

The New Industrial Revolution: Opportunities for Britain and the World

Cranfield University, Feb 18 2014

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After the economic crisis...



What's the future for manufacturing?



Some optimistic views



“There’s a new zeitgeist: I’m seeing a global manufacturing renaissance” :
Jeff Immelt, chief executive, General Electric, April 2012.

China a big part of the picture



A mix of skills and capabilities



But production jobs becoming scarcer



Where are the people ?



EU manufacturing employment dropped 11 per cent between 2008 & 2012 (net loss 4.3m jobs)



The new industrial revolution

- What manufacturing means
- Global trends – where Britain fits in
- The 5th industrial revolution
- Business strategies

The new industrial revolution

- The meaning of manufacturing**

What lies behind manufacturing

- Manufacturing = Materials + Energy + Ideas
- The creative force behind 10bn unique products
- It accounts for 16 per cent of world economy (10pc of UK economy)
- It employs about 300m people or roughly 5 pc of world population.(In the UK, manufacturing employment about 2m, or about pc of population)
- The price effect: manufacturing characterised by deflation (compared to services)

The table of life

Group

1

IA

2

IIA

3

IIIB

4

IVB

5

VB

6

VIB

7

VIIB

8

VIII

9

VIII

10

VIII

11

IB

12

IIB

13

IIIA

14

IVA

15

VA

16

VIA

17

VIIA

18

VIIIA

1

¹H

Hydrogen

1.00794

1a

13.5984

3

³Li

Lithium

6.941

1s²2s

5.3917

11

¹¹Na

Sodium

22.98976928

[Ne]3s¹

5.1391

19

¹⁹K

Potassium

39.0983

[Ar]4s

4.3407

37

³⁷Rb

Rubidium

85.4678

[Kr]5s

4.1771

55

⁵⁵Cs

Cesium

132.9054519

[Xe]6s

3.8939

87

⁸⁷Fr

Francium

(223)

[Rn]7s

4.0727

2

⁴He

Helium

4.002602

1s²

24.5874

4

⁹Be

Beryllium

9.012182

1s²2s²

9.3227

12

¹²Mg

Magnesium

24.3050

[Ne]3s²

7.6462

20

²⁰Ca

Calcium

40.078

[Ar]3d^{4s}

6.1132

38

³⁸Sr

Strontium

87.62

[Kr]5s²

5.6949

56

⁵⁶Ba

Barium

137.327

[Xe]6s²

5.2117

88

⁸⁸Ra

Radium

(226)

[Rn]7s²

5.2784

10

²⁶Fe

Iron

55.845

[Ar]3d⁶4s²

7.9024

26

²⁶Fe

Iron

55.845

[Ar]3d⁶4s²

7.9024

44

⁴⁴Ru

Ruthenium

101.07

[Kr]4d⁷5s¹

7.3605

76

⁷⁶Os

Osmium

192.23

[Xe]4f¹⁴5d⁶6s²

8.3482

110

¹¹⁰Ds

Darmstadtium

(281)

[Rn]5f¹⁴6d¹⁰7s²

6.0260

112

¹¹²Cn

Copernicium

(285)

[Rn]5f¹⁴6d¹⁰7s²

5.9914

114

¹¹⁴Uuq

Ununquadium

(289)

[Rn]5f¹⁴6d¹⁰7s²

6.2617

116

¹¹⁶Uuh

Ununhexium

(293)

[Rn]5f¹⁴6d¹⁰7s²

6.50

118

¹¹⁸Rn

Radon

(222)

[Hg]6p⁶

10.7485

120

¹²⁰Uuo

Ununoctium

(294)

[Rn]5f¹⁴6d¹⁰7s²

4.97

122

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Ununseptium

(294)

[Rn]5f¹⁴6d¹⁰7s²

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124

¹²⁴Uuq

Ununquadium

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[Rn]5f¹⁴6d¹⁰7s²

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Ununhexium

(293)

[Rn]5f¹⁴6d¹⁰7s²

6.50

128

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Ununseptium

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Ununoctium

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Ununseptium

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Ununoctium

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Ununseptium

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Ununoctium

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Ununseptium

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³⁵⁰Uuo

Ununoctium

(294)

[Rn]5f¹⁴6d¹⁰7s²

4.97

352

³⁵²Uus

Ununseptium

(294)

[Rn]5f¹⁴6d

[†]Based upon ¹²C. () indicates the mass number of the longest-lived isotope.

Bringing order to chaos (countering the 2nd law of thermodynamics)



10,000 years of evolution in adding information to materials



Stone age axe : resources needed to make one unit

Number of manufacturing workers: 1

Number of sites: 1

Number of materials: 1

Skills honed by learning over decades

Where we are now



The iPhone 5: resources needed to make one unit

Number of manufacturing workers: 5,000

Number of sites: 50

Number of materials: 50

Skills honed by science and technology advances

The new industrial revolution

- The meaning of manufacturing
- Global trends – where Britain fits in**

1800 – At the dawn of modern manufacturing

Share of world production



Early Chinese astronomical clock

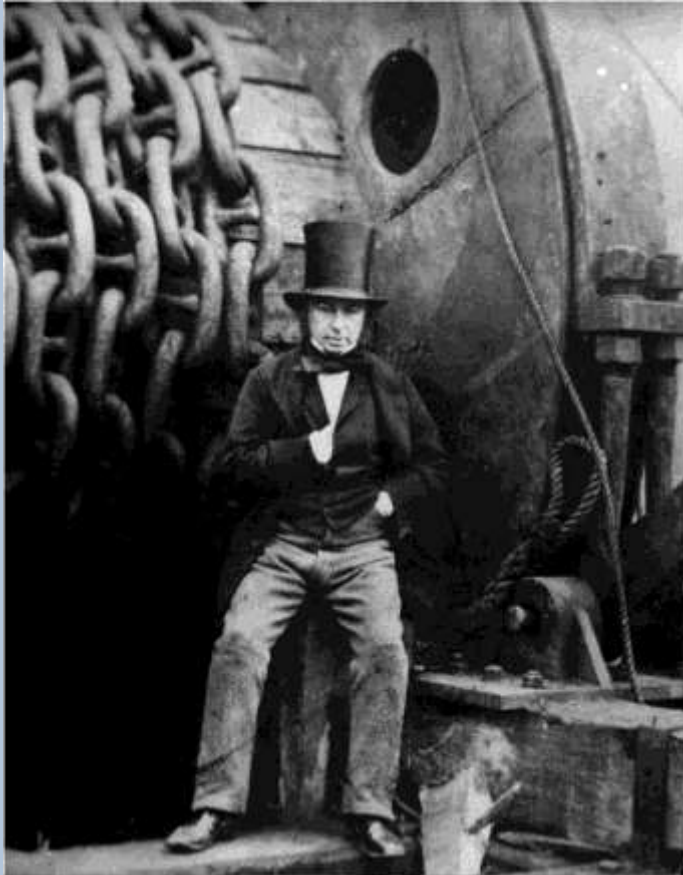
1. China	33.3%
2. India*	19.7%
3. Russia	5.6%
4. UK	4.3%
5. France	4.2%
6. Germany**	3.5%
6. Japan	3.5%

Source: Paul Bairoch data; *includes Pakistan;

** German states

1900 – Britain's century; but the US taking over

Share of world production



Isambard Kingdom Brunel, pioneer of the
First Industrial Revolution

1. US	23.6%
2. UK	18.5%
3. Germany	13.2%
4. Russia	8.8%
5. France	6.8%
6. China	6.2%
7. Japan	3.5%

Source: Paul Bairoch data

2012– China regains the lead

Share of world production



Giant Sany crane

1. China 22.4%

2. US 17.5%

3. Japan 9.4%

4. Germany 6.0%

5. South Korea 2.8%

6. Italy 2.4%

7. Russia 2.3%

Source: UN data

Growth in manufacturing output 2000-12

China +241%

Britain - 9%

Europe + 14%

World + 52%

France + 1%

Germany + 23%

Japan + 13%

US +20%

(Constant 2005 dollars, Source: UN)

Who's re-shoring?

Changes in shares of world manufacturing (2011-12)

China	+1.8 percentage points
US	+ 0.3 percentage points
Mexico/Australia/Russia	+ 0.1 percentage points
Brazil/Germany	- 0.5 percentage points
Italy	-0.4 percentage points
Japan	-0.3 percentage points
Spain/India	-0.2 percentage points
Switzerland/UK	-0.1 percentage points

(Source: UN)

World manufacturing output 2012 (\$bn, current prices)

1. China	2,556 (22.4%)
2. US	1,994 (17.5%)
3. Japan	1,076
4. Germany	686.6
5. S Korea	315.8
6. Italy	279.9
7. Russia	262.4
8. Brazil	253.8
9. India	239.5
10. France	233.1

World	11,426	Source: UN
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World manufacturing output 2012 (\$bn, current prices)

11. UK	219.5
12. Indonesia	210.2
13. Mexico	205.0
14. Canada	185.6
15. Spain	161.8
16. Taiwan	130*
17. Turkey	123.2
18. Australia	120.7
19. Switzerland	113.4
20. Thailand	111

Source: UN, IHS Global Insight

* estimate

World manufacturing output/ population 2012 (\$bn, current prices)

(top 20 manufacturing nations only)

1. Switzerland	14,125
2. Japan	8,459
3. Germany	8,277
4. S Korea	6,428
5. US	6,280
6. Taiwan	5,579
7. Canada	5,344
8. Australia	5,260
9. Italy	4,588
10. France	3,535
World	1,616

World manufacturing output / population 2012 (\$bn, current prices)

(top 20 manufacturing nations only)

11. UK	3,492
12. Spain	3,468
13. Mexico	1,690
14. China	1,865
15. Russia	1,832
16. Thailand	1,664
17. Turkey	1,662
18. Brazil	1,291
19. Indonesia	867
20. India	190

World	1,616
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World manufacturing output 2012 (percentages)

Asia 43%

Europe 26%

N America 22%

S America 3%

Africa 2%

Rest of world 4%

Source: UN

World manufacturing deflation

A typical factory-produced item today typically sells for half the price it sold for in 1970 (relative to overall global inflation)

The new industrial revolution

- The meaning of manufacturing
- Global trends – where Britain fits in
- The 5th industrial revolution**

The New Industrial Revolution (Fifth Industrial Revolution)-Key factors

1. Blended technology
2. Mass personalisation/customisation
3. Focus on specialisation/niches
4. Environmental stewardship
5. Service dimension
6. Global networking
7. Cluster dynamics
8. The new geography – China/India/S America
9. The maverick manufacturer

The New Industrial Revolution

1. Blended technology

The A350: many key technologies



Glass for flat-screen TVs/monitors...



Blended technology: the biotech/electronics mix



The New Industrial Revolution

1. Blended technology
2. **Mass personalisation/customisation**

Technology/business methods make customisation more affordable and practicable...



The Zara production model – short production runs, made near the customer – Tibbard chef's uniforms (Manchester)

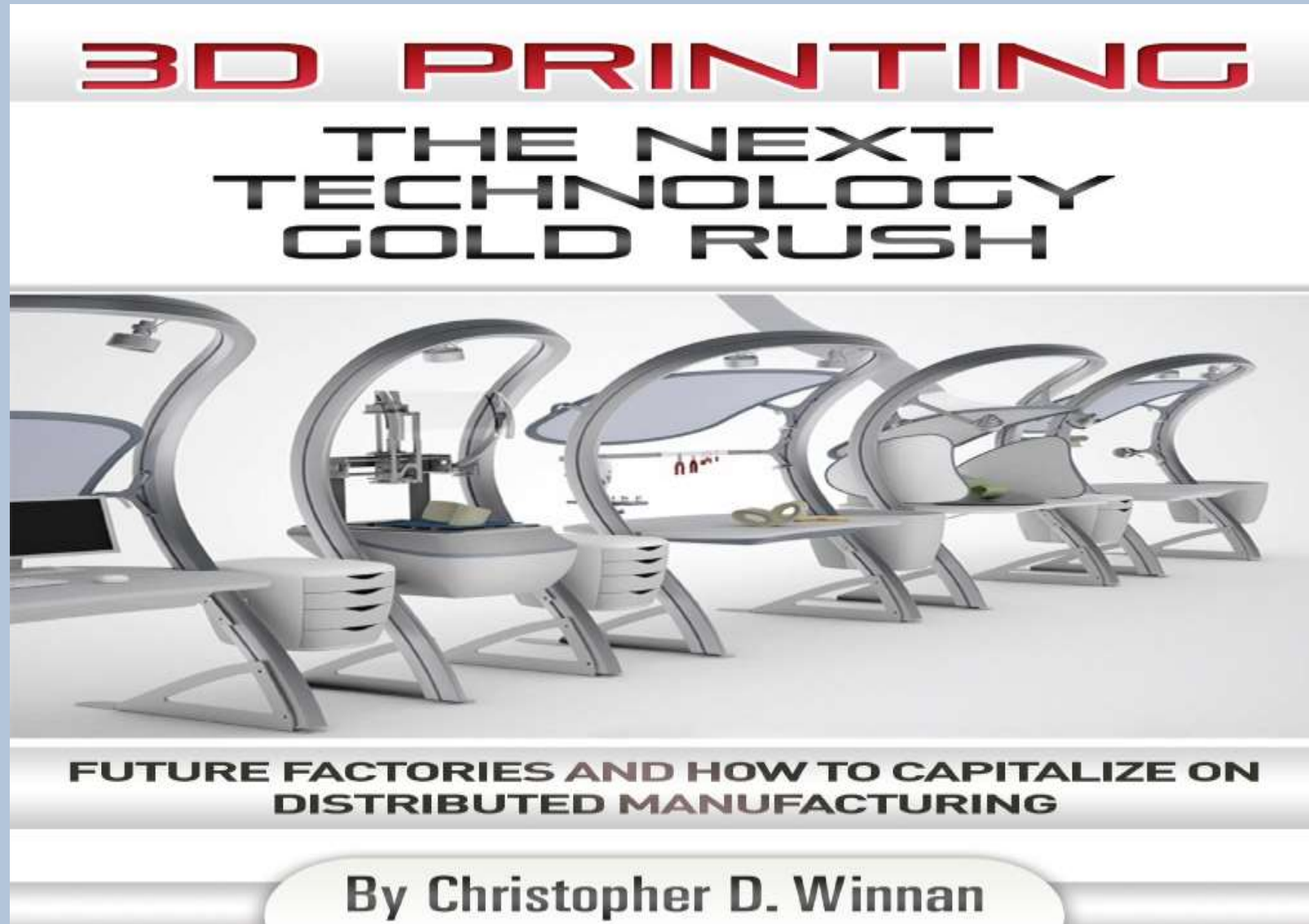


The New Industrial Revolution

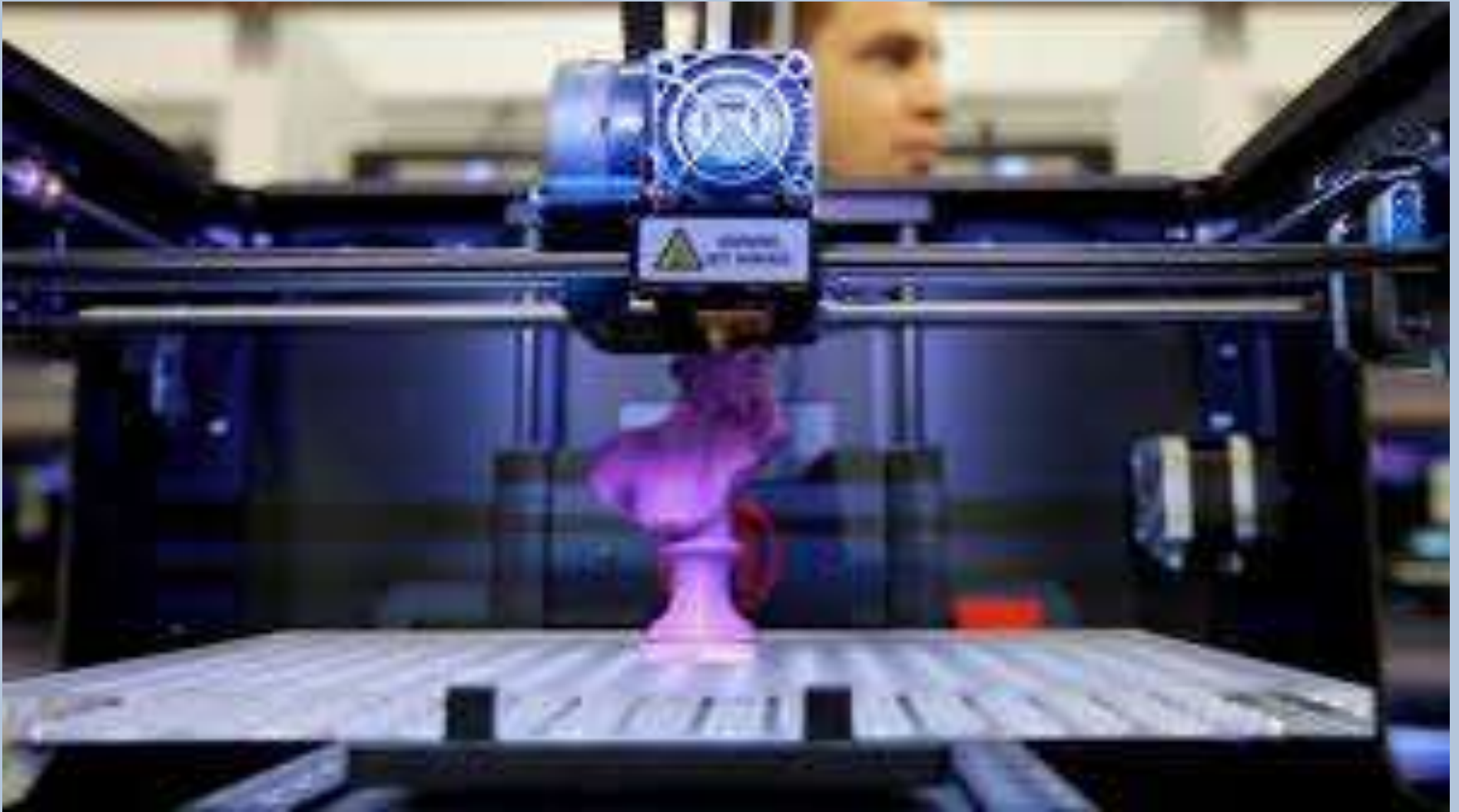
1. Blended technology
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3D Printing adds new tools

The new technology of “additive manufacturing”



How 3D printing machines work



Renishaw enters this new field with a £400,000 machine



Abe Reichental and his 3D-printed guitar



3D printing machines...use in fashion industry



The New Industrial Revolution

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3. **Focus on specialisation/niches**

Manufacturing specialisation : leverage innovation



Tunnelling machines – Herrenknecht (made in Germany)



The New Industrial Revolution

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4. **Environmental stewardship**

Environmental stewardship: Dando Drilling (Littlehampton)



Environmental stewardship: grow your own wool



The New Industrial Revolution

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- 5. Service dimension**

Service dimension at Cammell Laird (Birkenhead)



Different industries, same skills



Servitisation : Manufacturers as consultants



The New Industrial Revolution

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5. Service dimension
- 6. Global networking**

What's the link between.....



.....Chinese electronics factories....



....the Westwind air bearing company in Dorset



.....and a factory in Cheshire countryside?



Global networking: R.A.Chilton coatings company near Chester



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Clusters: NW England textiles sector (Panaz)



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China dimension: Jaguar Land Rover (Halewood plant)



Jaguar Land Rover: long-term promise paying off



Made in Rochdale: the Chongqing connection



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Maverick approach: Thomas Heatherwick – designer/engineer



The maverick manufacturer: go with the flow



The new industrial revolution

- The meaning of manufacturing
- Global trends – where Britain fits in
- The 5th industrial revolution
- Opportunities for Britain**

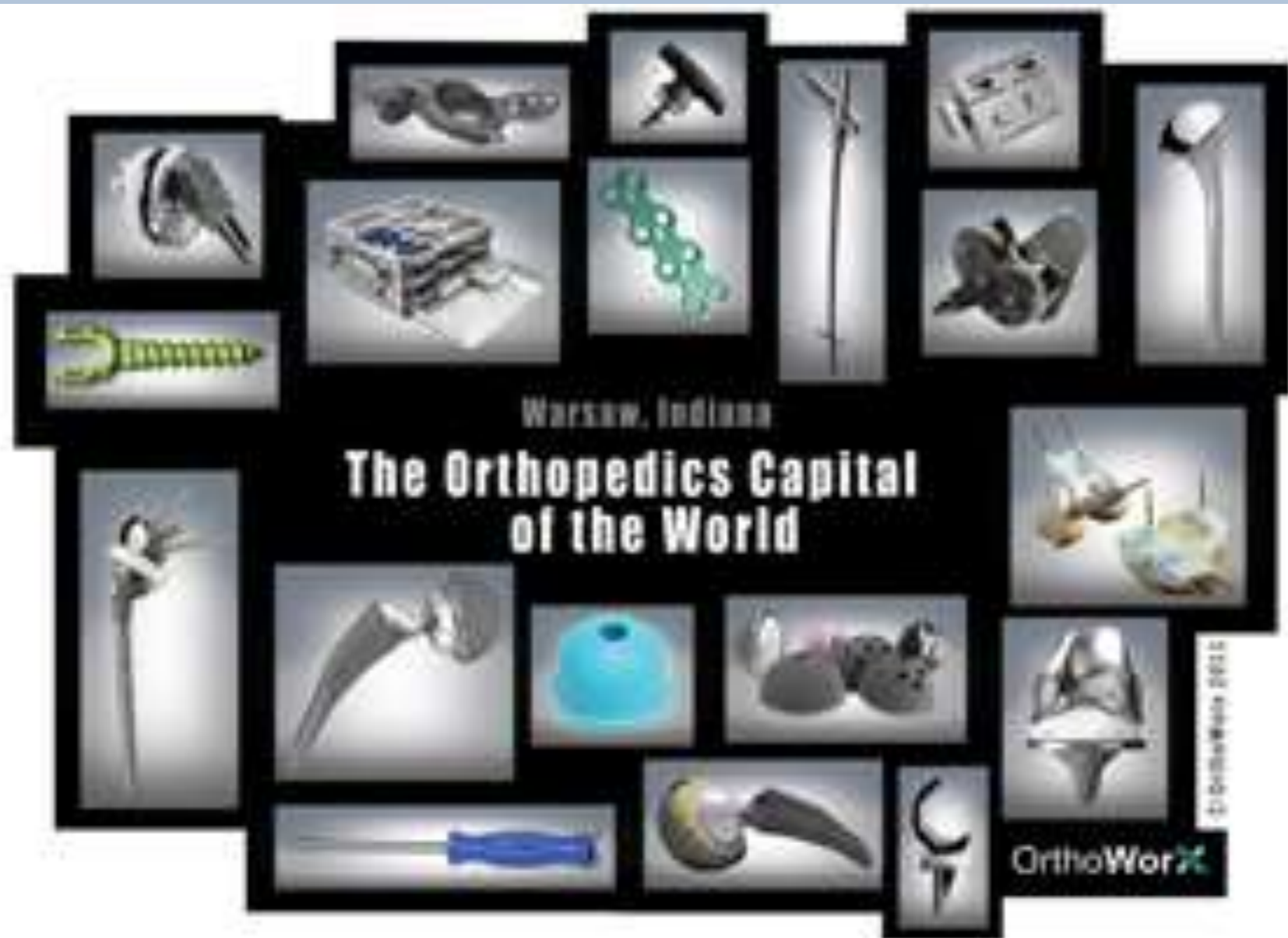
Encourage entrepreneurs: Ning Li of Made.com



Support specialists : Sir David McMurtry of Renishaw



Develop cluster thinking



Add skills to old industries



Add service skills: manufacturers as physicians



Possibilities abound

