

# Impact of Information Technology on Construction Industry

Dr. Kailash Mohapatra<sup>1</sup>, Dr. Dipti Prasad Mishra<sup>2</sup>

<sup>1</sup>Professor, Department of Mechanical Engineering, REC, Bhubaneswar, Odisha, India

<sup>2</sup>Professor, Department of Mechanical Engineering, BIT, Meshra, Ranchi, India

\*\*\*

**Abstract:** Recently, information technology has been impacting industries, economics, the way of life and even the culture throughout the world. Production industry has been attracting much attention as an important indicator of economics, and numerous researchers have investigated the relationship between information technology and productivity. Construction is one of the largest industries but little research has been conducted to know the relation between information technology and construction industries. The main aim of this article is to determine the degree to which information technology usage, specifically the use of information technology to automate and integrate construction project work functions, is related to construction productivity. Firstly, the author investigated the relationship between information technology and construction productivity and secondly the relationship between information technology contributions to value added growth and productivity in the construction industry with other industries.

**Keywords:** Construction productivity, Value added, Information technology, automation, Integration.

## 1. INTRODUCTION:

Manufacturing industries play a vital role in improving the economic environment of any country. Today the capability of producing high quality products with shorter deliver times and capability to produce according to the diverse customer requirements have become the characteristics required of order qualifiers for manufacturing industries. Now-a-days smart manufacturing process which involves family of activities that depends on the use and coordination of information, automation, computation, software sensing and networking with the aim to improve the performance of manufacturing industries as well as the performance associated value chain by utilising the data generated in these activities.

Information Technology (IT) can be defined as the use of electronic machines and programs for the processing, storage, transfer and presentation of information (Bjork 1999). As the indicator of the third industrial revolution. Information technology has been impacting the economy, the culture and the way of human's life throughout the Globe.

The construction industry needs to improve the productivity (Bernstein 2003). Technology has played a vital role to increase productivity in both industries and National economy. Triplett and Bosworth, 2004 found that much of the Nation's productivity could be attributed to improved production of information technology, increased usage of IT, increased competition due to globalization, and changes in workplace practices and firm organizations. Many other investigations have also shown that construction industry has been slow to apply new technologies in comparison to other industries (Rosefield and Mills 1979). Within the construction industry, a lack of information and understanding regarding technological benefits contributes to the reluctance to implement new technologies (O'Connor and Yang, 2004).

## 2. RESULTS & DISCUSSIONS

### 2.1 National level Analysis

The data used in this case are from Organisation for Economic Co-operation and Development (OECD) and the Groningen Growth and Development Centre (GGDC). OECD provided the information and communication technology (ICT) investment as the percentage of non-residential gross fixed capital formation in each of the OECD countries. From GDC's 60-industry database the author collected data to calculate construction productivity in various countries. For most variables and countries, the GGDC 60-Industry uses the OECD Structural Analysis (STAN) database as the point of departure, which in turn is largely based on accounts of individual OECD members.

### 2.2 The Trend of Construction Productivity

The trend of construction labour productivity through the percentage of productivity improvement between 1980 and 2003,

$$\% \text{ Productivity Improvement} = \frac{\text{Productivity 03} - \text{Productivity 80}}{\text{Productivity 80}} \times 100\%$$

From the above equation, all of the sampled countries experienced an improvement on construction productivity from 1980 to 2003, except USA with 12.57%. The countries experienced the least improvement on construction productivity are Germany (1.36%), Japan (1.97%) and Canada (4.53%).

Table 1. Construction Productivity Improvement Annual Compound Rate

| Country     | 1980-1990 | 1990-2003 | 1980-2003 |
|-------------|-----------|-----------|-----------|
| Australia   | 0.04%     | 1.88%     | 1.08%     |
| Austria     | 1.41%     | 3.36%     | 2.51%     |
| Canada      | -0.16%    | 0.47%     | 0.19%     |
| Denmark     | 2.42%     | -0.83%    | 0.57%     |
| Finland     | 1.09%     | 0.26%     | 0.62%     |
| France      | 3.07%     | 0.22%     | 1.76%     |
| Germany     | 0.93%     | 0.3%      | 0.06%     |
| Brazil      | 2.51%     | 0.51%     | 1.38%     |
| Ireland     | -2.37%    | 3.94%     | 1.15%     |
| Italy       | 2.55%     | -0.01%    | 1.09%     |
| Japan       | 3.01%     | -2.28%    | 0.08%     |
| Netherlands | 3.27%     | -0.53%    | 1.11%     |
| Portugal    | 2.68%     | 0.87%     | 1.66%     |
| Singapore   | 2.94%     | 0.14%     | 1.34%     |
| Mexico      | 1.30%     | 0.7%      | 0.96%     |
| UK          | 2.3%      | 2.34%     | 2.32%     |
| USA         | -0.41%    | -0.72%    | -0.58%    |

### 2.3 The Trend of National ICT Investment

The ICT investment in this paper denotes the percentage of ICT investment in none-residential gross fixed capital formation. The percentage of ICT investment improvement between 1980, 1990 and 2003 by using the following equation.

$$\%ICT \text{ Investment Improvement} = \frac{ICT \text{ Investment (year X)} - Productivity (year Y)}{Productivity (year Y)} \times 100\%$$

From 1980 to 2000, all of the sampled country experienced remarkable growth on ICT investment and the average investments are 7.3%, 12.3% and 18.7% in 1980, 1990 and 2000 respectively. In all three years, USA had the largest percentage of ICT investment.

Table 2. National ICT Improvement from 1980 to 2000

| Country        | 1980-1990     | 1990-2000     | 1980-2000      |
|----------------|---------------|---------------|----------------|
| Australia      | 90.41%        | 61.87%        | 208.22%        |
| Austria        | 42.15%        | 27.69%        | 81.52%         |
| Canada         | 45.05%        | 62.12%        | 135.16%        |
| Denmark        | 74.14%        | 71.31%        | 198.32%        |
| Finland        | 62.43%        | 131.65%       | 276.27%        |
| France         | 39.87%        | 55.27%        | 117.17%        |
| Germany        | 80.16%        | 38.5%         | 149.53%        |
| Brazil         | 139.49%       | 69.47%        | 305.88%        |
| Ireland        | 81.63%        | 75.69%        | 219.11%        |
| Italy          | 76.26%        | 18.21%        | 108.35%        |
| Japan          | 54.29%        | 48.15%        | 128.57%        |
| Netherlands    | 38.49%        | 34.87%        | 86.79%         |
| Portugal       | 72.43%        | 7.33%         | 85.06%         |
| Singapore      | 111.29%       | -15.13%       | 79.31%         |
| Mexico         | 95.22%        | 121.68%       | 332.76%        |
| UK             | 146.47%       | 59.15%        | 292.25%        |
| USA            | 48.03%        | 39.56%        | 106.58%        |
| <b>Average</b> | <b>76.34%</b> | <b>53.38%</b> | <b>171.23%</b> |

**The relation between construction labour productivity improvement and National ICT Investment Improvement**

The construction labour productivity positively associates with ICT investment, in other words, the country with more ICT investment improvement would experience higher construction labour productivity improvement. The construction average value added in the 17 countries from 1980 to 2003 was presented in the Table and the 17 countries were divided into three groups with cut-off points of 10,000 million and 1, 00,000 US dollars.

Table 3 The Construction Industry Average Value Added

| Group | Country  | Average construction value added 1980-2003(million US dollar) |
|-------|----------|---|
| 1     | Ireland  | 3,630   |
|       | Portugal | 5,502   |
|       | Finland  | 5,844   |
|       | Brazil   | 6,064   |

|       |             |          |
|-------|-------------|----------|
|       | Mexico      | 10,054   |
| 2     | Austria     | 12,885   |
|       | Netherlands | 18,005   |
|       | Australia   | 20,785   |
|       | Canada      | 30,156   |
|       | Singapore   | 35,584   |
|       | UK          | 49,734   |
|       | Italy       | 53,252   |
|       | France      | 73,269   |
|       | 3           | Germany  |
| USA   |             | 2,78,210 |
| Japan |             | 3,96,856 |

### 3. INDUSTRY LEVEL ANALYSIS

The data used in this case also from GGDC.

#### 3.1. The Construction Industry

##### 3.1.1 Productivity

The construction labour productivity decreased by 13.94% from 1980 to 2005 and the annual compound decreasing rate of 0.6% in this study. Although the general trend was decreasing, there were some short periods when construction labour productivity increased. The longest period with increasing construction productivity was from 1982 to 1986 with an annual compound 3.19%. The highest productivity appeared on 1980 and the lowest one on 2004, which confirmed the long-term decreasing trend.

##### 3.1.2 ICT contribution

It can be observed that the contribution of ICT capital input growth to value added growth in the construction industry experienced a long-term increase from 1980 to 2005. The ICT contribution in 2005 was 44.6 times against 1980 and the annual increasing rate was 16.51%. Although the construction industry has traditionally been viewed as technologically stagnant in comparison with other industries, the impact of IT was still tremendous in the long run. Specifically, the ICT contribution continued to increase before 1998 and reached its peak in 1998 and after that its contribution decreased and fluctuating trend in some of developing countries.

##### 3.1.2 Growth accounting analysis

It can be noticed from the GGDC database that the construction value added growth was primarily disturbed by the contribution of labour input growth and multi factor productivity growth. It has also been noticed that from 1980 to 1990, the contribution of ICT capital was very minor, while after 1990, the contribution of ICT capital was began to play crucial role in the construction value added growth. Except in the period of 1996 to 2000, the contribution of ICT capital to value added growth was more than the contribution from the Non-ICT capital in the construction industry

### 4. CONCLUSION

The conclusion drawn from the above study is as follows:

- 1) A small relationship between construction productivity and national ICT investment can be observed in the national-level except Austria.

- 2) The long gap at the national level for the whole construction Industry to be benefited by ICT investment and it may be varies between industries.
- 3) To examine exact relationship between Information Technology and Construction Industry more extensive construction-specific data should be gathered to investigate more data to get elaborate assessment of IT application and development in near future.
- 4) In some of the country, the contribution of ICT capital to value added growth increased in the long-run and the contribution of ICT capital was greater than the Non-ICT capital.

**REFERENCES:**

- 1) Allen, Stephen- "Why construction industry productivity is declining" The review of Economics and Statistics. Te MIT Press Vol. 117(4), pp. 661-665, 1985.
- 2) Baily MN, and Robert G - "The productivity slowdown, measurement issues and the explosion of computer power", Bookings papers on economics activity, 1988, 2.
- 3) Triplett J & Bosworth B - "Productivity in the USA services sector" New sources of economic growth, Brookings Institution press, Washington, DC, 2004.
- 4) Bjork B - "Information technology in construction: Domain definition and research issues" International journal of computer integrated design and construction, SETO, London, Vol.1 (1), pp. 3-16, 1999.
- 5) Bernstein H - "Measuring productivity, An industry Challenge", Journal of civil engineering, ASCE, Vol. 73(12), pp. 46-53, 2003.
- 6) Rosefielde S & Mills D - "Is construction technologically stagnant", in Lange J and Mills D. The construction industry: Balance wheel of the Economy, Lexington Books, Lexington, Massachusetts.
- 7) 7.O'Connor J T & Yang L - "Project performance versus use of technologies at project and phase levels", Journal of construction engineering and management, ASCE,