Outline:

The UK Government is currently seeking “a path of long-term growth which is sustainable and more balanced across regions and industries”.¹ The West Midlands – with manufacturing tradition and infrastructure – can contribute to this national endeavour, particularly through the growth of manufacturing output and exports.

This lecture addresses three questions. In doing so, it moves from broad considerations of economic strategy to detailed recommendations on how innovation and growth in manufacturing can be supported by public policy.

¹ Department for Business, Innovation and Skills (December 2010). Manufacturing in the UK: An economic analysis of the sector. BIS Occasional paper No.10A.
Structure of the lecture:
The lecture funnels down

1. from general considerations on the importance of manufacturing industry,
2. to the continued importance of traditional manufacturing in the Midlands and, finally,
3. to particular evidence-based policy recommendations for supporting innovation in traditional-sector SMEs.

Parts 2 and 3 draw on research completed for the G Prix project.

A major theme of Government economic strategy
UK Government is seeking “a path of long-term growth which is sustainable and more balanced across regions and industries”.
Department for Business, Innovation and Skills (December 2010).
Manufacturing in the UK: An economic analysis of the sector. BIS Occasional paper No.10A.

"We want the words: made in Britain, created in Britain, designed in Britain, invented in Britain, to drive our nation forward."
George Osborne, 2011 Budget Speech
1 Why is manufacturing industry special?

Why rebalance the UK economy towards manufacturing?

The arguments challenging complacency about deindustrialisation are not new but in recent decades have been unfashionable in policy circles. The current agenda of rebalancing the UK economy provides the opportunity to restate the potential contribution of manufacturing to sustainable economic growth.
Dispenses with 2 myths (at least!):
1. “We don’t make anything any more!”
2. Mrs Thatcher destroyed manufacturing industry


Employment
c. halved

Value of output
Risen by c.25%

Result
Productivity more than doubled!

Source: ONS productivity and employment data; in p.9 of:
The case for rebalancing

- Why we should be concerned by de-industrialisation
  1. Threat to productivity growth
     - As the economy becomes dominated by (relatively) slow growth services, so productivity growth across the whole economy slows
       - *Productivity isn’t everything, but in the long run it is almost everything.* A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.
  2. Threat to the current account on the balance of payments
     - Manufactured goods are *tradable*
       - Manufacturing accounts for c. 55% of UK exports of goods and services
         » 5× larger than total export earnings from all knowledge-based services
       - As the economy becomes dominated by (relatively) untradable services, so it becomes harder for the country to export to “pay its way”
       - In the long run, balance is restored by currency depreciation
         ⇒ reduced capacity to import
         ⇒ falling living standards
  - What is special about manufacturing?
    - A major source of sustained productivity growth
    - Enables a sustainable rise in living standards


**Further on knowledge-based services:** Chang, H-J (2010). *23 Things they don’t tell you about capitalism*, London: Allen Lane, p.98:

“Not all services are equally non-tradable. The knowledge-based services ... - banking, consulting, engineering, and so on – are highly tradable. For example, in Britain since the 1990s, exports of knowledge-based services have played a crucial role in plugging the balance of payments gap left behind by de-industrialisation ... However, even in Britain, which is most advanced in the exports of these knowledge-based services, the balance of payments surplus generated by these services is well below four per cent of GDP, just enough to cover the country’s manufacturing trade deficits.

With the likely strengthening of global financial regulations as a consequence of the 2008 world financial crisis, it is unlikely that Britain can maintain this level of trade surplus in finance and other knowledge-based services in the future.

.....

Moreover, it is questionable whether the strengths of the US and Britain in the knowledge-based services can be maintained over time. In services such as engineering and design, where insights gained from the production process are crucial, a continuous shrinkage of the industrial base will lead to a decline in the quality of their (service) products and a consequent loss in export earnings.”
Manufacturing ⇔ Productivity ⇔ Innovation

<table>
<thead>
<tr>
<th>Innovation ≡ commercial exploitation of ideas</th>
<th>Innovation and productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of innovation</td>
<td>Effect on labour productivity</td>
</tr>
<tr>
<td>1. Product innovation</td>
<td>(Value of output ÷ Hours worked)</td>
</tr>
<tr>
<td>• New and improved products</td>
<td>Higher value added per unit of input</td>
</tr>
<tr>
<td>2. Process innovation</td>
<td>Less input per unit of output</td>
</tr>
<tr>
<td>• New and improved processes</td>
<td>More output per unit of input (or vice versa)</td>
</tr>
<tr>
<td>3. Organisational innovation</td>
<td>Various effects</td>
</tr>
<tr>
<td>4. Marketing innovation</td>
<td>a) Higher price per unit</td>
</tr>
<tr>
<td>a) Marketing techniques</td>
<td>b) Higher sales ⇒ Lower unit costs</td>
</tr>
<tr>
<td>b) Entering new markets</td>
<td>c) New markets</td>
</tr>
<tr>
<td>– Especially by exporting</td>
<td>⇒ Growth + New experiences</td>
</tr>
<tr>
<td></td>
<td>⇒ New learning</td>
</tr>
</tbody>
</table>

If productivity is the metric of economic development then innovation is the driver.

Definition of innovation encompasses diversification

1. Product innovation
2. New markets

Exporting - finding new markets
• *not* part of the conventional definition of innovation
• But consistent with Schumpeter:

“The fundamental impulse that sets and keeps the capitalist engine in motion comes from the *new consumers’ goods*, the *new methods of production* or transportation, the *new markets*, the *new forms of industrial organisation* that capitalist enterprise creates ... the same process of industrial mutation ... that incessantly revolutionises the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.”

Schumpeter (1942)
Response by government: proliferation of innovation support programmes

- Situation in the EU
  - Lack of coherence
    - > 400 innovation support programmes
  - Cost: no reliable estimate
    - Many € billions
  - No idea of programme effectiveness
    - Little idea of best practice
- Lack of best practice evaluation of innovation support programmes
  - “… whilst there are examples of high quality evaluations, this is not the norm … there remain too few examples of top quality evaluations … about … the impact which policy changes have upon SMEs and the economy more widely.”
    - OECD, 2007, pp.11-12


MAPEER identified 185 SME support programmes in research and technical development (RTD) alone (see the October 2011 MAPEER Conference booklet, “Programme Clustering Dissemination”.)
Origin of the G Prix project

- EU problem
  - No evidence base for allocating resources for support under FP8
- EU Response: DG Research
  - 3 research projects ⇒ evidence-based policy
    - MAPEER: focus on programmes
    - RAPPORT: focus on high-tech “gazelles”
    - G Prix: focus on traditional manufacturing industry
  - c. €4 million funding
Good Practice in Regional Innovation (& the X?)

- Which support measures can help regions based on traditional industries to prosper in the knowledge economy?

- Framework 7
- D-G Research
- 27 months: November 2009 – February 2012
7 EU regions

- West Midlands, UK
- Limousin, FR
- North/Central of Portugal, PT
- Comunidad Valenciana, ES
- North Brabant, NL
- Saxony-Anhalt, DE
- Emilia-Romagna, IT
The regional importance and potential of SMEs in traditional manufacturing industry

Focus on the West Midlands

West Midlands, 2008

c.106,000 companies employing 1 - 249
  Micro (<10); Small (<50); Medium (<250)
Only 500 employ 250 people or more
  255 employ between 250 – 499
  245 employ 500 or more people
Traditional manufacturing sectors

- Definition
  - Not high/low tech
    - As in OECD definitions
  - Instead: definition by typical characteristics
### 5 Traditional sector industries in the West Midlands

<table>
<thead>
<tr>
<th>Main traditional sector characteristics</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ceramics</td>
</tr>
<tr>
<td>1. Long established</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Main source of employment (at least in certain sub-regions)</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Mature and declining</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Labour intensive (relative to the average for manufacturing industry in the region)</td>
<td>Yes</td>
</tr>
<tr>
<td>5. Main source of wealth creation (at least in certain sub-regions)</td>
<td>Yes</td>
</tr>
<tr>
<td>6. Innovation capacity (see also Table 7 below)</td>
<td>Yes</td>
</tr>
<tr>
<td>7. Capacity to diversify into new, high-growth activities</td>
<td>Yes</td>
</tr>
<tr>
<td>8. Export-led contribution</td>
<td>Yes</td>
</tr>
<tr>
<td>9. Cluster location (relevant for at least significant industries within the sector)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table from: GPrix Deliverable 1.2, report on the *Regional Economic Fabric of the West Midlands* (2010)
Importance in the regional economy

- Total manufacturing turnover in the West Midlands
  - 2008: c.£50 billion
- > 40% accounted for by the five GPriz industries

<table>
<thead>
<tr>
<th>Sector</th>
<th>Automotive</th>
<th>Metal Manufacturing</th>
<th>Textiles</th>
<th>Ceramics</th>
<th>Leather</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of enterprises</td>
<td>500</td>
<td>4,900</td>
<td>650</td>
<td>190</td>
<td>91</td>
<td>6,400</td>
</tr>
<tr>
<td>Number of employees</td>
<td>4,100</td>
<td>84,100</td>
<td>5,500</td>
<td>4,800</td>
<td>1,800</td>
<td>138,000</td>
</tr>
<tr>
<td>(annual average)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnover (million)</td>
<td>£10,000</td>
<td>£9,600</td>
<td>£420</td>
<td>£530</td>
<td>£86</td>
<td>£21,000</td>
</tr>
</tbody>
</table>

Source: Disaggregated regional data at the 2-digit level provided by special request to the Office of National Statistics (Ultimate source: Annual Business Enquiry, 2009).
Table from: GPriz Deliverable 1.2, report on the Regional Economic Fabric of the West Midlands (2010)
## Innovation in five traditional sectors in the West Midlands

<table>
<thead>
<tr>
<th>Type of innovation</th>
<th>Leather</th>
<th>Ceramics</th>
<th>Textiles</th>
<th>Metal Manufacturing</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>No</td>
<td>Yes (notably hotel and catering)</td>
<td>Yes (notably technical textiles)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Process</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (notably technical textiles)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Organisational</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Marketing</td>
<td>Yes (notably new export markets)</td>
<td>Yes (but lack of new export markets)</td>
<td>Yes</td>
<td>? (successful exporter; but new export markets?)</td>
<td>Yes (successful exporter; but new export markets?)</td>
</tr>
</tbody>
</table>

• Strongly innovative in products and processes
• Less innovative in organisation and marketing

Source: GPrix Deliverable 1.2, report on the *Regional Economic Fabric of the West Midlands* (2010); Sector reports
The latest evidence!

• Manufacturing industry in the British Midlands
  – "In Britain as a whole, some 100,000 manufacturing jobs have been lost in the past two years. In the Midlands, manufacturing employment has grown slightly ... the firms have emerged surprisingly nimble and profitable from recession."
    • *Economist*, February 11th 2012 (p.32)

• Consistent with GPrix research on SME innovation in traditional manufacturing industries
  – SMEs that have survived in traditional manufacturing
    • Very good at what they do
    • Innovative (in the broadest sense)
UK businesses have to invest more in innovation activities to grow. Innovative businesses grow twice as fast, both in employment and sales, as businesses that fail to innovate.

For instance in ‘The vital 6 per cent.’ (2009), NESTA. NESTA econometric analysis shows that firms that had introduced a product innovation in 2002-04 experienced a 4.4 per cent average employment growth rate between 2004-07, in contrast to the 2 per cent average growth rate displayed by non-innovators. And the figures are 10 percent and 5.8 per cent respectively if we consider sales growth.
Resources devoted to innovation, 2005 compared to 2009
(GPrix sample for the West Midlands=98)
③ How can SMEs in traditional manufacturing industries be helped to innovate?

From the GPrix research:
① Evaluation of the effectiveness of support measures for SMEs in traditional manufacturing industry
② Recommendations for more effective support
Recommendation ①: Evaluation – the key to improved effectiveness of innovation support

- UK programme evaluation
  - No best practice evaluation
- Useful on the **process**
  - Often contain good evidence on what firms like/dislike
- Inadequate for evaluating programme **effectiveness**
Evaluation methodology

Best practice evaluation methodology is necessary

- "Broadly, lower quality evaluations seem to produce more "favourable" outcomes for the project, because they attribute observed change to the policy when this may not be justified ... In contrast, the more sophisticated approaches strip out the other influences, and so only attribute to the programme its "real" effects ... policy makers need to be aware that there is a risk that low grade evaluations ... lead to misleading pictures of programme effectiveness."
  - OECD, 2007, pp.11 and 21; also, pp.50 and 54)

Characteristics of best practice **quantitative** evaluation:

1. **Comparison group of non-participants**
   - A "counterfactual"
     - To measure **additionality**
       - Innovation outcomes that would not have occurred without support

2. **A selection model**
   - To account for the non-random assignment of participants and non-participants

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## Innovation support programmes for West Midlands SMEs in traditional sectors: summary

<table>
<thead>
<tr>
<th></th>
<th>Innovation Vouchers</th>
<th>Innovation Networks</th>
<th>Designing Demand</th>
<th>Knowledge Transfer Partnerships (KTP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation: % of SMEs in West Midlands</td>
<td>c.0.1%</td>
<td>Less than 0.1%</td>
<td>0.04% (all firms)</td>
<td>0.23% (all firms)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.26% (SMEs excluding micros)</td>
<td>1.16% (SMEs excluding micros)</td>
</tr>
<tr>
<td>Total annual budget for the West Midlands (2010)</td>
<td>&lt; £1 million</td>
<td>Circa £1.2 million</td>
<td>&lt; £1 million</td>
<td>c. £9.5 million</td>
</tr>
<tr>
<td>Average subsidy (% of total cost)</td>
<td>75%</td>
<td>50%</td>
<td>&lt; 33%</td>
<td>33% (large firm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60% (SMEs)</td>
</tr>
<tr>
<td>Value of support to SME</td>
<td>£3574</td>
<td>Up to £15,000</td>
<td>Average: £32,000</td>
<td>c.£100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Typical range: £6,000-£17,000</td>
<td></td>
</tr>
<tr>
<td>Substantial excess demand?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Independent Evaluation?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (for internal use only)</td>
<td>Yes</td>
</tr>
<tr>
<td>Evaluation meets best practice standards?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Additionality rigorously assessed?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No (at best partially)</td>
</tr>
<tr>
<td>Use of comparison group?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Can we recommend any programme as best practice? No!

- In the absence of rigorous evaluation, cannot judge
  1. Programmes effectiveness
     - Value for money
  2. Best practice with respect promoting innovation

- Proposals
  - Evaluate programme *effectiveness*; not just *process*
  - Make funding of support programmes conditional on
    1. Training in evaluation methodology
       - So that evaluation reports can be properly specified
    2. Implementation of best practice evaluation

Practical implications for officials and managers commissioning research into programme effectiveness
Make the consultants/research group explain
  1. How they will obtain a comparison group of non-participating firms
  2. How they will address selection bias
Effect of participation on the probability of SME innovation:

GPRIX EVALUATION OF SUPPORT PROGRAMME EFFECTIVENESS
Qualitative evidence

• Clear evidence of *selection bias*
  – From programme managers
    • Interviews
    • Documents

• Two types of selection
  – Observed
    • By Programme Managers
  – Unobserved
    • Firms self-select onto programmes
Quantitative evidence: the consequences of selection bias

- Random selection (e.g. drug trials)
  - Compare the innovation outcomes of
    - Participants
    - Non-participants

- Non-random selection
  - “Cherry picking” (“cream skimming”) of participants
  - Exaggerates participation effects
    - Attributes to the programme the effects of differences between participating & non-participating firms
      - Selection bias
        » Like comparing selective with non-selective schools

Non-random selection
- By programme managers
- By firms’ self-selection

Sample Selection Bias as a Specification Error
James J. Heckman
pp. 153-54:
The wages of migrants do not, in general, afford a reliable estimate of what nonmigrants would have earned had they migrated. The earnings of manpower trainees do not estimate the earnings that nontrainees would have earned had they opted to become trainees.
In each of these examples, wage or earnings functions estimated on selected samples do not, in general, estimate population (i.e., random sample) wage functions.

Comparisons of the wages of migrants with the wages of nonmigrants (or trainee earnings with nontrainee earnings, etc.) result in a biased estimate of the effect of a random “treatment” of migration, manpower training, or unionism.
Random selection:
Outcome can be attributed to participation

Non-random selection:
Outcome effects depend on the selection process

Firms

Random selection

Programme participants

Non-participants

Innovation outcomes

Firms

Observed & unobserved characteristics

Selection

Programme participants

Non-participants

Innovation outcomes
G-Prix evaluation – estimating treatment effects taking into account selection bias

- G-Prix survey sample used to estimate two treatment effects
  1. ATE
     - Average Treatment Effect
       - Effect of programme participation on the innovation of all firms in the sample
  2. ATT
     - The average effect of treatment on the treated
       - Effect of programme participation on participating firms in the sample
- Extensive modelling
  - ATE and ATT estimated for 20 measure of innovation output

Models estimated for 20 dependent variables in two categories
  1. 16 innovation indicators
     Types of innovation outcome
     Product; Process; Organisational; Marketing
     Sub-categories of each (e.g. Product – goods; services)
  2. 4 categories of innovation sales
     Percentage of sales accounted for by new or improved products or process
     >5%; >10%; >25%; >50%

Longer-term economic outcomes
Consistent empirical results

• ATT and ATE
  – 18 out of 20 models: ATT<ATE
    • Probability of this result with no systematic relationship
      = 0.0002 (2 in 10 thousand)
  – 9 out of 20 models: ATT≤0 and ATE>0
    • Probability of this result with no systematic relationship
      = 0.03 (3 in 100)

Example:
The effect of programme support on product innovation:
• ATT: average estimated effect on supported firms is zero
• ATE: average estimated effect for firms randomly selected from the entire population – increased probability of innovation by 12 percentage points
Estimated effects of participating in support programmes: interpretation

- Effects on SMEs of participating in support programmes
  - Little or no effect on the probability of participants innovating
  - Potentially positive effect if support had been allocated randomly to firms in the sample

- Perverse selection of participants
  - More likely to participate
    ⇒ Less likely to innovate as a consequence
  - Less likely to participate
    ⇒ More likely to innovate as a consequence

- Why?
  - Result of extreme selection bias
    • Support for those firms already most likely to innovate
  - Reflects the selection procedure by programme managers
    • Typically “cream skimming” or “cherry picking”
Additionality:

- Effects of programme participation over and above differences accounted for by observed and unobserved differences between participants and non-participants

Help *typical* firms that can benefit from support
Recommendation ②: Reform the selection process

• Aim:
  – Select those firms that gain the most from support rather than those with the greatest propensity to innovate

• How?
  0 Move from cream-skimming towards random selection
    – Subject to transparent eligibility criteria

• Corollary
  ② Remove participation obstacles
  ③ Increase the number of firms wanting to participate in innovation support programmes

Two reasons for this selection strategy: incentive and scope

1. Programme Managers assessed on raw results
   • Incentive to select the most innovative firms

2. Obstacles – notably bureaucratic – to SME participation in support programmes
   • Lack of interest by SMEs in support programmes,
   • Programme Managers forced to actively recruit
     • Gives more scope to “cream skim”

Consistency?
• A more random selection process
• A more generic approach to support programmes
Recommendation ③: Simplify and broaden the scope of R&D tax credits

• R&D tax credits
  – UK’s largest innovation support programme (£1b in 2009-10)
  – Not easily compatible with the innovation model of SMEs in traditional manufacturing
    • Design central to SME innovation in traditional manufacturing
    • Innovation models based on “tacit knowledge” and “advanced craft skills”

• Proposal
  – Reform R&D tax credits
    • Broader eligibility
      – To help traditional sectors
    • Simplify application
      – To help SMFs

Consistent with MAPEER recommendation to shift from the concept of “powerful research” and excellent research” to “powerful exploitation” and excellent innovation (see Conference Booklet, October 2011)
Also, see: MAPPEER (October 2011). Measure to foster SMEs’ participation in R&D&I activities, pp.4 and 9. www.mapeer-sme.eu

“... SMEs are not attracted by the public funding (sic) Research programmes.”

pp.4-5:
“The micro enterprises less than 10 years old, are the class size with the major contribution to create new employment. Public measures focused to this enterprise class could be an effective intervention.”

p.5: Recommendation 3:
“... Calls move from “pure excellence” towards “excellence and exploitability of results-benefits for the community ...Programmes should prioritise the exploitability of results rather than the pursuit of scientific excellence”

p.7: Recommendation 6
“Close the gap between the research activity and the potential exploitation of its results. Programme Managers should organise meetings between R&D consortia and users/buyers of technology ... Promotion of contacts with Venture Capital ... regarding the exploitation of results ...”
From R&D to Innovation tax credit?

- Consistent with other recommendations from GPrix and the other DG-Research projects
  1. Broader scope
     - to match the innovation model(s) of SMEs in traditional sectors
  2. Demand-led if the scope is sufficiently broad
     - Including design, marketing and exporting
  3. Simplification of innovation support
  4. Firms will invest in capacity to claim tax credit, if it is
     - institutionally stable and
     - help is available for first-time applicants
  5. No discrimination against business groups

- Above all, no “cherry picking”
  6. Available to all eligible firms
     - A way to increase value for money from innovation support

Consistent with current developments:
Small Company R&D Tax Credit
1. April 2012: from 175% to 225%
2. Easier for SMEs to claim
3. Government proclaims take-up as a KPI
4. The scheme “can help support design-led research and development”