

***General Purpose Technologies:  
A Survey, a Critique and Future  
Research Directions***

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# Schema

- Motivation
- Defining the General Purpose Technologies (GPT)
- Dataset of Literature Review
- GPT as in Bresnahan & Trajtenberg, 1995
- Research Themes Derived from the Literature
- Broad Categorization of Topics Covered and Future Research Directions
- Key Insights from the Survey
- Conclusions

# Motivation

- Literature on business-ICT adoption has been mostly unrelated to discussion on GPT.
- Studying business-ICT from GPT perspective can generate interesting discussion with respect to policy and strategy.
- It is not important to know if GPT contributes towards economic growth but *HOW & WHEN* GPTs plays such a role. Same is the case with ICT-Business value literature.
- Involving the dissemination of knowledge in the economy with the help of new digital applications that spawn transition towards “Knowledge Economy”

# General Purpose Technologies (GPTs) Defined

- Few technological improvements that have potential to affect an entire economy by changing *how* and *where* economic activity is organized.
- Examples include electricity, electronics, computer and the internet.

# Dataset of Literature Review

- Based on a survey of recently published empirical studies citing the original article of Breshnahan and Trajtenberg, 1995 title '*General Purpose Technologies: Engines of Economic Growth*'.

Study Period	Total # of Articles Citing the Paper	Total # of Articles Citing the Paper (b/w 2004-2013)	Total # of Empirical Articles	Total # of Published Empirical Articles
2004-2013	1492 (As of August 08, 2013)	1090	251	57

# GPTs as in Bresnahan & Trajtenberg, 1995

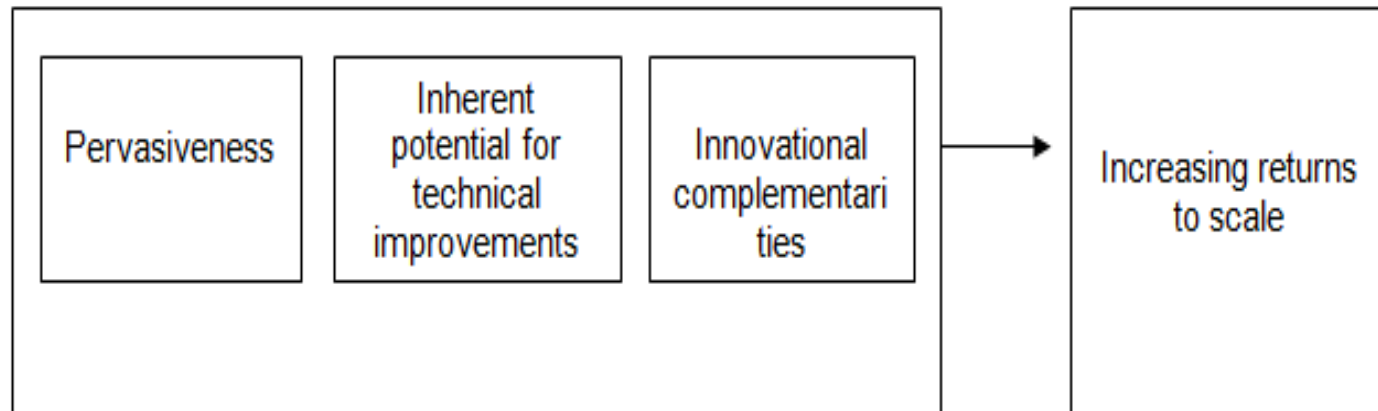


Figure 1: Explaining how Brasnahan & Trajtenberg, 1995 explained how GPT generates higher returns

# Research Themes Derived from the Literature

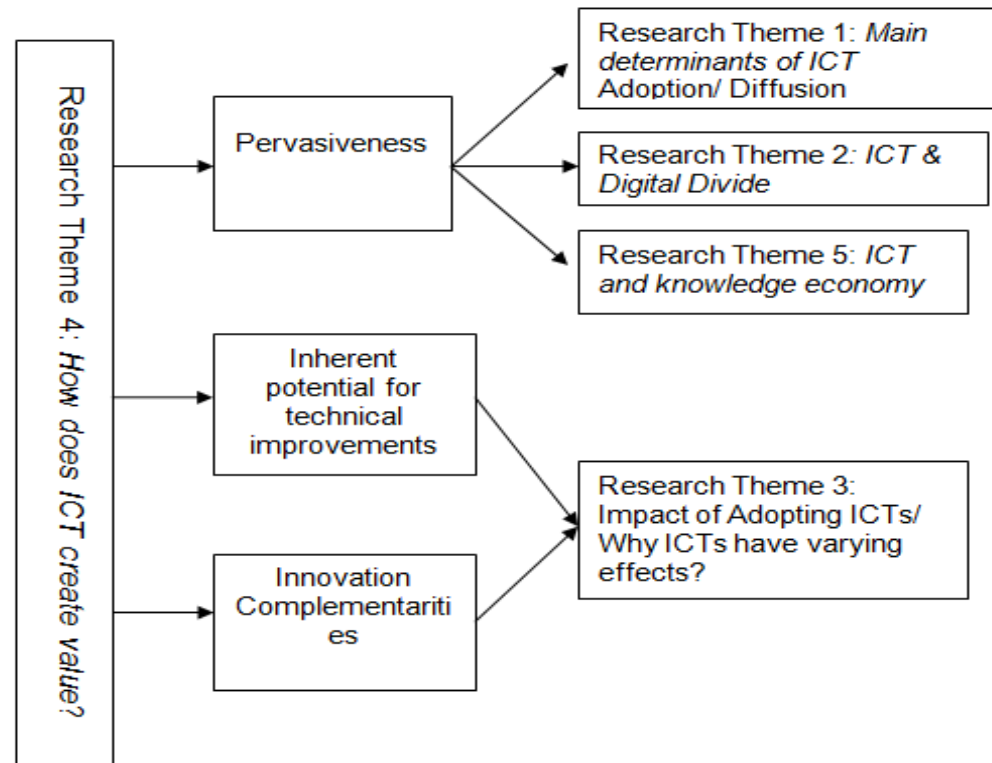


Figure 2: How literature address the ICT aspect of GPT citing Bresnahan & Trajtenberg, 1995

# Broad Categorization of Topics Covered

1. Main determinants of ICT adoption/ Diffusion
2. Form of digital divide in the recent times
3. Impacts of adopting ICTs
4. ICT value creation proposition
5. Role of ICT in Knowledge Economy



# Research Theme 1: Main Determinants of ICT Adoption/ Diffusion

## Key Insights

- Clear distinction between infrastructure & applications and within applications. Other distinctions include inter-firm, intra-firm, generic and strategic ICTs
- ICT diffusion uneven across firms, industries, time, space.
- Human capital is strong determinant of adoption
- Pervasiveness is shaped by market cond. Geo. Factors & firm internal factors
- Urban/ rural divide does not exist for basic or generic ICTs
- Urban firms use ICTs intensively

## Research Thrusts

- Link between ICT infrastructures and adoption of various business applications- Are there any complementarities between infrastructure technologies & business services and between business services

# Research Theme 2: ICT and Digital Divide

## Key Insights

- Two main areas studied, measuring the Digital Divide (DD) and determinants of DD
- Examined global DD (country level), domestic DD (groups within country), inter-firm DD.
- Spatial inequalities do not matter much
- Large firms use ICT to manage information flows, small firms for commercial purposes
- Skilled workforce is important determinant of DD

## Research Thrusts

- What sort of learning mechanisms are taking place at SMEs.
- More need for studying regional effects in ICT uptake in SMEs.

# Research Theme 3: Impact of Adopting ICT

## Key Insights

- Studies cover direct impact on productivity and through IT-enabled innovation
- Functional distinction clarifies kind of IT-enabled innovation
- BB and digital network technology is associated with higher level of wages, higher productivity but negative association with employment and price recovery

## Research Thrusts

- Studying impacts of ICT from functional role perspective to get an insight on complementary/ substitute/ orthogonal (or competing) ICTs.

# Research Theme 4: How ICT Creates Value

## Key Insights

- ICT creates value with horizontal (between different GPTs) and vertical (between GPT and application sector) innovational complementarities
- How capital skill and technology skill are complemented?

## Research Thrusts

- Need empirical evidence on horizontal and vertical innovational complementarities
- Direct link between ICT infrastructure and ICT services adoption.
- Identifying the 'generic function' of a GPT would clarify GPT link to productivity

# Research Theme 5: ICT & Knowledge Economy

## Key Insights

- ICT workers have above average returns
- Geographical concentration of ICT employment has greater +ve effect on labor productivity
- BB can enable knowledge firms to strategically locate in remote localities in some cases
- BB has positive impact on productivity only in localities with superior human capital
- BB is complementary for high skilled workers and substitute for low skilled

## Research Thrusts

- Which knowledge intensive activities take advantage of broadband provision by strategically locating in low-cost counties?
- Studies taking subsequent time-period to have a broader clarification on skill-biased technical change
- Which industries produce greater level of jobs and which industries provide higher wages?

# Types of ICTs Addressed in the Literature

ICT Type	No. of Published Empirical Articles
Broadband	8
ADSL	2
Computer/ PC	7
Internet	11
Email	2
Web Infrastructure	5
E-commerce	4
E-business	6
E-HRM	2
ATM Technology	1

# Key Insights from the Survey

- A major *shift* in the 'ICT as a GPT' literature in the study period
- Aggregate measures of information capabilities provide incomplete snapshot of a complex mechanism
- A big chunk of ICTs go to the intangibles
- Taking all ICTs as GPT may be misleading hence a functional distinction between ICTs is needed.
- Breaking ICTs into functional units would likely to address the adoption issues related to SMEs.
- Studying ICT typologies is also important because different types of ICTs can have competing performance implications.
- Network aspect of ICT corresponds to endogenous adoption process.

# Conclusions from the Survey

- Aggregate measures of ICT undermines ICT potential as 'Enabler of Innovation'.
- ICT roles and not investments should be studied to understand ICT and Organizational complementarities
- ICT products are mainly categorized into 'infrastructure' and 'business services'.
- Empirical studies increasingly disentangling 'infrastructure' and 'applications'.
- GPT hypothesis of ICT is mixed and needs further investigation



Thank you very much  
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