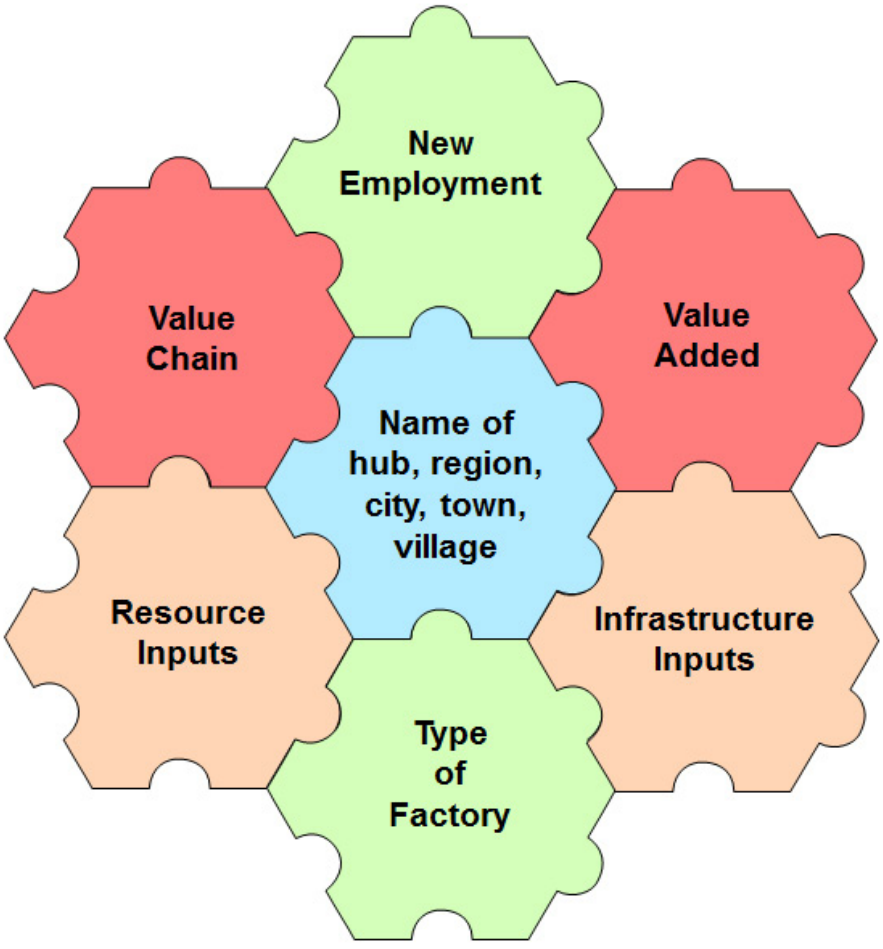

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Strategic Design of Innovative Production Systems

Strategic Design Symbol System v.2

Stephen Fox | Päivi Vahala

VTT TECHNOLOGY 270

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Stephen Fox and Päivi Vahala

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Teknologian tutkimuskeskus VTT Oy
PL 1000 (Tekniikantie 4 A, Espoo)
02044 VTT
Puh. 020 722 111, faksi 020 722 7001

Teknologiska forskningscentralen VTT Ab
PB 1000 (Teknikvägen 4 A, Esbo)
FI-02044 VTT
Tfn +358 20 722 111, telefax +358 20 722 7001

VTT Technical Research Centre of Finland Ltd
P.O. Box 1000 (Tekniikantie 4 A, Espoo)
FI-02044 VTT, Finland
Tel. +358 20 722 111, fax +358 20 722 7001

Preface

The potential for innovative production systems is increased by virtual-social-physical convergence (VSP). This VSP convergence adds read-write functionality of Web 2.0 and associated social media to virtual-physical convergence involved in, for example, advanced digital manufacturing. At the same time, there is increasing prevalence of narrow artificial intelligence (AI) within applications of virtual, social and physical technologies. These enable previously expensive and time-consuming engineering tasks to be carried out at very low cost and extremely high speed. VSP + AI is an underlying enabler of trends such as Sharing Economy and Third Wave Do-It-Yourself (DIY). Strategic design is highly relevant to formulating plans for innovative production systems. This is because innovative production systems cannot be generated through analysis of existing production systems. Rather, creativity is needed: in particular, creativity in seeing and shaping connections between many diverse factors. Strategic design involves addressing strategic issues using visual tools that enable creative expression. As many areas seek to re-distribute, re-shore, right-shore, and establish new production, innovative production systems are a global imperative. The symbol system shown in this publication has been developed to enable the widest possible participation during the strategic design of innovative production systems. This is facilitated by minimum use of words and maximum use of graphics.

Contents

1. Introduction

The Strategic Design Symbol System for Innovative Production Systems is presented in the following sections. This is the first version of this symbol system. It is anticipated that further versions will follow over time as a result of feedback from users.

Extensive information about innovative production systems can be found in the lead author's scientific publications; some of which are listed in the References section. Similarly, extensive information about the need for manual visual methods to facilitate broad participation can be found in other scientific publications by the lead author; some of which are also listed in the References section.

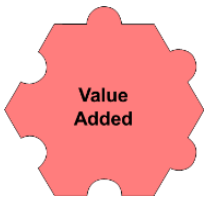
Field trials of the symbol system, which have not involved any participation by the authors, have demonstrated that the symbol system is self-explanatory. Thus, the symbol system is presented here without extensive written explanation.

2. Strategic Design Steps

Identify geographic location:

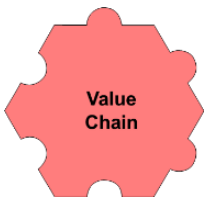
- ► Hub Name
- ► Region Name
- ► City Name
- ► Town Name
- ► Village Name

Determine what is the value to be added:



- ► Geographically Distributed Economy
- ► Demographically Distributed Economy
- ► Creates New Market
- ► On-Shoring
- ► Ecological Renewal
- ► Downcycling
- ► Disintermediation
- ► Localization
- ► Upcycling, Recycling
- ► other

Determine what type of value chain will be involved:

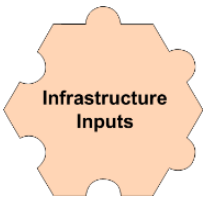


- ► Business to Business
- ► Business to Consumer
- ► Peer to Peer
- ► Agricultural
- ► Construction
- ► Consumer Goods Manufacturers
- ► Creative
- ► Healthcare
- ► Information & Communication Technology
- ► Mass Production
- ► Retail
- ► Space
- ► other

Determine what resource inputs are needed:

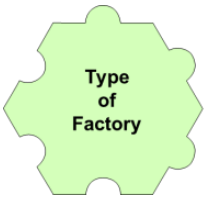
- ► Raw Materials
- ► Formed Materials
- ► Components
- ► Micro Electronics
- ► Recycled Materials
- ► other
- ► Open Source Designs
- ► Open Source Hardware
- ► Open Source Software

Determine what infrastructure inputs are needed:



- ► Computer Skills
- ► Manual Skills
- ► Digital Infrastructure
- ► Physical Infrastructure
- ► Data Analytics Skills
- ►Social Infrastructure
- ► Engineering Skills
- ► Creative Skills
- ► Energy Infrastructure
- ► Water Infrastructure
- ► Financial Infrastructure
- ► other

Determine what type of factory(ies) are best used there:

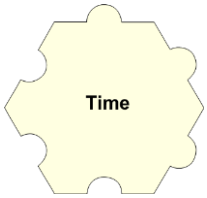


- ► Carry-able
- ► Moveable
- ► Independent Local Factory
- ► Factory Kit For Export
- ► other
- ► Mobile
- ► Home/Club
- ► Networked Local Factory

Determine the extent of new employment created:

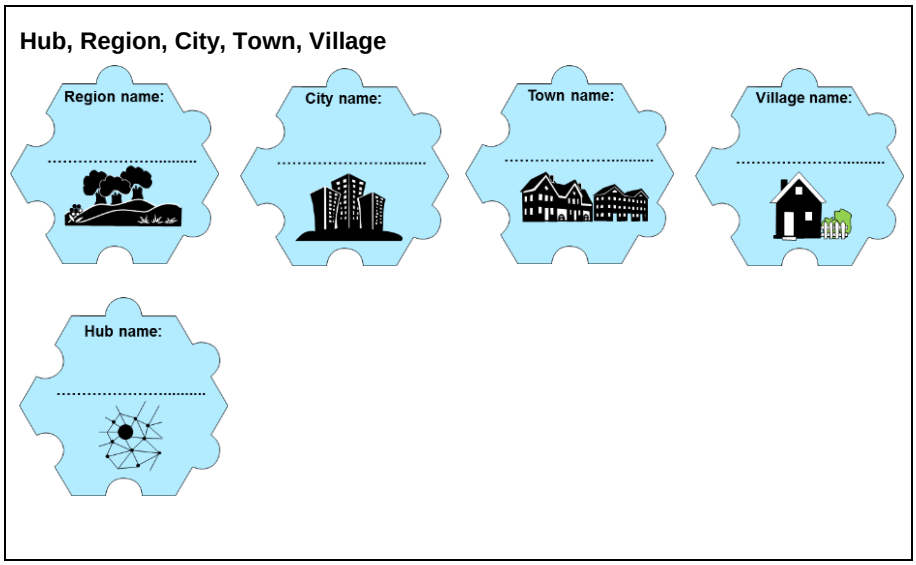
- ► 1-5 new jobs
- ► 6-50 new jobs
- ► 51-250 jobs
- ► 250+ new jobs

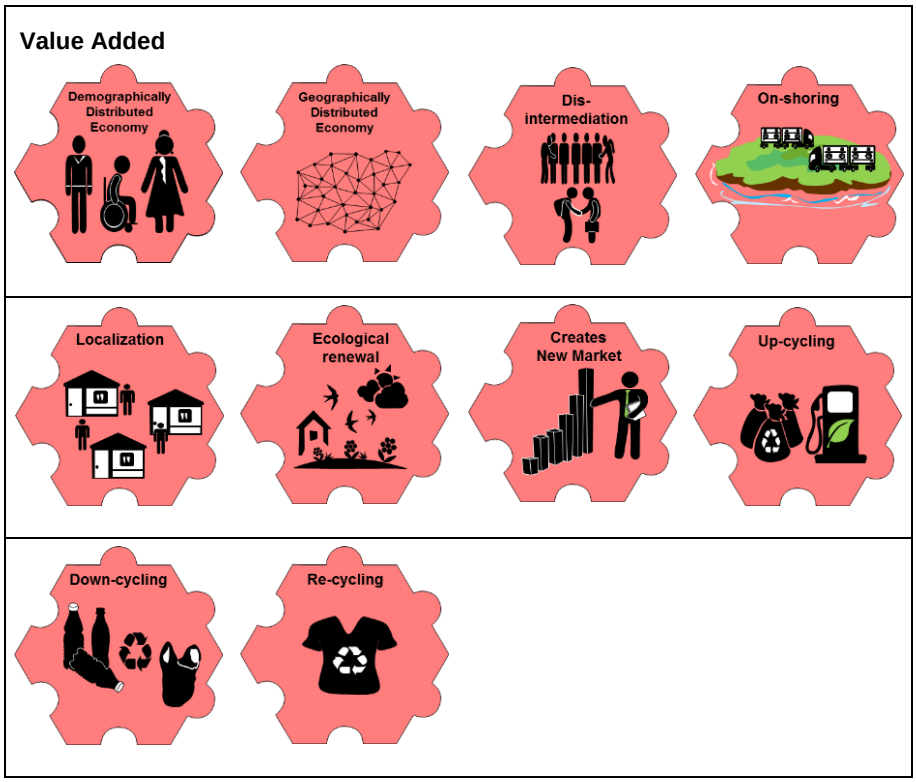
Determine the time timetable for completion:

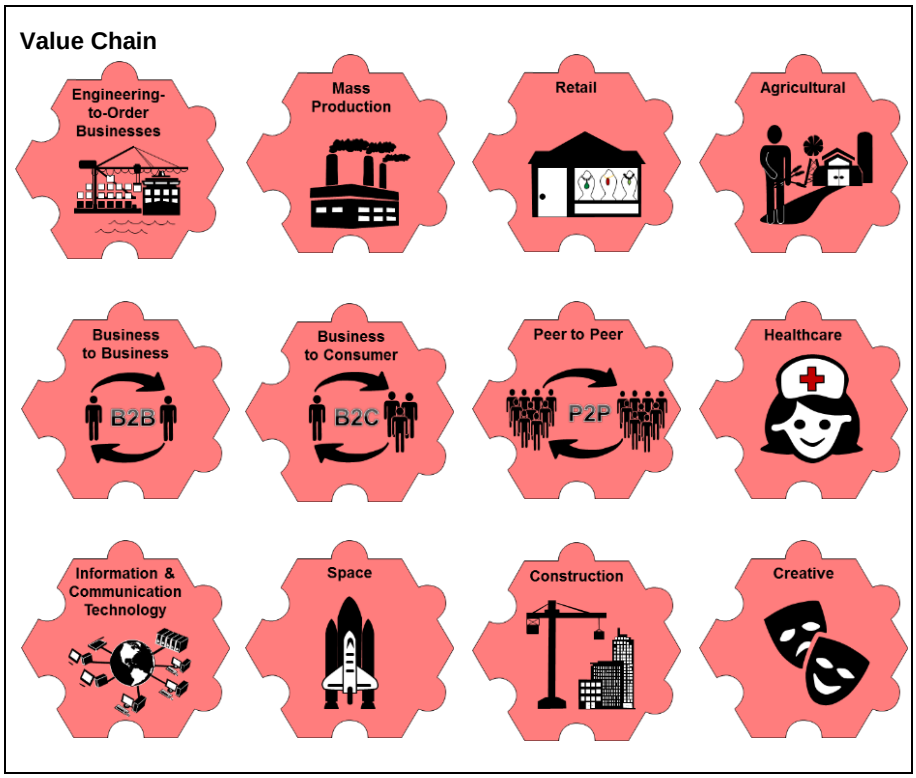


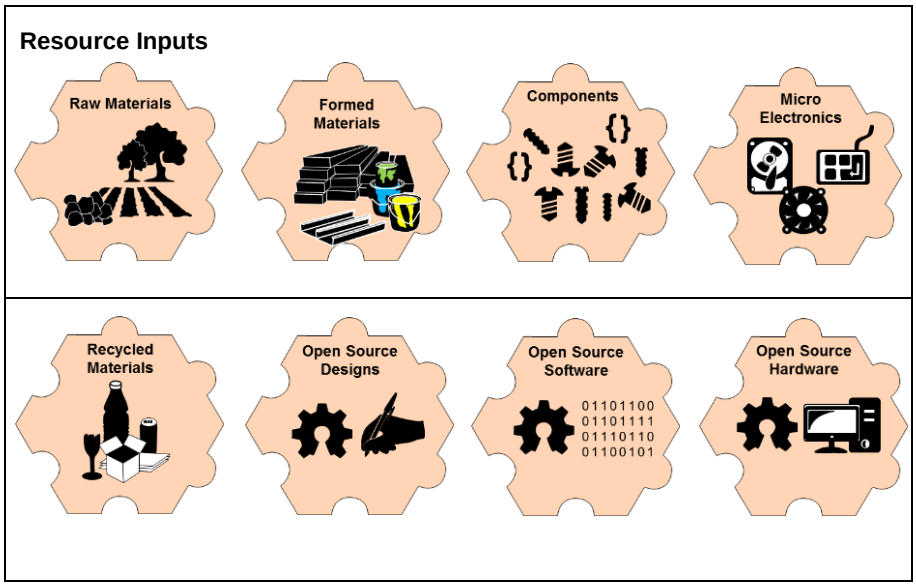
► Today
► + 1 year
►+ 3 years
►+ 5 years

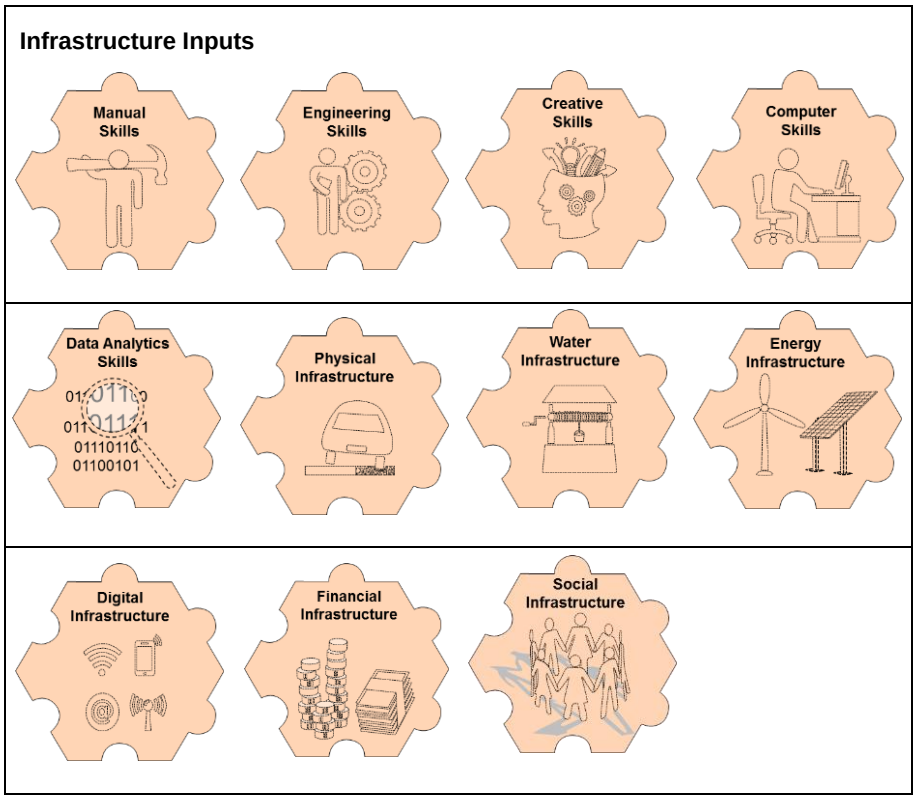
3. Symbol System Pieces

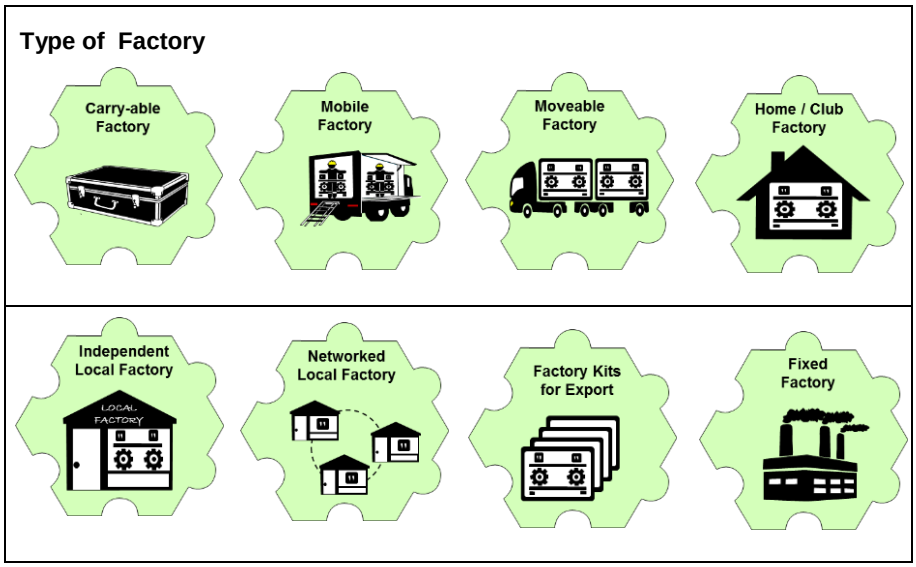



Value Added
Demographically Distributed Economy
Geographically Distributed Economy
Dis-intermediation
On-shoring
Localization
Ecological renewal
Creates New Market
Up-cycling
Down-cycling
Re-cycling

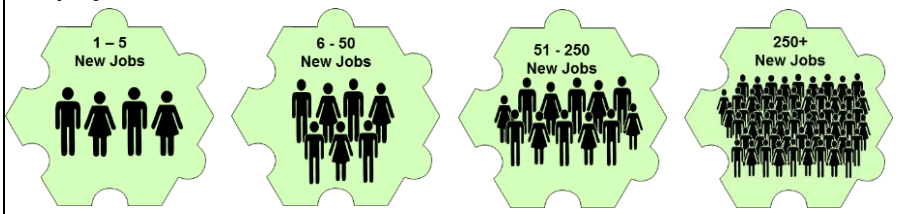

Value Chain
Engineering-to-Order Businesses
Mass Production
Retail
Agricultural
Business to Business
B2B
Business to Consumer
B2C
Peer to Peer
P2P
Healthcare
Information & Communication Technology
Space
Construction
Creative


Resource Inputs
Raw Materials
Formed Materials
Components
Micro Electronics
Recycled Materials
Open Source Designs
Open Source Software
01101100
01101111
01110110
01100101
Open Source Hardware

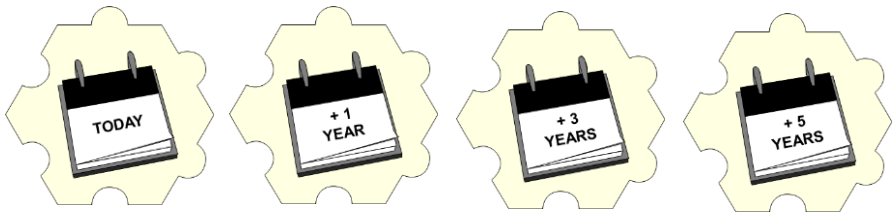

Infrastructure Inputs
Manual Skills
Engineering Skills
Creative Skills
Computer Skills
Data Analytics Skills
Physical Infrastructure
Water Infrastructure
Energy Infrastructure
Digital Infrastructure
Financial Infrastructure
Social Infrastructure


Type of Factory
Carry-able Factory
Mobile Factory
Moveable Factory
Home / Club Factory
Independent Local Factory
Networked Local Factory
Factory Kits for Export
Fixed Factory

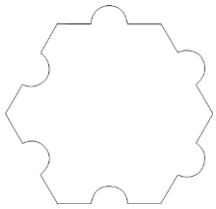
Employment



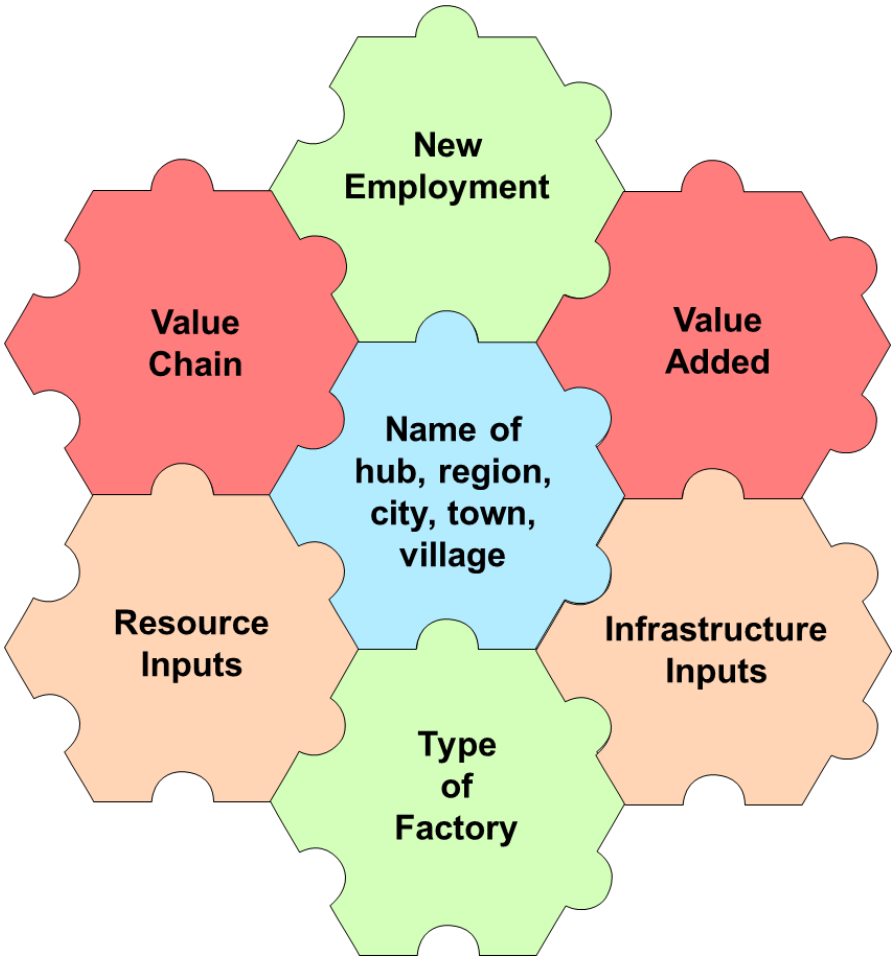
Time

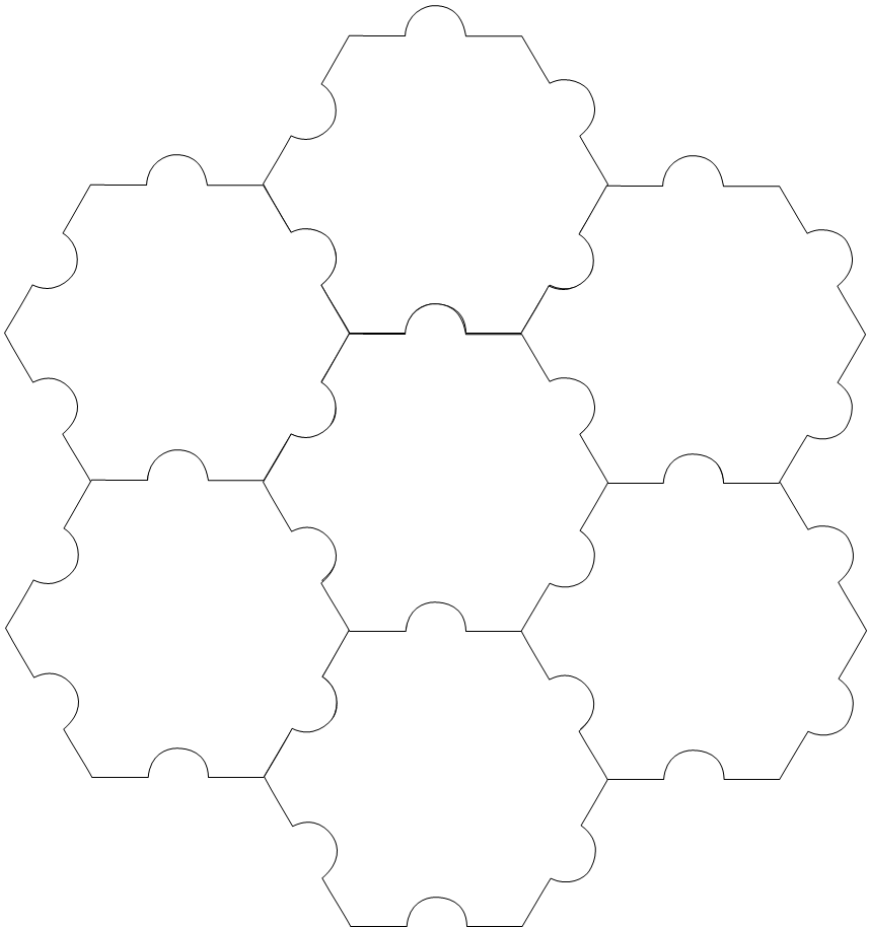


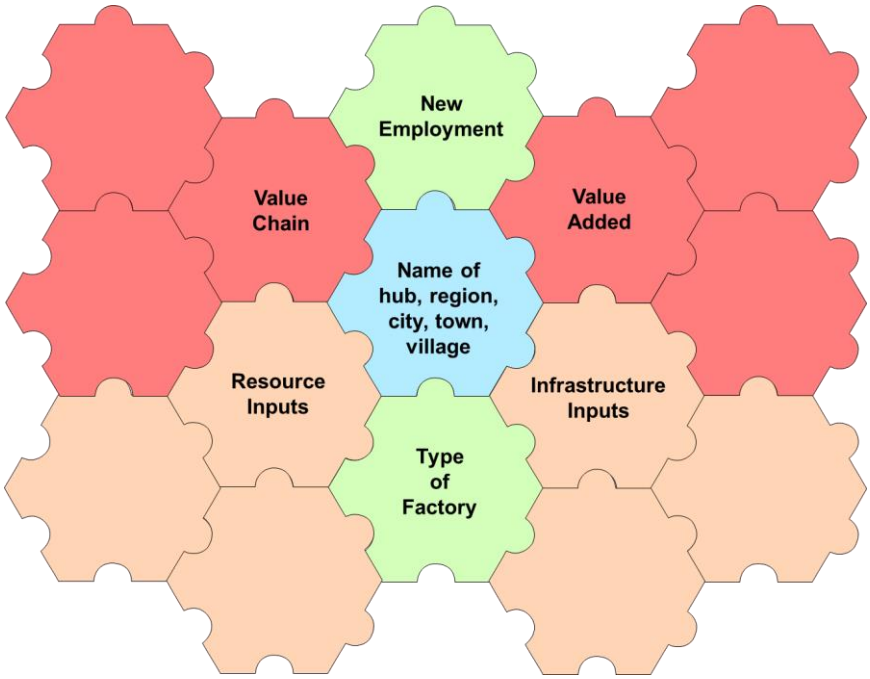
Blank Pieces

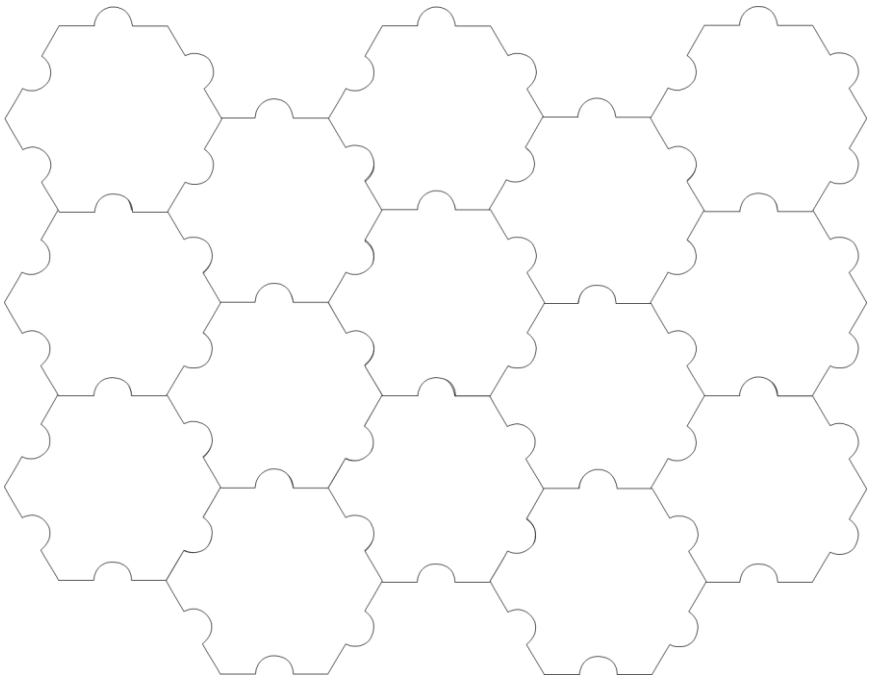


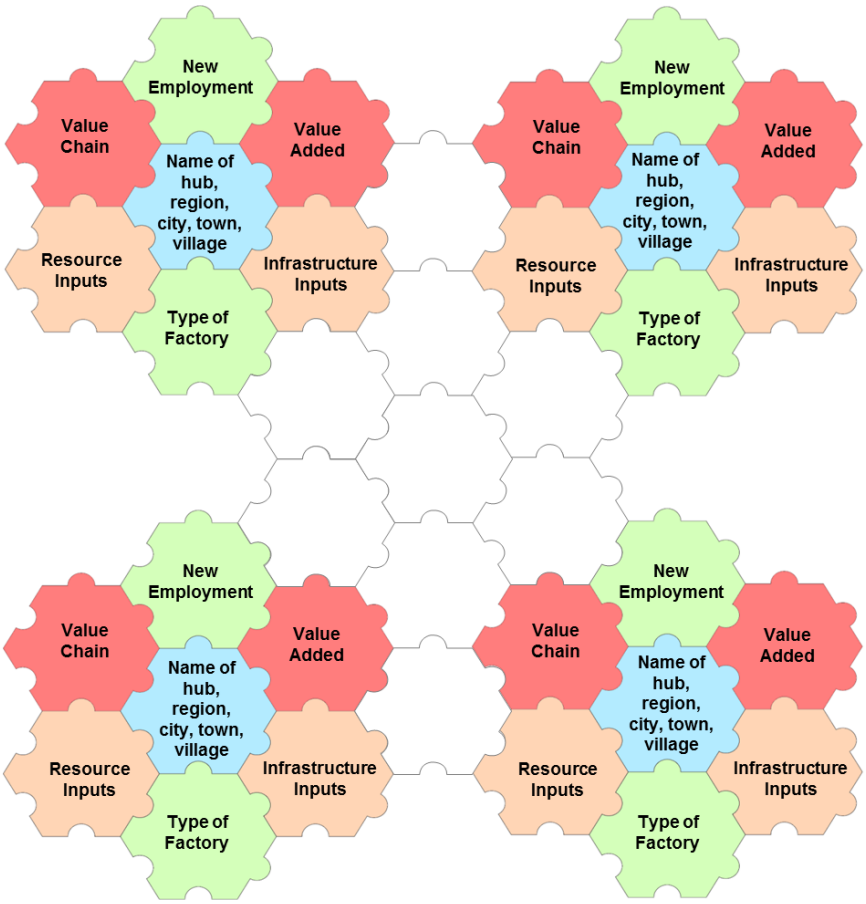
4. Symbol System Interconnections: Examples

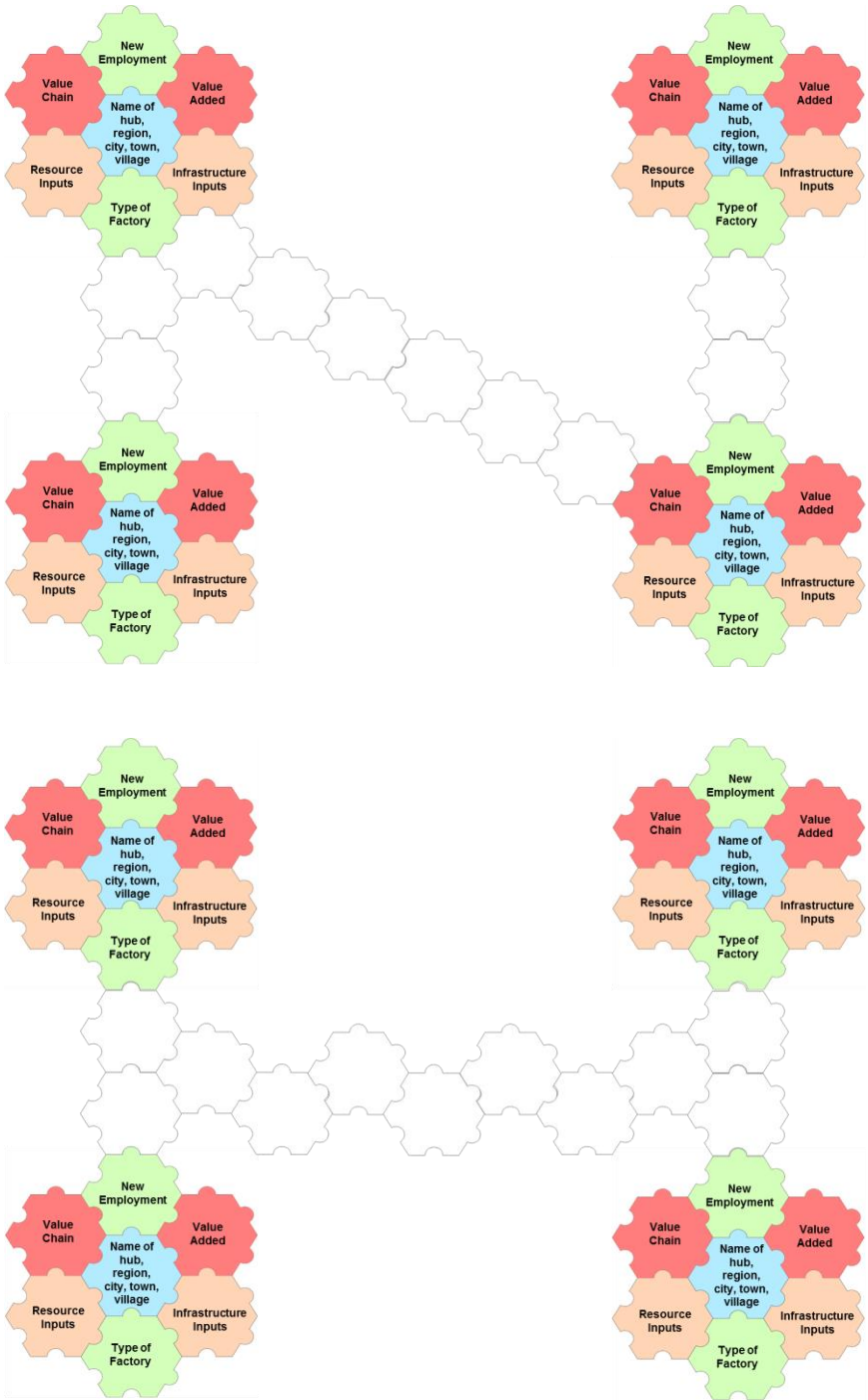





New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory




New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory
New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory
New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory
New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory

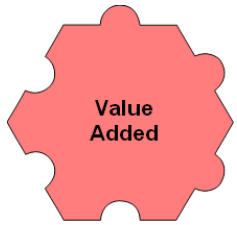

New Employment
Value Chain
Value Added
Name of hub, region, city, town, village
Resource Inputs
Infrastructure Inputs
Type of Factory

5. Strategic Design Questions

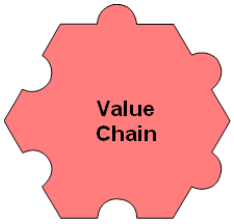
In which hubs, regions, cities, towns, and villages should innovative production be located?

https://www.goway.com/media/uploads/maps/australia_and_south_pacific/australia/victoria_map.jpg

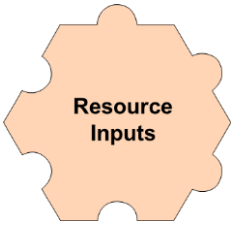
What will be the value added in selected hubs, regions, cities, towns, and villages?



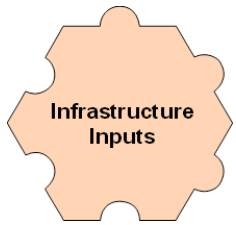
What value chains will be involved in selected hubs, regions, cities, towns, and villages?



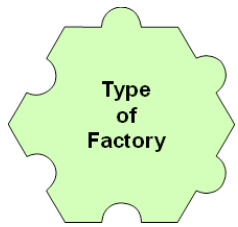
What resource inputs are needed in the selected hubs, regions, cities, towns, and villages?



What infrastructure inputs are needed in selected hubs, regions, cities, towns, and villages?



What factory types can most benefit which hubs, regions, cities, towns, and villages?



How many jobs will be created in selected hubs, regions, cities, towns, and villages?

6. Strategic Design Examples

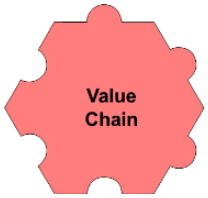
What geographic location:

- ► Hub Name
- ► Region Name
- ► City Name
- ► Town Name
- ► Village Name

What is the value to be added:

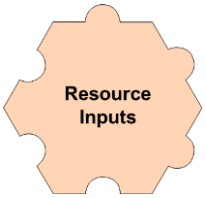
- ► Geographically Distributed Economy
- ► Demographically Distributed Economy
- ► Creates New Market
- ► On-Shoring
- ► Ecological Renewal
- ► Downcycling
- ► Disintermediation
- ► Localization
- ► Upcycling, Recycling
- ► other

What type of value chain will be involved:



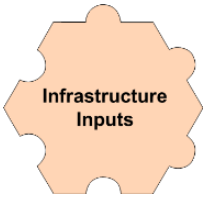
- ► Business to Business
- ► Business to Consumer
- ► Peer to Peer
- ► Agricultural
- ► Construction
- ► Consumer Goods Manufacturers
- ► Creative
- ► Healthcare
- ► Information & Communication Technology
- ► Mass Production
- ► Retail
- ► Space
- ► other

What resource inputs are needed:



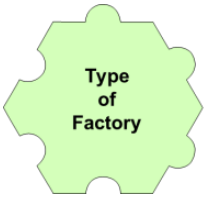
- ► Raw Materials
- ► Formed Materials
- ► Components
- ► Micro Electronics
- ► Recycled Materials
- ► other
- ► Open Source Designs
- ► Open Source Hardware
- ► Open Source Software

What infrastructure inputs are needed:



- ► Computer Skills
- ► Manual Skills
- ► Digital Infrastructure
- ► Physical Infrastructure
- ► Data Analytics Skills
- ►Social Infrastructure
- ► Engineering Skills
- ► Creative Skills
- ► Energy Infrastructure
- ► Water Infrastructure
- ► Financial Infrastructure
- ► other

What type of factory(ies) can be used there:



- ► Carry-able
- ► Moveable
- ► Independent Local Factory
- ► Factory Kit For Export
- ► other
- ► Mobile
- ► Home/Club
- ► Networked Local Factory

How much new employment will be created:

- ► 1-5 new jobs
- ► 6-50 new jobs
- ► 51-250 jobs
- ► 250+ new jobs

6.1 Example One - Mobile factories for fabricating wild fire management resources in-situ with local materials

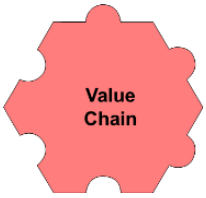
http://www.theage.com.au/victoria/victorian-bushfires-great-ocean-road-towns-hit-by-fires-20151225-glv2ud.html

Geographic location:

► Region Name

VICTORIA FIRE RISK AREAS
e.g. Lorne, Sunbury, etc

Value chain:

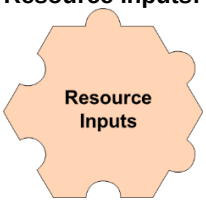


► Agricultural Companies

Value added:

► Geographically Distributed Economy
► Ecological Renewal
► Creates New Market (Factory Kits for Export)

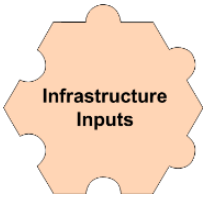
Resource inputs:



► Raw Materials
► Formed Materials

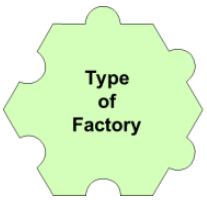
FOR PRODUCTION OF FIRE FIREBREAKS
AND OTHER FIRE BARRIERS

Infrastructure inputs:



► Manual Skills
► Engineering Skills

Factories:



► Mobile

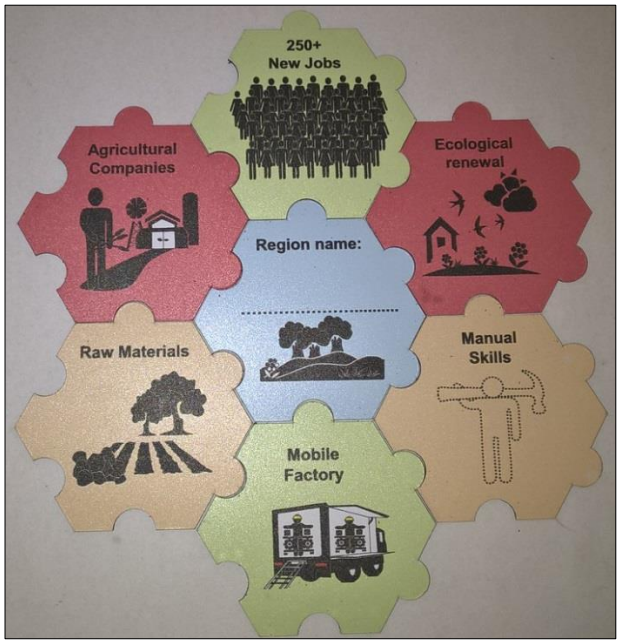
FOR HIGHLY EFFICIENT IN-SITU LOCAL PRODUCTION

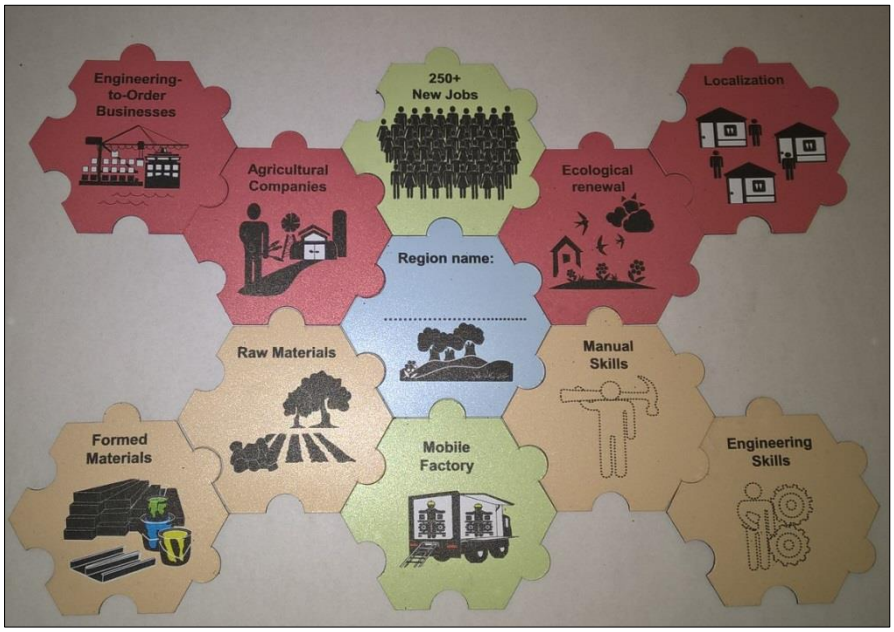
► Factory Kit For Export

to other regions with high wildfire risks e.g.:
CANADA, WESTERN CAPE SOUTH AFRICA, USA.

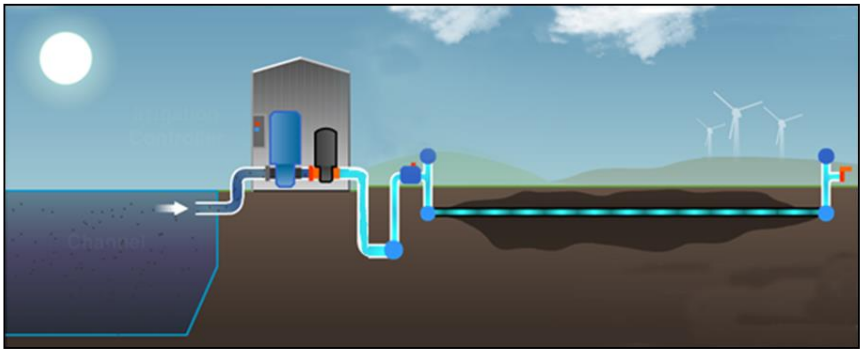
New employment:

► 250+ new jobs


250+
New Jobs
Agricultural
Companies
Ecological
renewal
Region name:
Raw Materials
Manual
Skills
Mobile
Factory


Engineering-
to-Order
Businesses
250+
New Jobs
Localization
Agricultural
Companies
Ecological
renewal
Region name:
Raw Materials
Manual
Skills
Formed
Materials
Mobile
Factory
Engineering
Skills

6.2 Example Two - Mobile factories for fabricating water management infrastructure in Western Victoria



http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation

Geographic location:

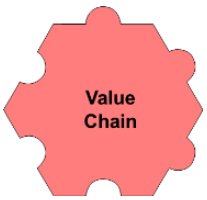
► Region Name:

SOUTH-WEST VICTORIA DROUGHT AREAS.

Value added:

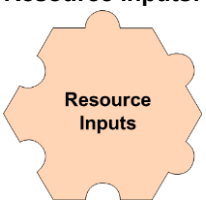
► Geographically Distributed Economy
► Ecological Renewal

Value chain:



► Engineering-to-Order Businesses

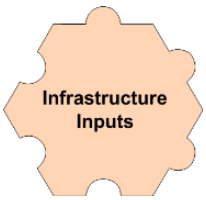
Resource inputs:



► Formed Materials
► Components

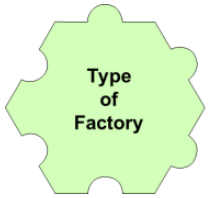
FOR PRODUCTION OF WATER MANAGEMENT INFRA-STRUCTURE

Infrastructure inputs:



► Manual Skills
► Engineering Skills

Factory:

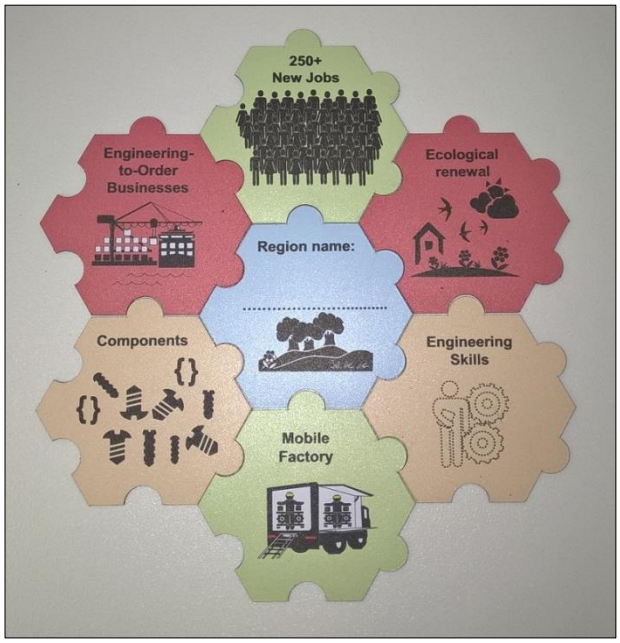


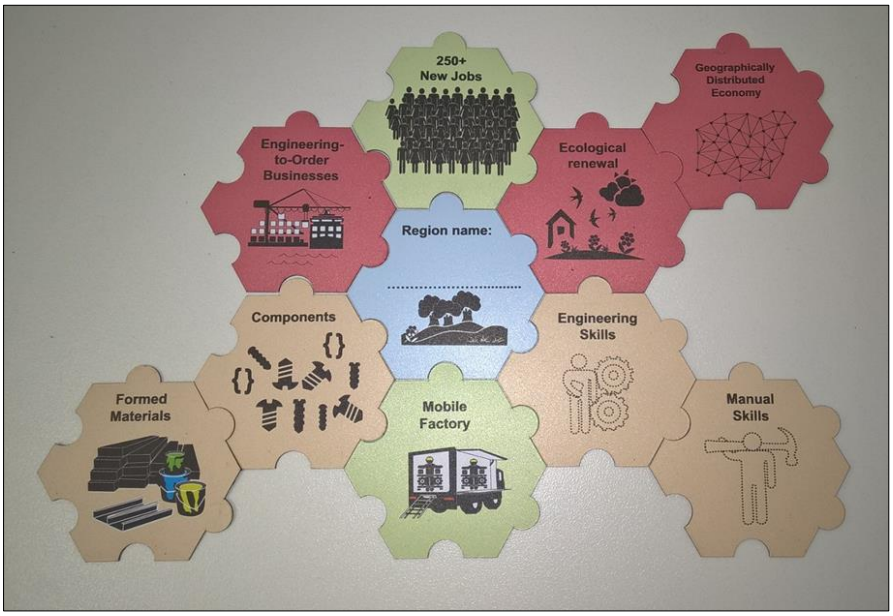
► Mobile

FOR HIGHLY EFFICIENT IN-SITU LOCAL PRODUCTION

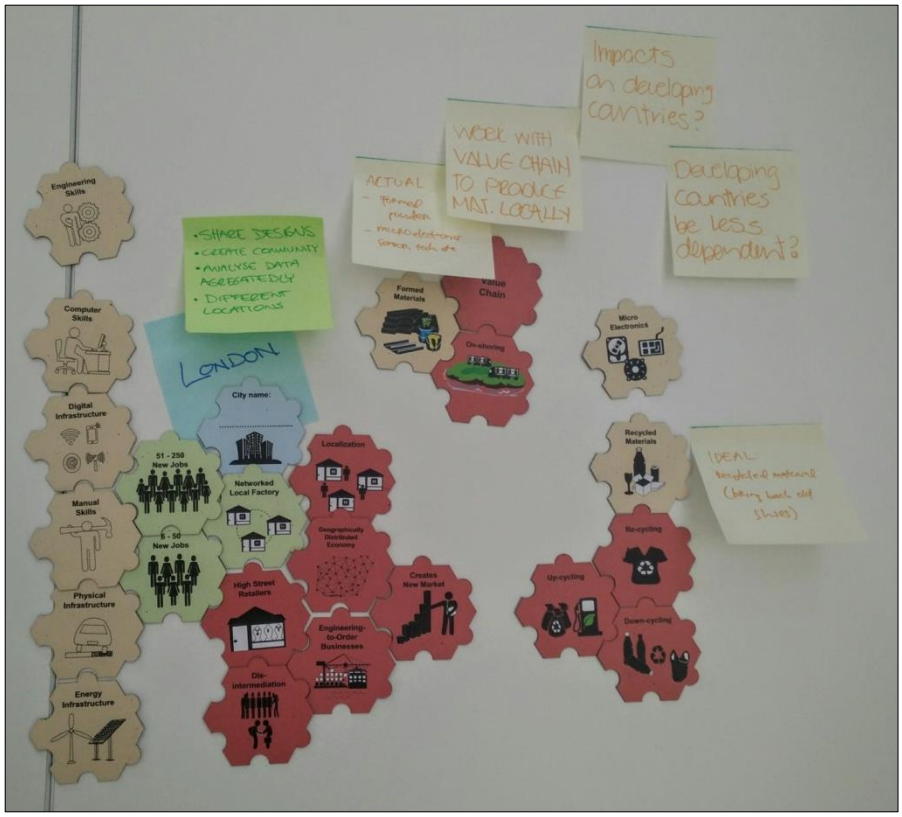
New employment:

► 250+ new jobs


250+
New Jobs
Engineering-
to-Order
Businesses
Ecological
renewal
Region name:
Components
Engineering
Skills
Mobile
Factory


250+
New Jobs
Geographically
Distributed
Economy
Engineering-
to-Order
Businesses
Ecological
renewal
Region name:
Components
Engineering
Skills
Formed
Materials
Mobile
Factory
Manual
Skills

6.3 Example Three – Networked local factories for new footwear production in UK and beyond



6.4 Example Four – New solutions for plastics recycling in Australia

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Innovative Production Systems

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Author(s)	Stephen Fox and Päivi Vahala
Abstract	Strategic design involves addressing strategic issues using visual tools that enable creative expression. Strategic design is highly relevant to formulating plans for innovative production systems. This is because innovative production systems cannot be generated through analysis of existing production systems. Rather, creativity is needed: in particular, creativity in seeing and shaping connections between many diverse factors. As many regions seek to re-distribute, re-shore, right-shore, and establish new production, innovative production systems are a global imperative. The symbol system shown in this publication has been developed to enable the widest possible participation during the strategic design of innovative production systems. This is facilitated by minimum use of words and maximum use of graphics.
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