

# Future Makespaces

in Redistributed Manufacturing

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Royal College of Art  
Postgraduate Art & Design



THE  
GREAT  
RECOVERY



## Roles, relationships and responsibility

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Researcher and Tutor, Design Products





**MANUFACTURING IS CHANGING**



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Rapid changes in the security of supply chains, demographic shifts & technological opportunities leave manufacturing bare, open to risks and responsible for actions: economically, socially and structurally vulnerable in the face of fundamental shifts in what society expects of it

Manufacturing Commission, 2015





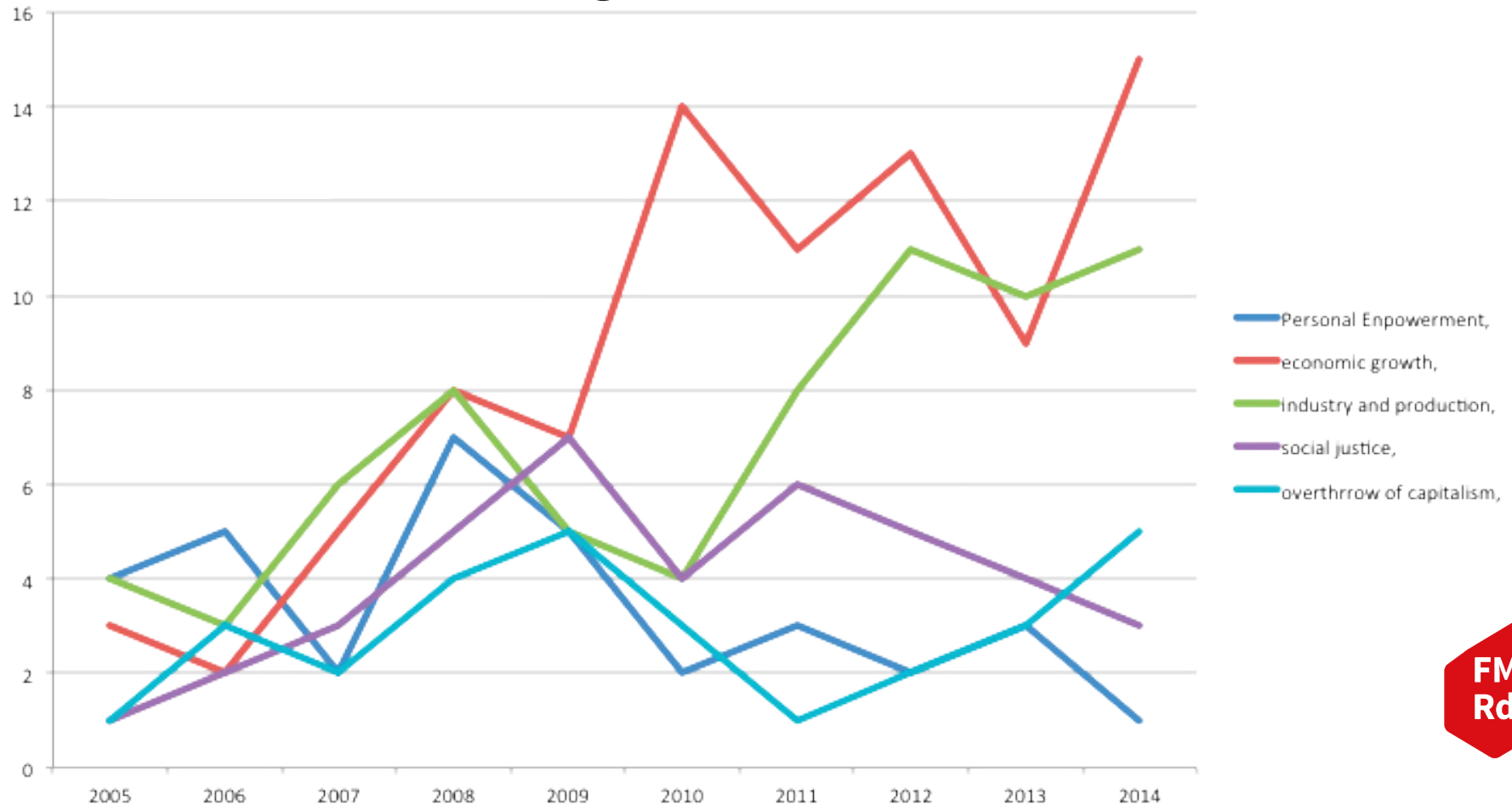
A photograph of a makerspace workshop. In the background, the word 'MAKERS' is written in large, white, three-dimensional letters on a wall. Below it, a sign says 'FOLLOW @themaklab ON TWITTER'. A person in a green shirt is working at a wooden workbench in the center. To the left, another person is standing near a workbench. The room is filled with various tools, materials, and workbenches. A large computer monitor and keyboard are visible on a desk in the foreground on the right. The text 'MAKERSPACES ARE ONE ASPECT OF THIS CHANGE,' is overlaid in large, white, bold letters across the center of the image.

**MAKERSPACES ARE ONE ASPECT  
OF THIS CHANGE,**

# PROMISED FUTURES

one aspect, with some awfully big aspirations pinned on it

“ ..the Maker Movement Will Solve World's Health Problems ”  
“ ..Maker Movement will emerge as the dominant source of livelihood ”







# IMPERATIVES v GRAND NARRATIVES

## redistributed manufacturing

Manufacturing should :

Humans must :

Technology is :

Makespaces will :

- 'Democratise Manufacturing'

- 'Everyone a maker'

- 'Revitalise communities'

- 'Enable sustainable local products'



# OUR CONTEXT

## ‘Future Makespaces’

Not just the spaces-also the surrounding digital platforms, cultures and behaviours that cultivate new ways of collaborating, producing and distributing.

Current capacity, capability & behaviours

Future capacity, capability & behaviours



Because makespaces  
are already starting  
to demonstrate the  
characteristics to enable  
Redistributed Manufacturing

## WHY?

- They are public facing centres of production with small scale and low cost tooling.
- Have a culture of online sharing and trading of design and making data
- Have the potential of driving the development of new business models and supply chains
- Real opportunities when Makespaces are linked to local businesses and waste management centres; with people able to cater to their local market and considering and designing the recycling systems when designing products
- Changes to dynamics of work and communities: reskilling or training; local business development
- Implications for industrial and social policy: regulations for recycling and opportunities for community centric production





# Defining Redistributed Manufacturing (re-distri-whatiwat?)



Broad working definition of “Technology, systems and strategies that change the economics and organisation of manufacturing, particularly with regard to location and scale.” (Pearson et al).

Subsequent definitions emphasise ‘localised production’ (Soroka), ‘customisable production units’ (Prendeville), decentralisation (Harrison) regionalisation (Mangier) geographic dispersal (Saki) .

The ‘re’ is itself contentious, why not simply distributed manufacturing?

DESIGNING ~ DESIGN DISTRIBUTION ~ ASSEMBLY  
~ PACKAGING ~ LOGISTICS ~ PRODUCTION ~  
COMPONANTS ~ RETAIL?

Our primary question is:

What roles will makespaces play in the future of Redistributed Manufacturing? \*

However, there is also a second question:

What value can be created with makespaces involved in Redistributed Manufacturing and who will benefit? \*





# **Possible Futures for Manufacturing in the UK**

Inevitable / Potential / Preferable / Desireable / Imperitive





## FUTURE PRODUCTION

### Desirable not inevitable

//

We are alive at a time when huge systems—industrial, infrastructural—are being remade, and I think it's our responsibility as we make choices both commercial and civic...to extrapolate forward, and ask ourselves: Is this a system I want to live inside?

Is this a system fit for humans?"

Sloan, 2015



So what do we actually do :

Run events, build a network, fund studies and make sense of it all through cross cutting research.



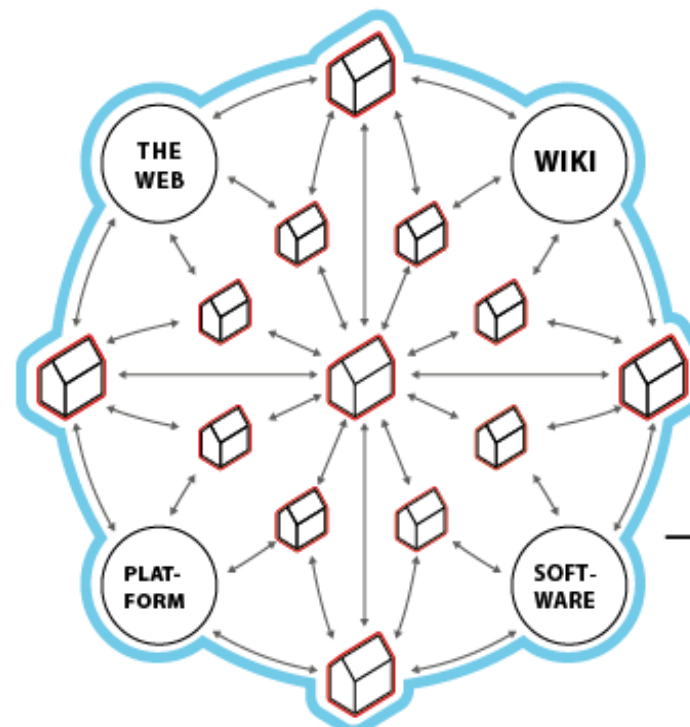


Over 500 members of the network; 103 core members, 93 associate and 776 impact members. Hosted 10 days of symposia in 4 locations, with 50 speakers and 161 participants. 48 institutions and organisations submitted study proposals (some collaboratively). Commissioned 525k feasibility studies, 3 expert roundtables with 24 experts, undertaken 5 targetted mini studies, resulting in 7 journal articles and an inprogress 5 chapter report outlining an agenda forming research pathway for the EPSRC.



## LEVEL 1 - MAKESPACES

Culture  
Facilities  
Technology  
Training  
Membership  
Location  
Network

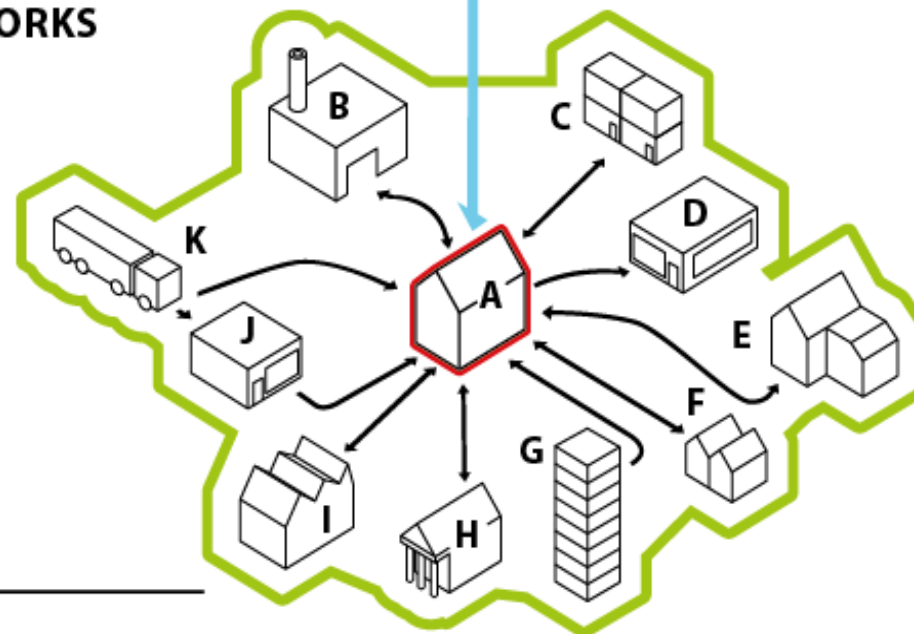


## LEVEL 3 - DIGITAL NETWORK

Online Design Tools  
Wikis  
Product Platforms  
Mass Customisation  
Co-design  
Social Media  
Online Retailers & Shopfronts  
Bureau Services  
Blogs  
CAD Repositories  
Crowd Funding

## LEVEL 2 - LOCAL NETWORKS

A Makespaces  
B Waste Management  
C SMEs & Start Ups  
D Retailers  
E Education  
F Local Residents  
G Investors  
H Local Government  
I Light Industry  
J Suppliers  
K Supply Chain



## LEVEL 4 - NATIONAL AND INTERNATIONAL

Material and Component  
Manufacturers / Suppliers  
Brands  
NGOs & Government  
Support  
Policy and Regulation  
Research Centres  
Software and Hardware  
Providers

# RE:FORM Reimagining Education for the Future Of Redistributed Manufacturing

Partners : Open University & Maklab

Where : Glasgow & Milton Keynes

Keywords : education, skills, collaboration,

“ RE:FORM explores the role future makespaces could play in working with academia to provide training to support the employment needs of redistributed manufacturing.



# Circular Makespaces

Partners : Sustain RCA

Where : London

Keywords : practices, tools, sustainability, knowledge

// This research uncovers triggers for circular practices to become embedded within Makespaces, informing principles of redistributed manufacturing and considering the implications of scaling existing working practices in Makespaces.



# Indie Manufacturing

Partners: Liverpool John Moores University, DOES Liverpool, UK Makerbelt network

Where : Liverpool and the North West

Keywords : supply chain, mapping, product design

// This project maps the manufacturer's around liverpool and the north, aiming to take an IoT product developed in a makespace in liverpool and manufacture 250 units through a more local supply chain.



# Material Makespaces

Partners : University of Oxford, Fab Lab London, Wevolver, Ethical Filament Foundation

Where : London & Oxford

Keywords : material, local variables, standards, data

// This project uses open source hardware and digital networks to generate and capture data about materials. Testing the feasibility of a digital commons of material knowledge and embedding a culture of testing materials and localizing material flows in a makespace.



## Re-mantle and make

Partners : Glasgow School of Art, Kalopsia Collective, GSA Makerspace, Johnston of Elgin, Knockando Woollen Mill, Muirhead Leather

Where : Glasgow, Edinburgh, Forres

Keywords : waste, circular economy.

//

Re-mantle and Make' is an approach for repurposing waste within the textile sector by utilising future makespaces. Identifying a more circular approach to textile design practice and production through integration into local manufacturing supply and waste chains, alongside informing and evaluating the design education curriculum.



**The impact of Makespaces:** local socio-economic processes associated with makerspaces

- Centre for Regional Economic Development (CRED)

**Distributed manufacturers in cities- a biodiversity study**

- Liz Corbin

**Futuring with Regional manufacturing data** – how can it enable more sustainable manufacturing futures?

- Makeworks & Open Work

**Relationship mapping of makerspaces and manufacturers**

- Jimmy Tidey

**Grey matter of open making; regulation and standards**

- Dark Matter Labs





Mapping and intervening in complex systems

-Michael Wilson, Empire Logistics

Platform Cooperativism and Redistributed Manufacturing - A roundtable discussion with Trebor Scholz.

Transition Design & Redistributed Manufacturing

- Cameron Tonkinwise, Carnegie Mellon

Evidence based speculative production futures

- Scott Smith

Future Makespaces – concluding roundtable with spaces



# REDISTRIBUTING WHAT?

## MEANS OF PRODUCTION

physical, non-human inputs'  
tools, factories, infrastructure  
natural resources and raw materials

## MODES OF PRODUCTION

the way of producing human  
labour power [also 'means' ^]  
technologies, knowledge, materials, cooperative work relations

## CONSEQUENCES

the affect of the process' capital accumulation, value extraction, waste, environmental impacts, social impacts.

## RELATIONSHIPS

to and around goods consumers > prosumer' commons, property, ownership, obligations, stewardship,

# TYPOLGY OF DISTRIBUTION

typologies of ownership, risk, reward

What is being distributed differently and what could be?

Means, modes, consequences & relationships



## sites of distribution

# VARIABLES FOR REDISTRIBUTION

end user | designer | prosumer | retailer | manufacturer

centrally | proximate to end user | offshore | onshore | outsourced |  
proximate to resources

peer-to-peer | peer-to-business-to-peer | business-to-peer | business-to-consumer

renting | borrowing | lending | buying | giving | exchanging | swapping | sharing.

intermediary | closed | paid | open | sharealike |

worker | organisation | customer | state | third party | NGO



# GENERATING FUTURE DISTRIBUTIONS playing with possibilities

... a [furniture] company, that distributes final mile delivery and assembly to the [end user] but maintains a [centralised] management of the supply chain & [non-proximate] primary material sourcing.

We can recognise and identify some key current players and some possible future trends and patterns



Who designs  
Where are decisions made about what is pro-  
cured or commissioned  
How are designs licensed  
Who manufactures components  
Where does design happen  
Where are the primary materials sourced from  
Where does assembly happen  
Where does packaging happen  
Where does primary production happen  
Where does the secondary production happen  
Who does the labour  
Where does the exchange or purchase happen  
Where does the remanufacturer happen  
What is outsourced and to where  
Where can repair services be accessed  
Who is responsible for the material stewardship  
Where does value extracted from this process  
accumulate?  
Who bears the risk in producing this product  
Who benefits from the exchange or purchase of  
the product  
Who benefits from the IP or designs generated by  
this product  
Where are the negative consequences of produc-  
tion felt on the supply/design chain  
Who has access to information about supply  
chain  
Where does the data about customers/users  
accumulate  
Who manages the custodianship of the product  
over time  
What rights does the user have to modify the  
product  
What is the organisational structure

## MEANS OF PRODUCTION

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# TYPOLGY OF DISTRIBUTION

## Trends, patterns, risks

a shift of where risk, responsibility & benefit falls on a supply chain and on whom



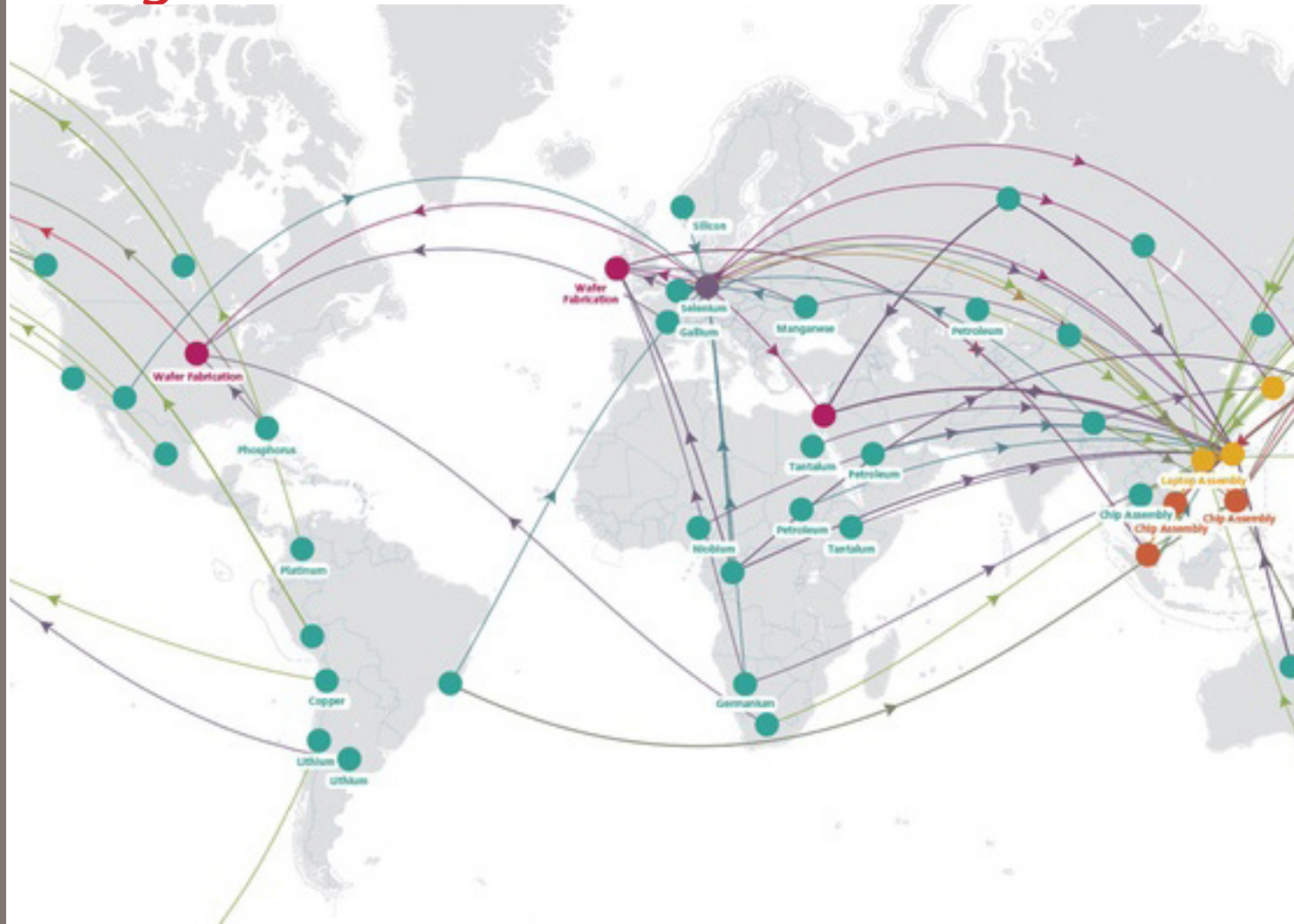


our collective naivety as to how production in general is distributed is becoming a hindrance in imagining, designing, prototyping and testing a better distribution of production.

This applies to Platform Coops as much as any other collaborative economy intervention.

## COMPLEXITY & DATA FETISHISM

signal, noise, action



“ We are so ignorant of the complexity of goods around us that anything beyond assembling a puzzle or an Ikea furniture can be hastily baptized as a DIY achievement.” Peter Troxler

## THE MAKER AESTHETIC TO MASS MARKET GAP

It is not enough to create a demographically limited social revolution that enables the elite, the empowered and the well resourced to make 'good' decisions about products.

Who (in makespaces) is making products  
for a world beyond mass-production?

The image is a complex, detailed painting by Pieter Bruegel the Elder, 'The Fight Between Carnival and Lent'. It depicts a bustling town square filled with numerous small scenes of people engaged in various activities, from religious processions to festive games. The scene is set against a backdrop of a large, fortified city with towers and battlements. A large, central face is superimposed over the middle of the painting, with its mouth open as if shouting or speaking. The face has a red, pointed hat and a red, pointed beard. The overall color palette is dominated by earthy tones, with a strong contrast between the dark, shadowed areas and the bright, illuminated parts. The text 'WHO BENEFITS ?' is written in large, white, bold, sans-serif capital letters across the center of the face.

**WHO BENEFITS ?**



An aerial photograph showing a large industrial complex, possibly a refinery or chemical plant, situated along a body of water. The facility features numerous storage tanks, processing units, and a complex network of pipes and roads. To the right of the industrial area is a residential neighborhood with a grid-like street pattern and several houses. The water on the left is a deep blue, and the surrounding land is a mix of green vegetation and developed areas.

# **OFFSHORING, COLLECTIVE NAIVITY AND WICKED PROBLEMS**



GOING BEYOND A TRICKLE DOWN APPROACH TO  
THE CIRCULAR ECONOMY IS NECESSARY

(OBVIOUSLY)



An inclusive future circular economy must escape the bounds of the corporate and effect the everyday practice and design decision making of actors at a range of scales of production.

# **FUTURE FACTORIES?**

# AMPLIFYING IMPACT

CAPABLE

ACCESSABLE

PERMEABLE

EMBEDDED

NETWORKED

The impact of makerspaces goes beyond their own capacity, but also requires them to be accessible, permeable and networked both in terms of knowing their locality but also connecting globally to other likeminded spaces and companies.





# Local 3D printing

Find a 3D printing service and get your parts in 48 hours

Get instant quote

[See how it works](#)

999,885

parts produced

48 hours

avg. turnaround time

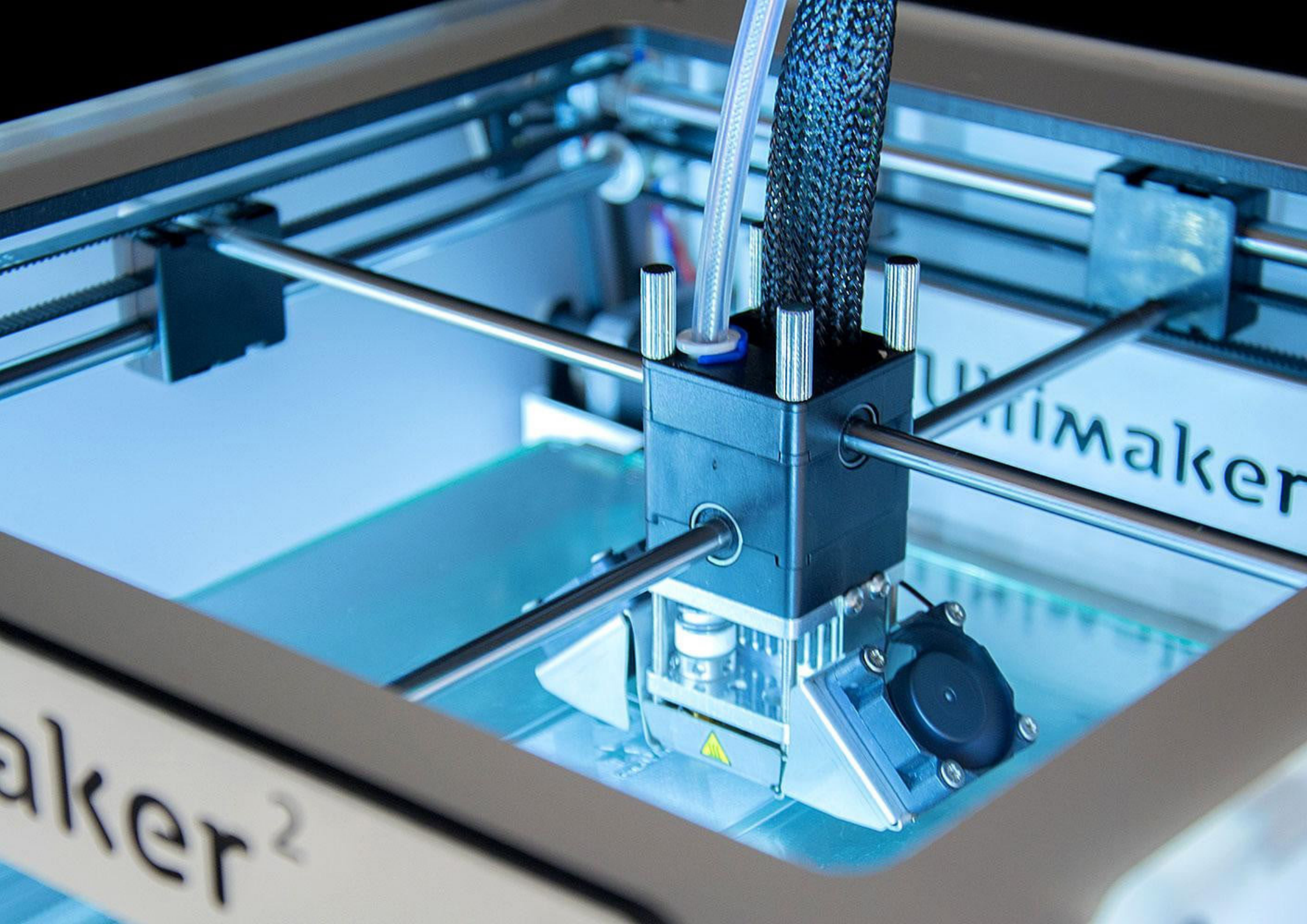
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services online







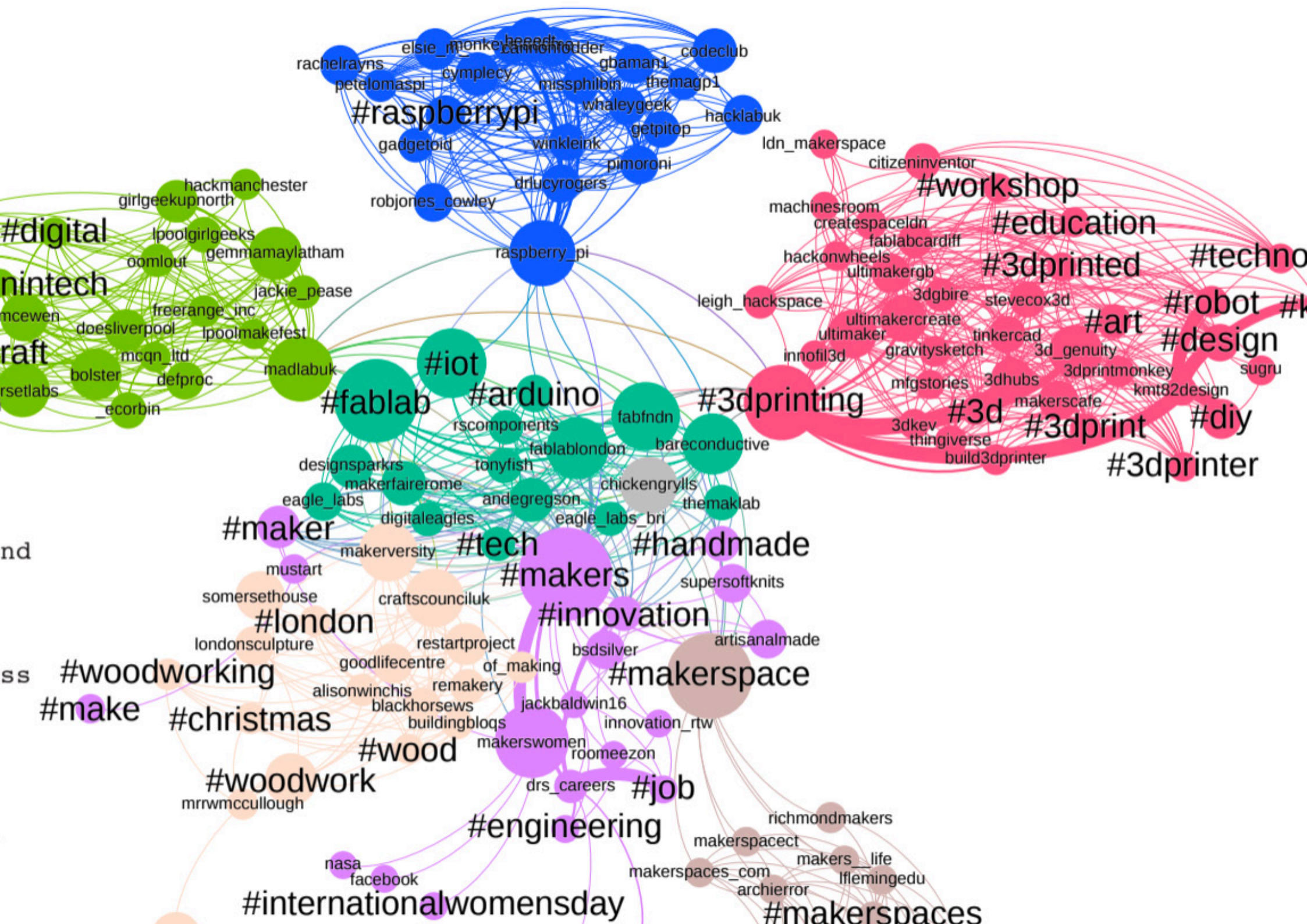






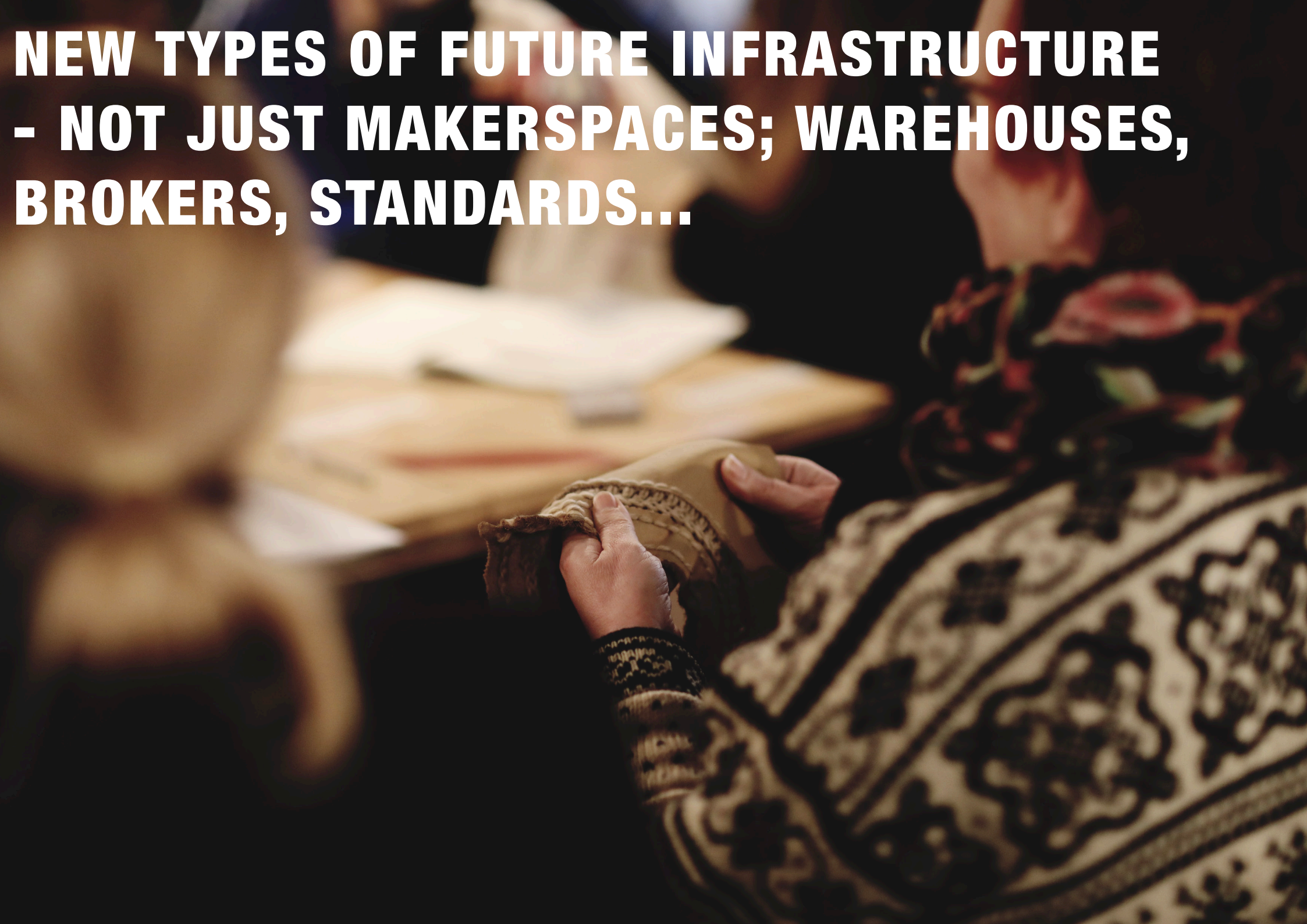








**NEW TYPES OF FUTURE INFRASTRUCTURE  
- NOT JUST MAKERSPACES; WAREHOUSES,  
BROKERS, STANDARDS...**









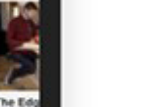










# Make Works Extension

291 options for the alternative manufacture of a black, plastic, folding chair

Edinburgh, GB (55.950, -3.200)

SIMILAR PRODUCTS	NEW AND USED	USE A LOCAL MAKER	BUY SECOND HAND	LOCAL MAKER SPACES	REPAIR IT!	HACK IT!	MAKE IT YOURSELF	KICKSTART
We found these folding chair that you can have manufactured nearby.	We found 5 new and used folding chairs on eBay within 50km of your current location	There are 8 local makers close to you that can build folding chairs or work with plastic	We found 25 used folding chairs on Gumtree within 50km of your current location	Close to you are 22 maker spaces where you could build a product like this yourself	We found the following repair shops where you could have this object repaired	See how people have hacked GUNDE's to create customised or entirely new objects	We found some Instructables tutorials you could use to build a folding chair at home	We found Kickstart chairs
 The Mhor Stool various	 Glasgow, 45.0 ml. £13.99 IKEA GUNDE Folding Chair Black White Camping Caravan Garden Home Office Chair	 Gabriel Polishing Spray painting company with an industrial spray shop. Production includes french polishing, high gloss finishes, spray metal and spray painting, finishing, polishing and restoration services. Starting cost: £100-£500 USES PLASTIC	 4 year old Ikea fold up chair bed with white cover £60	 MAKLab MAKLab is Scotland's first open access digital fabrication studio. Starting cost: £15	 Safestrip Furniture repair shop in Glasgow, Scotland	 Seating.	 Business Card Folding Sheet Metal Wrench	 The Edge solution work Be more maximize comforta desk/chair holds flat seconds
 Ikea Dining Table (Folding/Extendable with 3 chairs) Starting: 31 ml.	 Folding Plywood Sawhorses	 Edinburgh ReMakery We're not content with teaching repair skills in the community - we want to generate a repair revolution. This means changing the way	 Glasgow Print Studio Glasgow Print Studio is a printmaking facility providing	 Hacker help: Too many chairs. oct 22	 Folding "FMC"			

# Making sense of redistributed manufacturing products, tools and services

The core criteria a project or product must exhibit in order to be analysed within this typology :

- Can be distributed or locally made at scale - not just one offs or none distributable
- Incorporates variables based on end user need, place or supply chain risks - responsive design
- Able to utilise a range of scales, sites and paces of production - not mono-site batch or mass production.

DIY/DIWO production:



Digitally distributed  
mono manufacturing :





## Full Stack Redistributed Manufacturing :



## Propositional Objects:





The core variables that seem to indicate where projects sit within this typology are:

## MAKING SENSE OF REDISTRIBUTIVE PRODUCTS AND PRACTICE

**Infrastructure** - the infrastructure they make use of and its availability

**Prior Knowledge** - the prior knowledge and skills they require to obtain or produce

**Materials** - the bill of materials and whether that is limited or complex

**Risk** - how risk and quality assurance is managed

**Disruption** - level of influence on mainstream retail expectations or supply chains

**Engagement** - who is engaged and what is the effect on their experience & relationship to the product and its production.



Scales to assess where a project sits in relation to core variables.

## METRICS FOR MAKING SENSE

**Infrastructure** - the infrastructure they make use of and its availability

1 Domestic > 5 industrial new investment

**Prior Knowledge** - the prior knowledge and skills they require to obtain or produce

1 No prior knowledge or literacies > 5 advanced specialised skills

**Materials** - the bill of materials and whether that is limited or complex

1 Mono > 5 complex

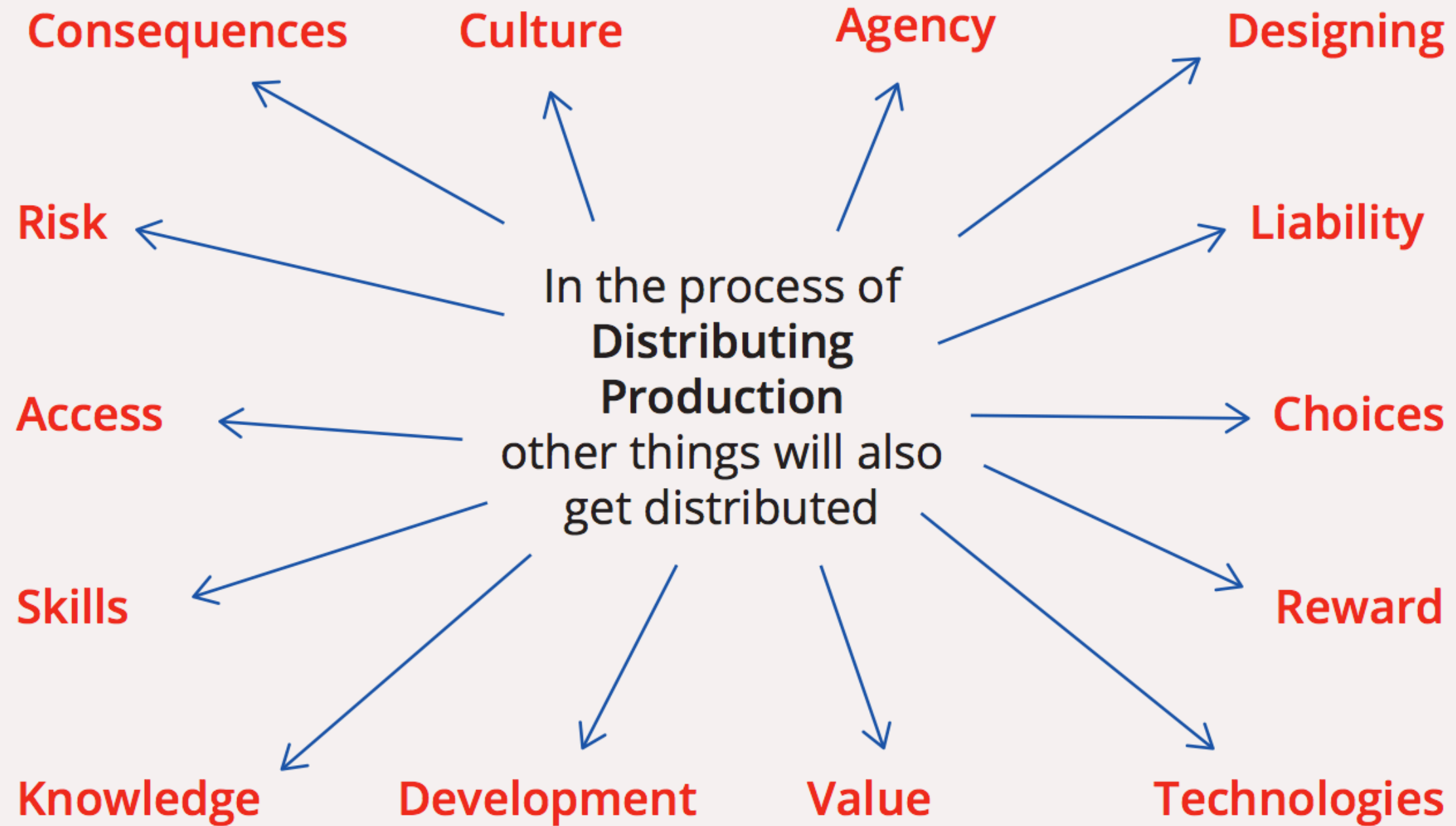
**Risk** - how risk and quality assurance is managed

1 Production is at own risk > 5 full institutional risk, standards and actuary infrastructure in place

**Disruption** - level of influence on mainstream retail expectations or supply chains

1 novel practice - 5 mainstream practice







# CLOSING REFLECTIONS





To enable RDM as a design and distribution strategy to scale and become the new normal we need to establish;

- 1) ways of 'knowing' and capturing data on existing production infrastructure and material availability in a given locality
- 2) ways of integrating and optimizing existing infrastructure to allow for the an RDM approach across a range of product types
- 3) designed experiences around purchasing and stewardship of emerging RDM product types and new user literacies. and
- 4) clear and evidenced metrics on the differing consequences of these approaches & distributions.



The characteristics of makerspaces and the functions and roles they have evolved have (sometimes inadvertently) allowed them to become places that hold knowledge of available production facilities and materials.

This has enabled makerspaces initially to hold roles as incubators and test beds of RDM practice, co-constructing it as a concept and practice.

However, the continuation of this practice will require makerspaces to evolve and keep pace with the emerging RDM economy.



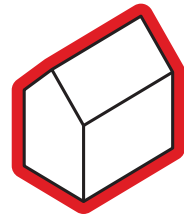


Designing for redistributed manufacturing is an applied challenge that requires new aptitudes, awareness and skills ...

In the future production visibility and traceability will become expected alongside end user agency which could enable lower consequence design choices but also the potential for increased opacity of the algorithms that it is built on.

**PRACTICING RESPONSIBLE FUTURING**





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THE  
GREAT  
RECOVERY



Thank you

Roles, relationships and responsibility

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