Diginova roadmap**


Diginova

Project Acronym: DIGINOVA

Project full title: " Innovation for Digital Fabrication "

Grant agreement no: 290559

NMP3-CA-2012-290559

Funding scheme: Coordination and support action

Coordination (or networking) action

Deliverable 4.3: Report on sector based strategy for addressing challenges facing manufacturing

Work Package: 4

Task: 4.3

Dissemination level: CO ☐ PU ☐ PP ☐ RE ☒

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Date: 09/08/2013

Summary: challenges & research recommendations

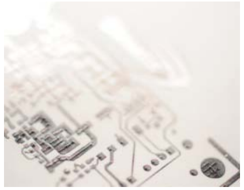
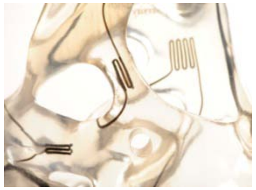
- **Recommendations for research available to feed into European research agenda**
  - Also identifying gaps in EU industrial capability, i.e. technology integration
- **Analysis of KTC's enables a prioritisation of research activities**
- **Areas of high priority include:**
  - Process reliability, repeatability, material waste
  - Process fundamentals and core system components
  - Material performance and material range
  - Data handling and quality control methods
  - Commercialisation agenda, education and legal framework

Summary: challenges & research recommendations

- **Currently observing convergence of 2D digital printing and Additive Manufacturing**
  - Formation of a new field in manufacturing
  - Diginova outputs have real novelty & added value

- **Numerous Key Technology Challenges must be addressed across all Technology Readiness Levels**

- **Europe well positioned to reclaim its manufacturing heritage**


Recommendation

- Diginova roadmap: growth opportunities for sustainable manufacturing in Europe
- Should be embedded in larger European program
- Link to Factories of the Future

Thank You!