

# Does IT mitigate GHG emission in industry? : Empirical and case study on 'Green IT'

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IT have both positive effect(e.g. video conferencing) and negative effect(e.g. high electricity consumption) on GHG emissions. In this study, we verified the environmental impact of IT capital empirically using Cobb-Douglas production function in Canada industry. In addition, to overcome some limitations of production function, we conducted in-depth case study in terms of green IT. Our results suggest that IT capital contributes to reducing GHG emissions and to increasing carbon productivity in industry. Furthermore, we found that the impact of IT is different between in manufacturing industries and in service industries through case study.

## Literature Review

- Dematerialization by IT (high carbon activity to low carbon alternatives) could play a substantial role in reducing emissions (Webb 2008).
- IT can improve energy efficiency directly by substituting IT for energy in production (Dedrick 2010).
- We established three research hypothesis.

<b>Hypothesis 1</b>	The contribution of IT capital to carbon productivity will be significantly positive.
<b>Hypothesis 2</b>	The contribution of IT capital to carbon productivity will be bigger than that of Non-IT capital.
<b>Hypothesis 3</b>	The manufacturing industries will be associated with bigger increase in carbon productivity by IT capital than the service industries will be.

## Methodology

- Based on Cobb-Douglas production function, we made two output model. After taking log, we estimated the model using two fixed effect panel regression.
- We estimated the carbon productivity by dividing two models.

- ✓ Good output model:  $Q = A * IT^\alpha K^\beta L^\gamma$
- ✓ Bad output model:  $C = B * IT^{\alpha'} K^{\beta'} L^{\gamma'}$
- ✓ Carbon productivity:  $\frac{Q}{C} = \frac{A}{B} * IT^{\alpha-\alpha'} K^{\beta-\beta'} L^{\gamma-\gamma'}$

[ Output: Gross output (Q), GHG emissions (C)  
Input: IT capital (IT), Non-IT capital (K), Labor (L)

## Data

- We used Canada industry data(2003~2007), provided by Canada Statistics.
- Panel data: 48 (industry) X 5 (years) = 240 observations

## Results

	Elasticity			Marginal product
	Gross output	GHG emission	Carbon productivity	
<b>IT capital</b>	1.47**	-0.39**	<b>1.86</b>	<b>9.01</b>
<b>Non-IT capital</b>	2.56***	0.40***	<b>2.16</b>	<b>2.91</b>
Labor hours	166.88***	0.28	166.60	

\*p<0.10; \*\*p<0.05; \*\*\*p<0.01

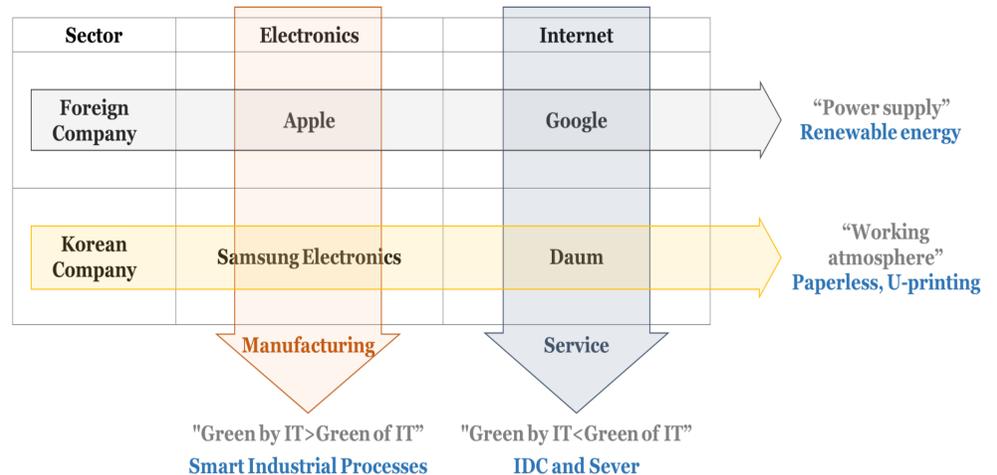
- IT capital contributed to reducing GHG emissions and to increasing carbon productivity.

	Manufacturing industries				Services industries			
	Elasticity		Marginal product		Elasticity		Marginal product	
	Gross output	GHG emission	Carbon productivity		Gross output	GHG emission	Carbon productivity	
<b>IT capital</b>	10.83*	-3.60	<b>14.43</b>	<b>185.39</b>	1.58***	-0.01	<b>1.59</b>	<b>3.95</b>
<b>Non-IT capital</b>	4.38***	1.68	<b>2.70</b>	<b>3.05</b>	2.16***	0.25***	<b>1.91</b>	<b>3.55</b>
Labor hours	61.89***	-48.18	110.07		38.70***	0.39**	38.31	

- Manufacturing industries have more potential to utilize IT for reducing GHG emissions.
- We could accept all three hypothesis.

## Case study

- To overcome the limitations of empirical study, we carried out case study that more focus on 'Green IT' activities of the corporations, based on sustainability reports and websites.



- The electronics industry focused on "Green by IT" activities, while the internet industry focused on "Green of IT" activities.
- Foreign firms tend to adopt actively major investments in the renewable energy sector. Whereas, domestic firms tend to passive work such as working atmosphere.

## Conclusion

- IT capital contributes to reducing GHG emissions and to increasing carbon productivity.
- Characteristics of green IT activities are different between in manufacturing industry and in service industry.
- For future research, we will conduct data analysis using more comprehensive data set and advanced methodology.
- For future research, we will investigate reasons for different green IT activities through extensive case study.

## References

- [1] Webb, Molly. "SMART 2020: Enabling the low carbon economy in the information age." The Climate Group. London 1.1 (2008): 1-1.  
[2] Dedrick, Jason. "Green IS: concepts and issues for information systems research." *Communications of the Association for Information Systems* 27.1 (2010): 11-18.