UNIVERSITY OF CAMBRIDGE

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An ‘industrial-innovation system’ approach to smart specialisation: the case of the agri-tech industry in the East of England

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POLICY LINKS
linking policy principles and practice

CSTI Science Technology Innovation Policy

Overview

1. Key messages
2. When ‘smart specialisation’ is not so smart
3. An ‘industrial-innovation system’ approach to smart specialisation
4. Case Study: Agri-tech industry in the East of England
5. Conclusions

Key messages

Key messages

- A critical challenge for smart specialisation is to properly characterise what makes a region ***distinctive*** at a useful level of detail and in a way that is recognised by local as well as external actors.
- However, identified priorities have been **too generic** and **not appropriately connected** to regional economic and innovation structures.
- Practice-oriented **analysis frameworks** and **data sources** at an adequate level of disaggregation to support this task are in short supply.
- An **'industrial-innovation system' approach** is proposed to support key analytical tasks involved in smart specialisation.
- The utility of the approach is demonstrated through a selected case study in the agri-tech industry in the East of England.

When ‘smart specialisation’ is not so smart

The Smart Specialisation Mountain

'GPS principle'

competition

low capacity in regional govt.

power boundaries between ministries

short term-ism in political cycles

DEAD END

Operational Minefield

threats to effective EDP (traditional interest groups, etc.)

Analytical Slope

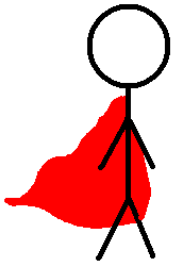
- too broad priorities
- no local asset assessment

DEAD END

1. Where are we?

2. Where to go?

3. How to get there?



Key strategic questions / analytical challenges to effective smart specialisation

What we want in theory
clearly articulate **what makes regions distinctive at a useful level of detail** and in a way that is recognised by the local and external stakeholders
use **region distinctiveness as the basis** from which a **limited number of promising opportunity areas** are identified
strategise to ensure that **distinctive & competitive capabilities** are leveraged in order to pursue **promising & feasible opportunities**

Collaboration with BEIS

A pilot project has been conducted as a collaboration between the UK Department for Business, Energy & Industrial Strategy (BEIS) and the Policy Links unit of the Centre for Science, Technology & Innovation Policy (CSTI).

The aims was to explore new approaches to enhance the effectiveness of smart specialisation in UK regions.

Case study in the agri-tech industry in the East of England.

CSTI POLICY LINKS Department for Business, Energy & Industrial Strategy Agri-Tech East

Smart specialisation in the UK?

Department for Business, Energy & Industrial Strategy

Note: This report was commissioned and completed before the United Kingdom European Union membership referendum of 23 June 2016. While the results of the referendum have important implications for the report, the ideas here presented remain higly relevant to UK regional development policy efforts.

An ‘industrial-innovation system’ approach to smart specialisation

An ‘industrial-innovation system’ approach to smart specialisation

- Grounded on the recognition of the structure and dynamics of modern industries and technologies.
- Integrates value chain structure and an explicit distinction between *knowledge generation*, *knowledge diffusion* and *knowledge absorption* capabilities.
- Simple yet highly structured approach with the potential to guide not only **more systematic statistical analyses** but also a **more effective ‘entrepreneurial discovery process’.**

The value of the value chain structure

The issue

- Modern industries increasingly cut across sectors and technologies.
- Statistics available to policy makers have not kept up with pace of change (BIS, 2015).
- A number of ‘unmeasurable sectors’ (e.g. ‘app economy’) simply not monitored (NAE,2015).
- Aggregated data does not allow identifying niche areas of regional strength.

need to understand industrial activity beyond sector & technology boundaries

The value of the value chain structure

The value chain framework provides a useful structure for smart specialisation analyses:

- holistic perspective and focus on processes of value addition and dynamic linkages between diverse economic actors
- **sectoral & technological interdependencies**

Processes of value addition
Diversity of industrial activities cutting across sectors and boundaries
Diversity of actors and interrelated capabilities

need to understand industrial activity beyond sector & technology boundaries

The value of the value chain structure

The issue

- Excessive focus on R&D not aligned with business opportunities (Foray et. al., 2012).
- Relatively weak focus on absorptive capacity and take up of capacity and take up of existing knowledge and technologies (EC, 2015).
- Lack of emphasis on mechanisms to diffuse knowledge.

need to understand innovation beyond knowledge creation and R&D

The value of the value chain structure

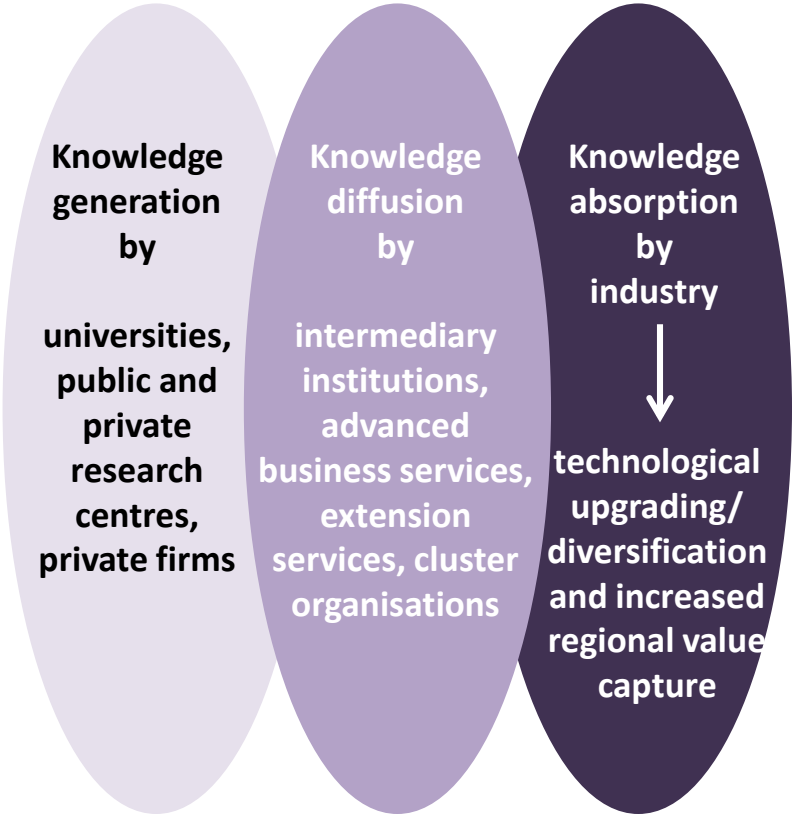
Regional innovation system typically understood to be "a set of interacting private and public interests, formal institutions, and other organizations that function according to organizational and institutional arrangements and relationships conducive to the **generation, use, and dissemination of knowledge**" (Doloreux and Parto, 2005).

need to understand innovation beyond knowledge creation and R&D

A systemic view of the regional innovation system

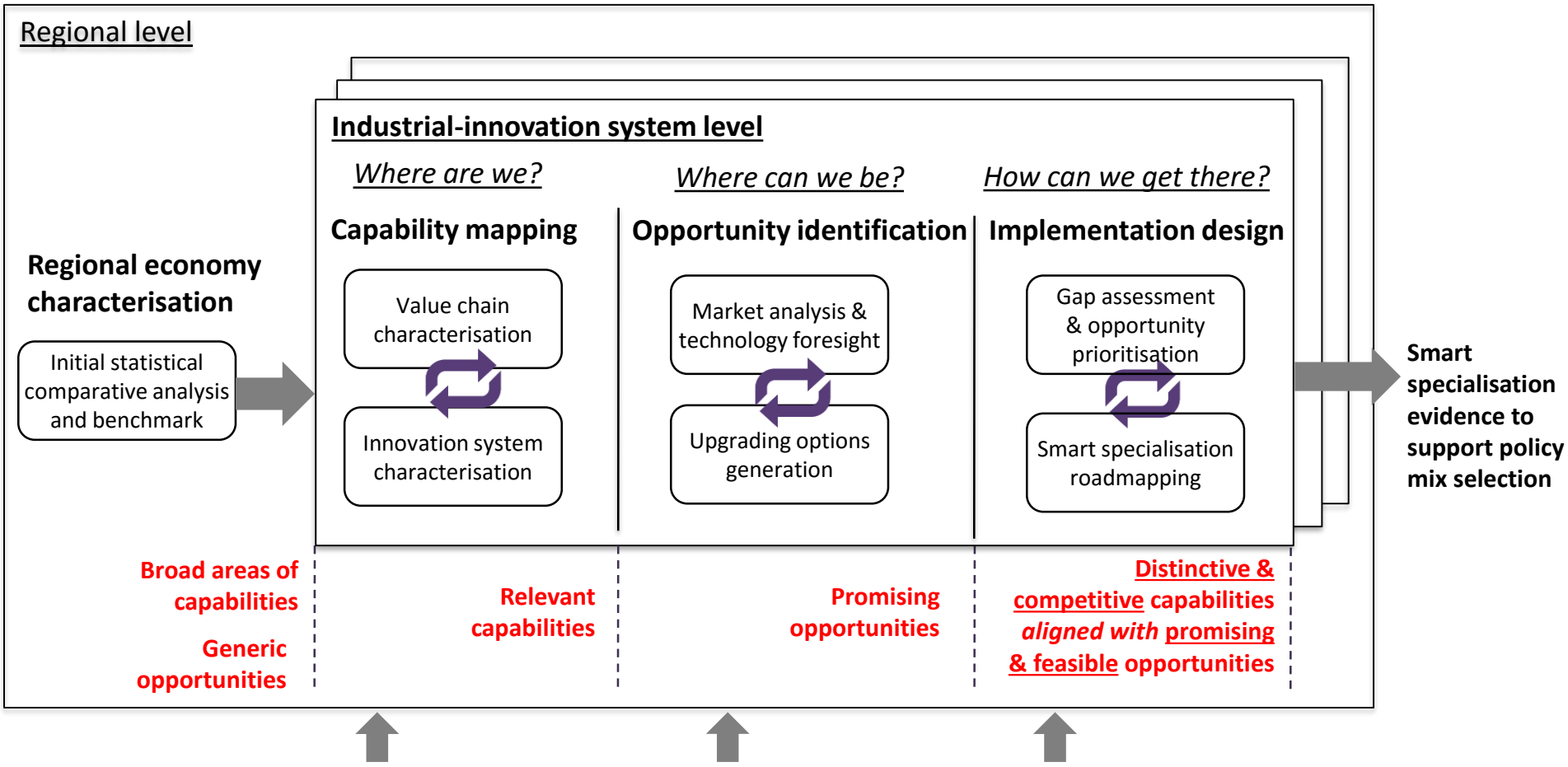
At the most basic level, three types of interrelated innovation system capabilities can be distinguished:

- *capabilities to create new knowledge*
- *capabilities to diffuse knowledge*
- *capabilities to absorb knowledge*



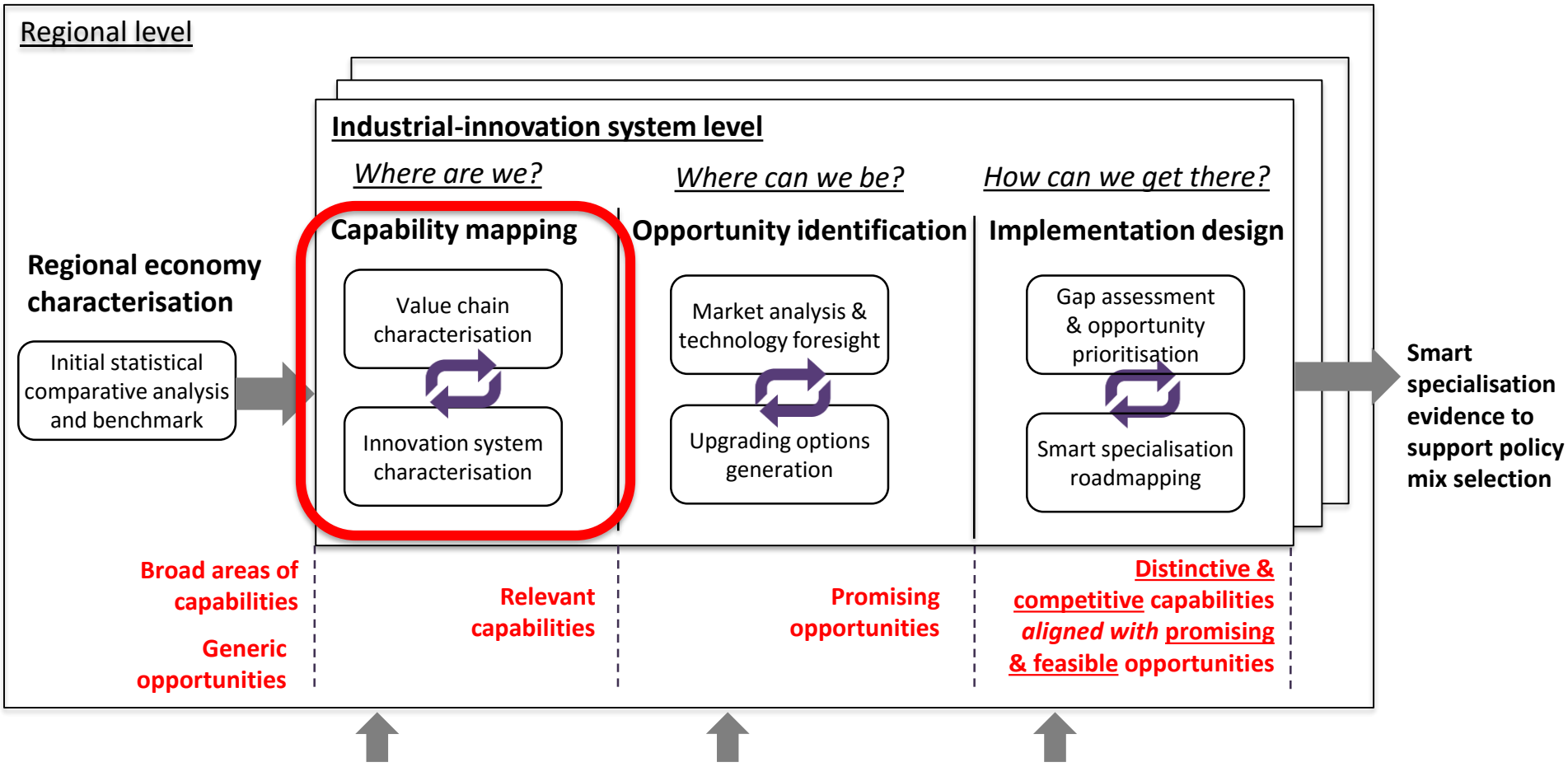
need to understand innovation beyond knowledge creation and R&D

An ‘industrial-innovation system’ approach to smart specialisation

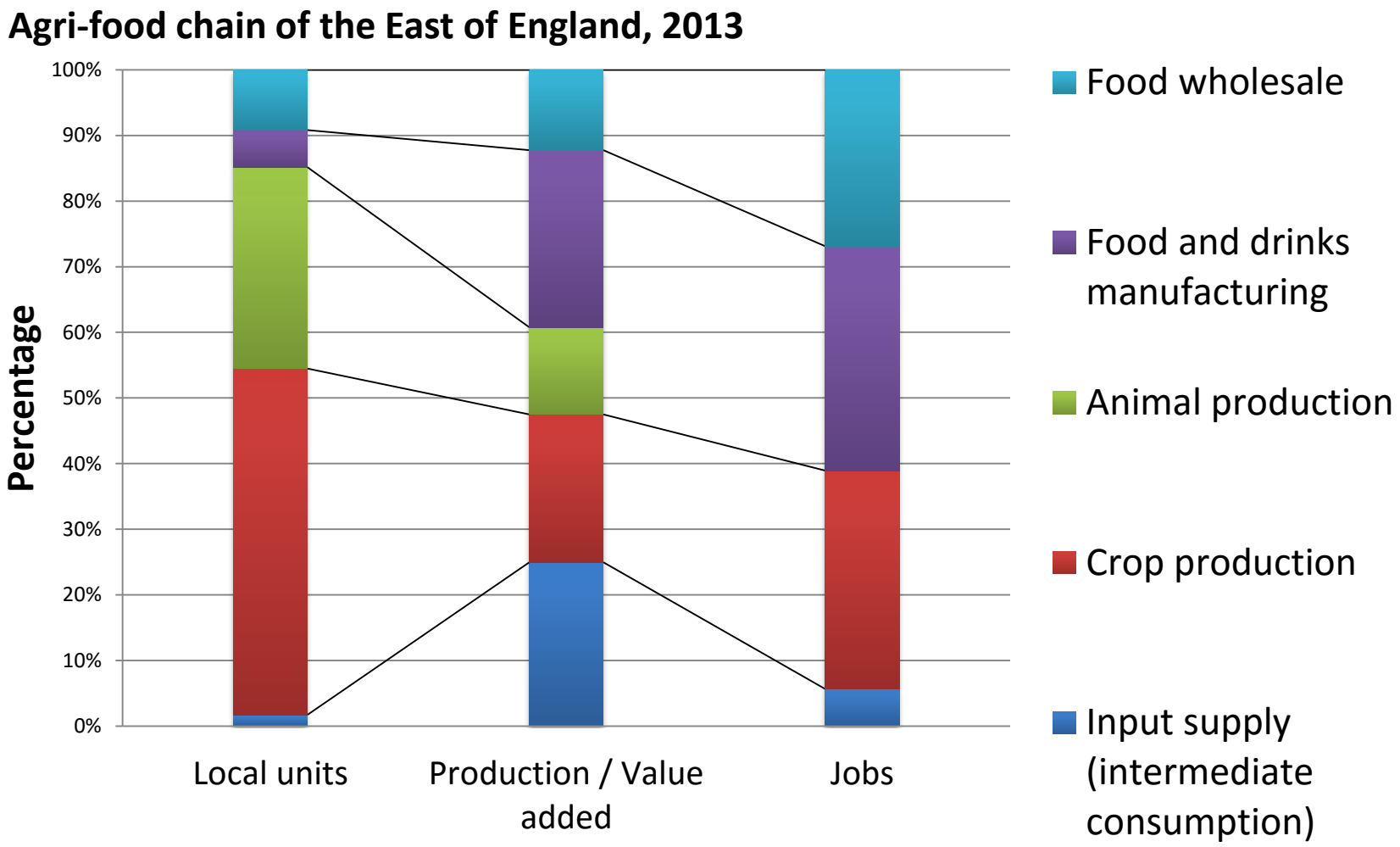


Case study: agri-tech industry in the East of England

An ‘industrial-innovation system’ approach to smart specialisation



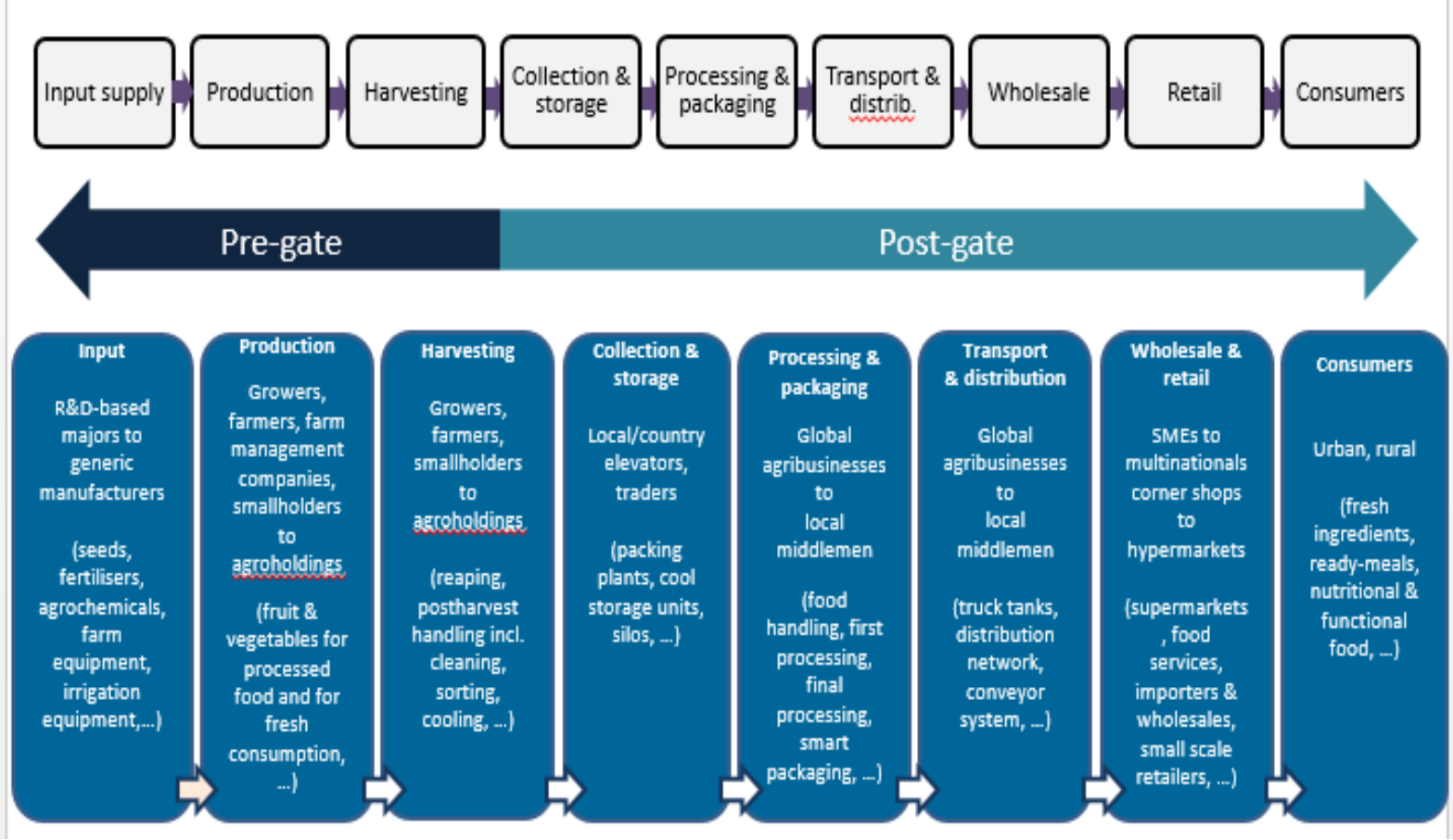
Value chain capability mapping



Key economic riables analysed across the value chain

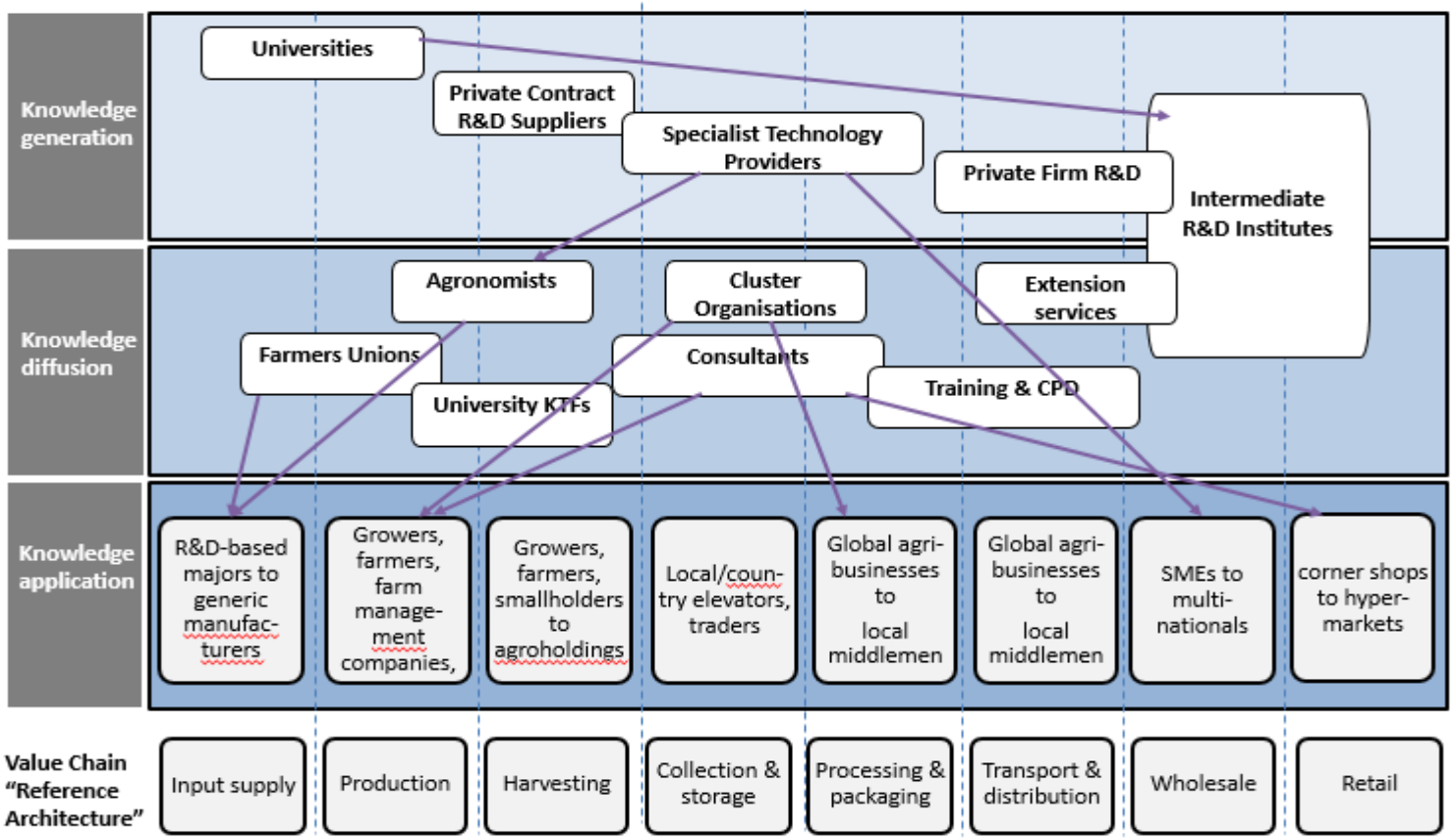
Value chain capability mapping

- Illustration on the whole range and types of stakeholders involved
- Supporting thinking about interrelated capabilities in a structured & dynamic way
- Highlighting linkages between stakeholders with seemingly different industrial interests and technical competencies



Regional innovation system capability mapping

- Systematic review of innovation system capabilities
- Explicit distinction between knowledge generation, diffusion and absorption capabilities; recognition that innovation is more than just R&D
- Careful characterisation of actors, mechanisms and institutions (and their linkages) in the regional innovation system



Regional innovation system capability mapping

Knowledge generation

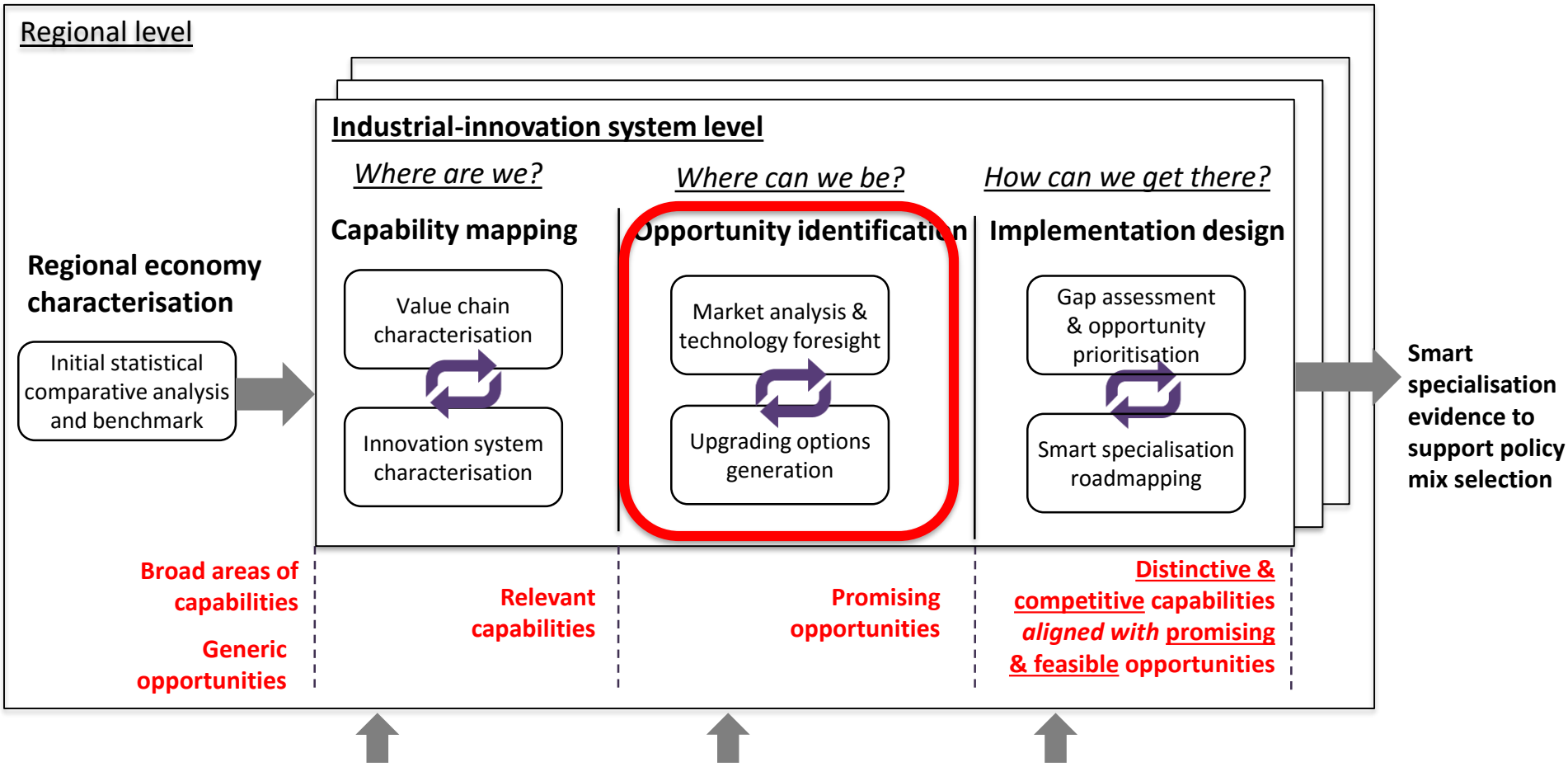
Comparison of East of England and other UK regions

Knowledge diffusion

Indicator	England	Greater Cambridge & Greater Peterborough			Hertfordshire			New Anglia			South East			South East Midlands			East of England	
	Value	Value	%	Ranking	Value	%	Ranking	Value	%	Ranking	Value	%	Ranking	Value	%	Ranking	Value (Sum / average)	%
Knowledge generation																		
Business Enterprise R&D expenditure (£ millions), 2013	16,838	1,332	7.9	1	1,322	7.9	2	641	3.8	12	957	5.7	9	647	3.8	11	4,899	29.1
Percentage of science, research, engineering, technology and associated professions in the total employment, July 2013 - June 2014	7.2	11	-	3	8.6	-	9	5.9	-	29	6.1	-	24	7.3	-	16	7.8	-
Students graduating with first degrees with honours in HEIs by LEP area, 2013/14	308,127	6,228	2.0	19	4,087	1.3	22	3,587	1.2	26	14,105	4.6	5	11,186	3.6	8	39,193	12.7
STEM Research-based doctorate degrees awarded by LEP area, 2013/1				3	53	0.5	26	179	1.6	21	161	1.4	20	223	2.0	17	1,447	12.9
Count of active patents, 2012/13				3	10	0.1	27	36	0.2	25	72	0.5	23	164	1.1	14	2,119	14.1
Knowledge diffusion																		
Higher Education Business and Community Interaction income (3 year average in real terms values / £000s), 2010/11-2012/13	2,803,563	177,421	6.3	3	49,312	1.8	19	30,582	1.1	22	75,389	2.7	16	76,585	2.7	15	409,289	14.6
Contract research income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	967,439	29,465	3.0	9	4,734	0.5	25	4,785	0.5	24	16,441	1.7	17	15,159	1.6	18	70,584	7.3
Collaborative research income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	668,294	68,789	10.3	2	1,152	0.2	29	10,458	1.6	18	8,703	1.3	19	7,860	1.2	20	96,962	14.5
Continuing Professional Development income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	359,124	30,836	8.6	3	2,886	0.8	29	3,138	0.9	27	22,412	6.2	4	39,009	10.9	2	98,281	27.4
Consultancy income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	314,666	27,480	8.7	3	12,021	3.8	9	6,167	2.0	16	15,204	4.8	6	5,765	1.8	21	66,637	21.2
Regeneration and development programmes income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	129,615	2,290	1.8	18	23,990	18.5	1	4,716	3.6	12	3,456	2.7	16	731	0.6	26	35,183	27.1
Facilities and equipment related services income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	117,273	1,960	1.7	18	1,609	1.4	21	754	0.6	26	3,738	3.2	13	456	0.4	28	8,517	7.3
Intellectual property income in HEIs (3 year average in real terms values / £000s), 2010/11-2012/13	63,452	12,350	19.5	2	59	0.1	28	272	0.4	19	184	0.3	20	4,089	6.4	3	16,954	26.7
Knowledge application																		
Percentage of firms engaged in product or service innovation, 2010-2012	45	24	-	7	15	-	35	14	-	36	18	-	23	25	-	3	19.2	-
Percentage of firms engaged in process innovation, 2010-2012	10	15	-	4	10	-	28	11	-	24	9	-	32	14	-	9	11.8	-
Percentage of firms engaged in strategic and marketing innovation, 2010-2012	16	32	-	1	29	-	12	21	-	37	28	-	18	31	-	4	28.2	-
Percentage of firms undertaking R&D by local economic area, 2010-2012	15	26	-	2	16	-	9	12	-	13	15	-	27	19	-	11	17.6	-

Knowledge absorption

An ‘industrial-innovation system’ approach to smart specialisation



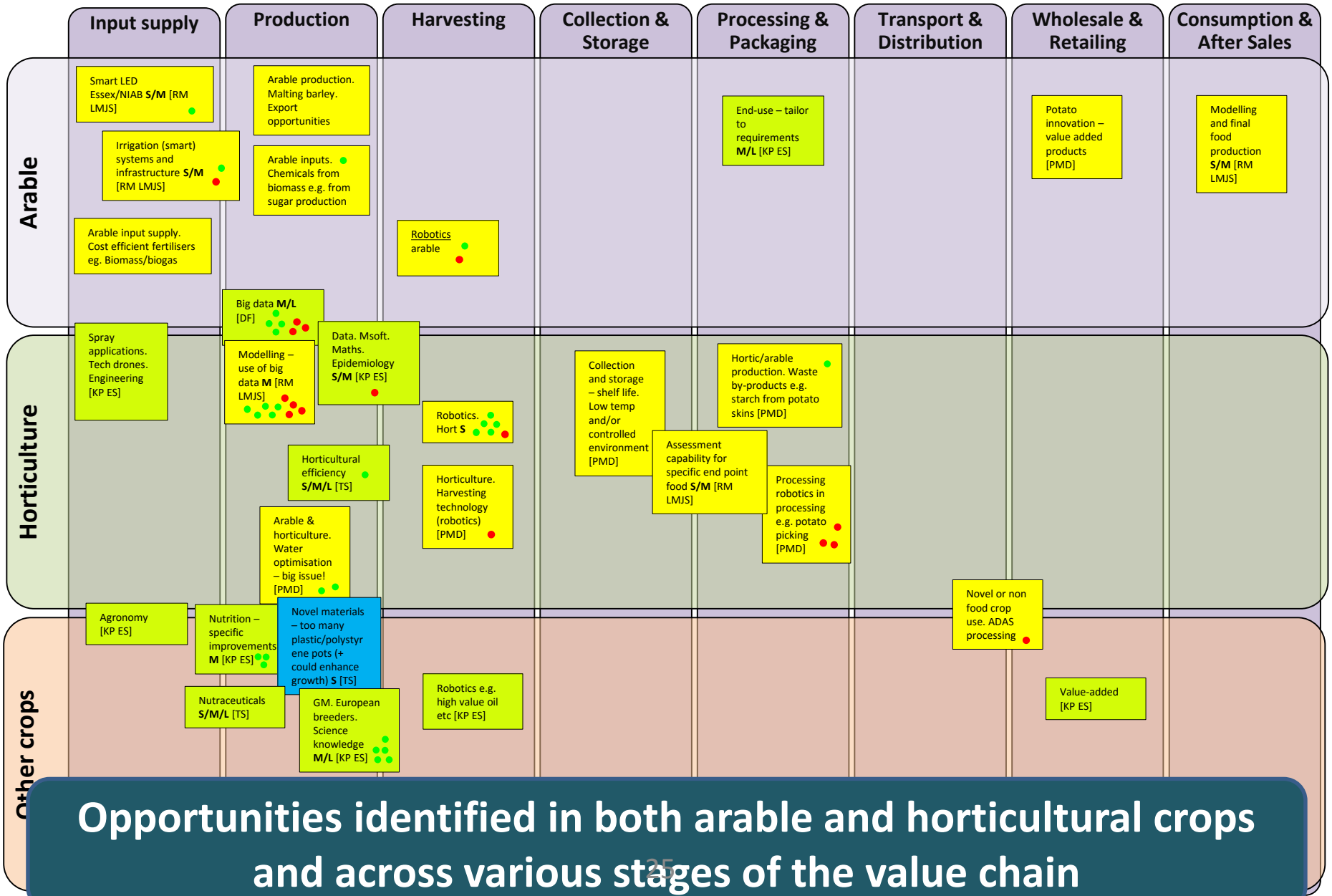
What are the main market opportunities for the region?

Please tell us your Top 3

Health cohort studies – what's growth **M** [TS]

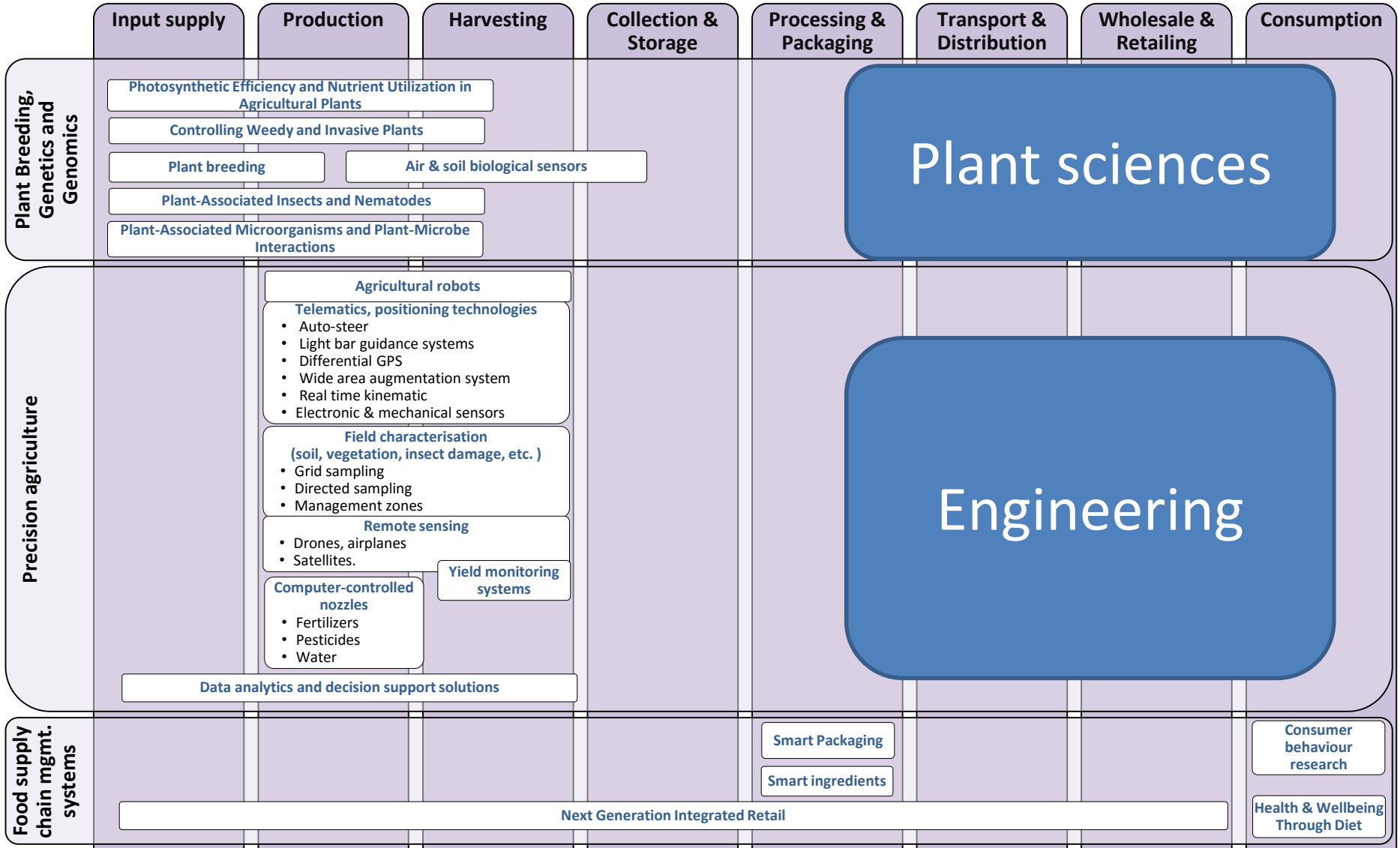
Diversity – can test and sell on wide range of expertise [KP ES]

Know-how across whole chain generating links [KP ES]



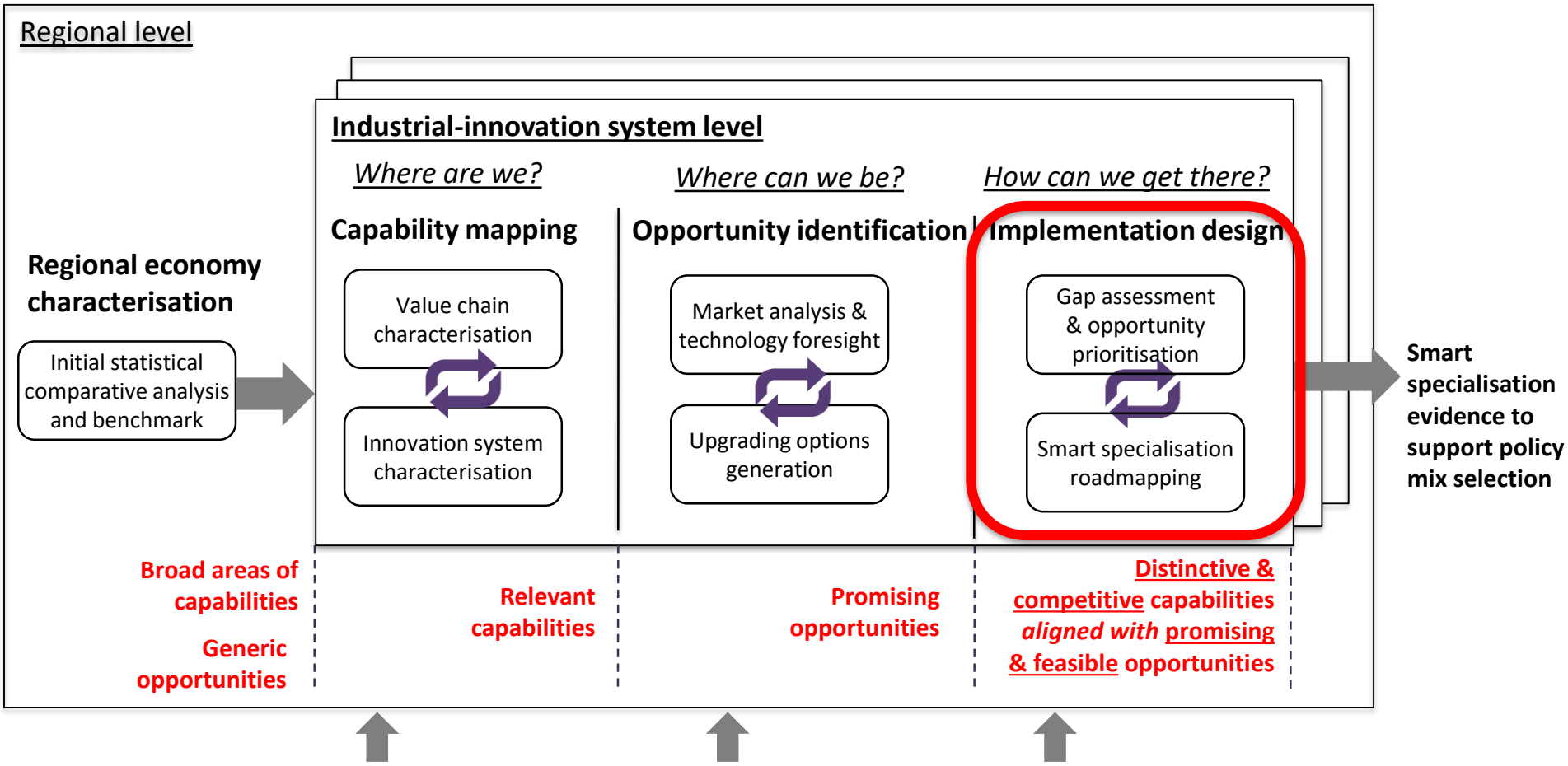
Opportunities identified in both arable and horticultural crops and across various stages of the value chain

Identifying opportunities: technologies opportunities

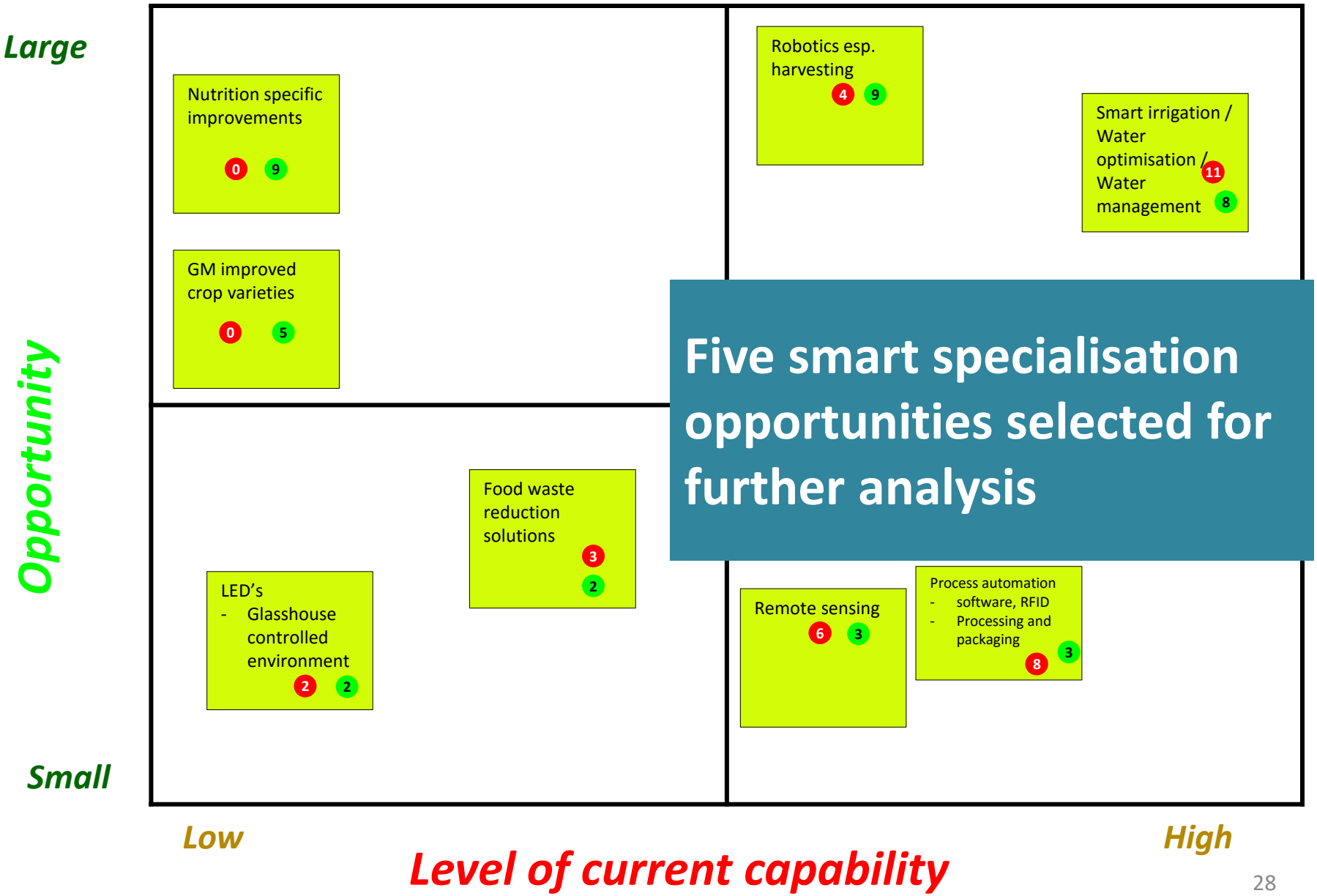


Opportunities expected from a combination of disciplines, in particular plant sciences and engineering

An ‘industrial-innovation system’ approach to smart specialisation



Example: Gap assessment & opportunity prioritisation



Example: Smart specialisation roadmapping

Priority Challenge / Opportunity
Fresh produce fortification (for improved human nutrition)

Team: KP	L Smith	CD
BC	MS	LS

Description of challenge / opportunity (including indication of size)	• EOE (inc Lincs) produces around ~40% of UK's (daily) fresh produce • Consumer demand for healthy product • High market value commanding higher prices • Import substitution (…↑ food security for UK) • Innovative fresh produce growers – tightly linked to retailers (inc M&S, Ocado) • Industry led, hungry for innovation
Why should the region pursue this?	• End-to-end capability to create and capture value/economic benefit • Non-glasshouse (field) • Very strong links with academia and growers and breeders • Highly innovative, research-active growers, hungry for new innov. & appetite for new things • Academics, institution capable of utilizing new genetic resources in veg germplasm • Strong/growing links between R&D organisations and retailers
What are the main agronomic / technical challenges?	• Matching varietal delivery with required inputs (water, chemical, management) • Soils – link between soil/inputs and nutritional quality/impact of product • Management of pests and diseases • Management of extremes of weather/climate change • Consumer perception/acceptance } Applying big data predicting capabilities is a challenge

Local capabilities to address challenge / opportunity

	Current relevant capabilities / strengths	New capabilities / strengths that will need to be developed	Key issues to be addressed	Key competitors, their initiatives & strengths
In the research & innovation base	Genetics / genomics / plant sciences / quadrum	Hardware and product development for data value extraction	• Produce novel genetic lines • link between husbandry / management regime and nutritional quality of product	• UC Davis • Wageningen • Warwick
In local organisations / networks	• Farmer groups • ATE • Anglia Farmers • Innovation Farm	NO GAPS!		
In the industrial value chain	• Unilever • Bayer / Syngenta • Elsoms	• Managing supply and demand • Interpretation of big data information leading to better decision making and input management	• Better supply chain management • No match for translational resource • Need better understanding of targets for bio-fortification	• Netherlands • Spain
Other			Exclusion gap of subsidy funding to farmers (who would otherwise be excluded) Loss of critical crop protection products in the EU could lead to low	

The region has the potential to capture an opportunity in:

The region is particularly well-positioned because:

Key issues to be addressed:

Feedback from stakeholders

"Claiming you are world class in everything will not be believed and therefore in an emerging sector like agritech **it is vital that we collectively agree where our real strengths lie.**

The workshop successfully brought together a wide cross section of partners to identify the USP of the AgriTech East region and this will strengthen our ability to attract companies and investment to the area, as well as helping us to develop bids for national and EU funding."

Representative of family-owned firm

Conclusions

Conclusions

- Strategies that are really ‘smart’ and ‘specialised’:
  - characterise regional industrial and innovation capabilities at a level of detail that allows clearly recognising what makes the region *distinctive*
  - identify, upon the recognition of this distinctiveness, promising opportunity areas against the backdrop of international competition
  - strategise to ensure that distinctive & competitive capabilities are leveraged in order to pursue promising & feasible opportunities
- An ‘industrial-innovation system’ approach to better characterise regional value chain and innovation system capabilities offers the potential to make smart specialisation smarter.

POLICY LINKS

linking policy principles and practice

Contact: Carlos Lopez-Gomez, cel44@cam.ac.uk

Policy Links is the knowledge exchange unit of the Centre for Science, Technology & Innovation Policy (CSTI), University of Cambridge

Sources of evidence

Analytical & documental evidence

- Regional data (e.g. regional innovation scoreboard)
- National data (e.g. ONS, BIS reports)
- International data (e.g. international foresight studies)

Qualitative insights

- Expert interviews (scoping and scanning approach)
- Site visits (first-hand observations)
- Smart Specialisation workshop (supporting ‘entrepreneurial discovery process – EPD’)

Challenges to effective smart specialsiation

Operational challenges

- difficulties to bring together participants from very different environments in an ‘entrepreneurial discovery processes’ (EC, 2015).
- national and regional governments might feel threatened by a transparent and inclusive bottom-up process.
- ensuring alignment of the priority setting with the budgetary process
- building absorptive capacity inside regional governments
- working with functional regions rather than administrative borders (Foray, 2014; OECD, 2013).
- cutting across traditional power boundaries between ministries
- project ideas that may differ from previous ministerial plans
- risk aversion to engage in new paths
- traditional interest groups and power structures might hinder openness to diversification (EC, 2015).

Note of clarification

- Focus on crops (not livestock in this instance)
- ‘East of England’ boundaries often have different interpretations → potential source of discrepancies
- Pre and post-gate activities considered

The case study proved the value of the suggested approach, in particular in:

- guiding a **clear identification** of what makes the cluster **distinctive**
- helping visualise how different organisations and stakeholders **fit and complement** each other rather than viewing the activities in competition with each other
- recognising the **role of technology-led firms** that are critical to the industry but are often not accounted for in the sector statistics.
- highlighting the **critical role of intermediaries** in the translation of knowledge from the science and research base into industry.

Feedback from workshop participants

"The structured methodology of the event provided a valuable focus to discussions. As a result, the output from the day felt that it had really captured the essence of the regions strength in agri-tech."

Lead Technologist - Agriculture and Food, Innovate UK

"The workshop provided a valuable insight into the challenges that farmers are facing in our area and the output will play a key role in helping the academic and industrial communities prioritise areas for research and investment. This will support the critical role played by Agri-Tech East in developing innovative solutions for farmers and creating new business opportunities, both of which will be critical in maximising the potential of this area."

Representative of major transnational agricultural firm

"Claiming you are World class in everything will not be believed and therefore in an emerging sector like agritech it is vital that we collectively agree where our real strengths lie. The workshop successfully brought together a wide cross section of partners to identify the USP of the AgriTech East region and this will strengthen our ability to attract companies and investment to the area, as well as helping us to develop bids for national and EU funding."

Consultant and representative of family-owned firm

Insights and perspectives from interviews

What makes the East of England different?

"Unique depth and breadth of the research and business sectors"

"Feeling of being just one person away from knowledge"

"Combination of strong research bases in engineering & plant sciences"

"Except for dairy, the whole agri-tech supply chain can be done entirely in the East of England"

Concept of ‘smart specialisation workshop’

Workshop with carefully selected local stakeholders

Collaboration with leading cluster organisation in the region.

Over 20 (carefully selected) representatives from industry, academia, govt.

3 main exercises

- What Makes Agri-tech in the EoE Different?
- Market Opportunities
- Addressing Challenges / Exploiting Opportunities