Cities, Communities and Homes: Is the Urban Future Livable?
AMPS, Architecture_MPS; University of Derby
Derby: 22-23 June 2017

LABOUR PRODUCTIVITY IN THE UAE CONSTRUCTION AND HOUSING SECTOR

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INTRODUCTION

Productivity is the efficiency in the process of transforming inputs (i.e. Labor and capital) into outputs (i.e. goods and services). Thus, productivity growth implies the ability and capacity to produce more goods and services from the same amount of inputs i.e. labor, capital, land, energy, etc. So, improved productivity can generate higher incomes, better goods, services and living standards. By implication, education and training can improve the quality of labor force which constitutes a key determinant of growth in productivity[i].

Labor productivity of a country is measured by the amount of income or GDP produced by one hour of labor (rate of GDP per hour of work). It is important to make clear that all officially acknowledged finished goods and services (the total output of goods and services within a country irrespective of who owns them) have a market value and the total of these in a given period is the country's Gross Domestic Product (GDP)[ii,iii].

Growing labor productivity can be interpreted through economic growth (real output or long-run aggregate supply), international competitiveness and efficient production of goods and services. It could also be interpreted through rising living standards in a country. A country's standard of living is often a function of its GDP per capita. However, in macroeconomics there are three principal determinants of economic growth and these are improved labour force, increased capital stock, and improved technology. The quantity and quality of these determinants that is available for production define whether economic growth increases or decreases. As a rule, economic growth will occur when the aggregate supply function of these determinants increases in quantity, quality or both.

It is a well-known fact that labor force is significant to economic growth. The level of output will increase if the size of labor force increases (and nothing else changes). Labor force may increase due to growing population, changing attitude to work or immigration (especially when immigrants often work harder and contribute far more than locals to output). Economic growth (increase in real GDP or long-run aggregate supply) can, therefore, change due to the size (quantity) of the labor force. But labor productivity is about the quality of labour force and more often than not a function of incentives, skills, education and technology[i]. Similarly, the quality and quantity of capital stock available significantly influence economic growth (GDP)[i, ii,iv]. Thus, when a sizeable proportion of GDP is invested in new Plants, machinery and enabling infrastructure, there is a higher tendency for economic growth or increase in real output (long-run aggregate

supply). With better facilities and tools, the quality of output increases and this indicate a strong relationship between labor productivity and capital stock. Technological advancement or the rate of adoption of new technology is the third primary factor of economic growth or increase in real GDP (aggregate supply). But adoption of new technology and innovative schemes to boost and promote business is more likely in a competitive environment and slow in a noncompetitive and protective environment. So, governmental policies which deemphasize protectionism and monopoly of inefficient local industries and restrictive practices may lead to a much faster growth rate[i].

Thus, one could argue that country's productive potential is considerably dependent on the magnitude, competence (quality) and attitude to work of its labor force; the proportion of invested GDP over a long period (magnitude and quality of capital stock); and the rate of adoption of new technology.

In the UAE, capital productivity (ratio of GDP to capital stock) considerably surpasses its labor productivity (especially in construction within the housing sector) and the country's technological access and advancement; which slightly presents an imbalance economic growth in macroeconomics. However, when considered by sector, labor productivity (in construction within the housing sector) is low when compared to the oil, finance and transport and manufacturing sectors[v]. Previous studies have shown that total labor productivity for the Gulf Cooperation Countries (GCC) has witness considerable decline in recent years[vi] and the recent global financial meltdown and its negative impact on construction and the property market have not helped matters either. This is unsurprising because productivity measures the efficiency of the production of goods and services. Invariably, when resource input is low compared to output, efficiency is high. In the construction business, the low input could be due to job cuts/lose or improved technological advancement. Certainly, this is not the case in the UAE as there are enough jobs but technological evolvement is weak as most construction projects are labor-intensive and use basic tools, basic craftsmanship and basic equipment. Low productivity in construction within the housing sector increases the dearth or shortage of low cost and sustainable housing. Less supply of housing in a country with a significant shortfall of sustainable and low cost housing means higher demand, price rise (cost) with its attendant problems of social exclusion and affordability for the average poor. Colliers International Report in 2014 emphasized that there is significant evidence to support the claim that "an affordability gap" exists in the current Dubai housing market, and there is a disparity between the demand for and supply of appropriate mid-market housing (housing that is affordable for a household in relation to its income)"[vii]. In a seeming cyclic style, this shortfall now impacts on productivity; just as productivity had initially impacted on the shortfall in production of low cost and sustainable housing. Affordable housing is a global phenomenon and particularly not peculiar to the UAE; nevertheless, it is evident globally that millions of families are financially over-stretched by housing costs and subsequently compelled to occupy inadequate housing which often undermines or compromise basic health and safety. Adequate and affordable housing is a universal human right and should be at the heart of urban policy. Affordable housing must possess the following features: structural stability, use of sustainable and good quality materials; basic services: light systems, water, ventilation; sanitary fixtures, doors and windows, etc. It should also provide adequate privacy, car park space, and lesser running costs than typical housing[viii].

But productivity is about working smarter i.e. using efficient and effective techniques to produce marketable goods and services, allowing more to be produced with the same amount of effort. So, an improved working environment, higher skilled workforce, innovative culture and technology will produce higher-value-added products and services that are worth more.

Although improving labor productivity in any sector is multi-faceted, this paper aims to identify major perceived external factors affecting labor productivity in construction within the UAE housing projects through relative importance ranking procedure using a Severity Index in Matrix Order (SIMO) model[ix].

METHODOLOGY

The methodology or principle applied in this study is quantitative and centers on research survey. Quantitative research is the method by which data is collected and presented in a statistically quantified order to sustain or controvert a subject matter[x],[xi]. However, the questionnaire used in this study was informed by the information gleaned from a pilot study (both literature and preliminary fieldwork).

Judgmental sampling technique was used for the major fieldwork of this investigation. Adopted sample size was 35, and the target sectors were contractors, consultant and clients. Five firms were selected by judgmental sampling for each of these sectors (see Table 1 for Fieldwork sample frame below).

This sample size was adopted purely from an experiential point of view i.e. the nature of the case-study (the difficulty of finding respondents in UAE who are willing to share information despite the guarantee of anonymity); logistical and financial reasons. Under these circumstances, the size of the sample becomes a function or dependent on 'what is readily available' or convenient for sampling if the research is to progress. The difficult with this type of sampling and sample size is the fact that it has a slightly weak statistical power due to wide confidence intervals or the tendency for high error in statistical prediction and hypothesis testing and the fact that the selection wasn't random or unbiased. Such tendency for higher error can impact significantly on the validity of statistical outcome in inferential statistics; which is very different from the basic non-parametric descriptive statistics (ranking) used in this study. Descriptive statistics simply pronounces what the data shows in manageable and acceptable format. Whereas inferential statistics infer or outspread conclusions beyond the immediate data. In this study, the authors simply intend to describe what the data shows not extending its conclusions beyond the immediate data (through the statistical/empirical model for the purpose of predictions).

Often for prediction or extending conclusions beyond the immediate data will require a random selection of respondents and a 95 % (or more) symmetric confidence interval is required (i.e. the sample population mean within this interval, or the sample has a 95% (or more) 'chance' of being a true representation of the surveyed population). The implication here is that at least a minimum sample size of 385 to 400 is required. Such size would be very difficult to achieve in the UAE; apparently far-off the financial resource and logistical capacities of the authors (or researchers).

These respondents (participants) are stakeholders in their various sectors, and they were selected by judgmental sampling, purely because of their experience in the field of housing construction. The designations of respondents were project managers and senior resident engineers for contractors, project engineers for consultants and supervisors for clients. The means of data collection was using questionnaires, and the total response rate was 80 percent (28 received out of 35 distributed). See Table 2 below for the breakdown of distributed questionnaires and responses.

The questionnaire was structured into five sections. Section 'A' comprises some personal questions concerning willingness to respond to the questionnaire; designation of the respondents; years of experience in the construction field; type of activity and number of employees working in the firm. In section 'B', respondents were asked to rate both external and internal factors that influence labor productivity in

construction within the housing sector; then they were to rank the factors that affect labor productivity amongst the workforce. In Section 'C', respondents were asked to rank those perceived factors responsible for declining labor productivity in the UAE. In section 'D' and 'E', they were asked to rate some recommended ways of improving labor productivity and some perceived benefits from labor productivity improvement.

However, this paper only analyses those major external factors affecting labor productivity in section 'B'. The analysis was carried out using the Severity Index in Matrix Order (SIMO) model[v1].

Table 1. Fieldwork sample frame

Sectors	Number of firms	Participants per firm	Total Participant per sector
Contractors	5	4	20
Consultant	5	2	10
Clients	5	1	5
Total	15		35

Table 2. Distributed and Received Questionnaires Sample Frame by Designation

Sectors	Designation	Questionnaire distributed	Questionnaire Received	Percentage (%)
Contractors	Project Manager	10	8	36
	Resident Engineer	10	7	14
Consultant	Project Engineer	10	9	41
Clients	Supervisors	5	4	9
Total		35	28	100

ANALYSIS

The following are the seven steps employed in building the SIMO model used in this investigation:

1. The external factors influencing Labor productivity in UAE were coded accordingly: F(1), F(2), F(3),…., F(17) (see Tables 3, 4, 5, 6 and 7).
2. Ranking positions of these factors as presented in Table 4 are in decreasing order of severity accorded by respondents i.e. P1, P2, P3,..., P18 (see the second row in Table 4).
3. Each factor frequency count is entered under the various ranking positions that were accorded by respondents (see Table 4). It is important to note that any of the factors could have frequency counts in multiple ranking positions.
4. The index factors column as shown in Table 4 is derived from the inverse array of arithmetic numbers 1,2,3,.....,17 to give 17, 16, 15, 14,…,1 multiplied by the inverse of 17 or (1/17) to give 17/17=1; 16/17=0.94; 15/17=0.88;.....1/17=0.06 (see the last column of Table 4).
5. The severity of each of the factors is found when the matrix of frequency counts under the various ranking positions (i.e. 17 X 17 matrix) is multiplied by the column of index factors in the last column

of Table 4 (i.e. 1X17 matrix) (see Table 5) to give the array of severity magnitudes in the form of 1X17 matrix (first and second matrices) shown in Table 6.

6. The external factors and their severity magnitudes above are then re-arranged in a decreasing order of severity i.e. p(1) > p(2) > p(3) >,…., > p(18) (see Table 7).
7. The threshold value or demarcation line is calculated by working out the statistical midhinge of Table 7.

The mathematical formats for the seven steps above are presented according to[vi] as follow:

$$F(j) = \sum_{i=1, j=1}^{i=n, j=n} \mu_{ij} \frac{\sigma_i}{n} \text{ .... (A)}$$

Where: $\sigma_i = (n+1) - i$

j = variable factor under consideration: for **j = 1, 2, 3,…, n-1, n**

i = ranked position of the variable factor under consideration: **i = 1, 2, 3,….., n-1, n**

Thus: $\boldsymbol{\sigma_1}$: represent variable factor position 1; $\boldsymbol{\sigma_2}$: represent variable factor position 2…, $\boldsymbol{\sigma_n}$: represent **n**[th] variable factor position.

$\frac{\boldsymbol{\sigma_i}}{\mathbf{n}}$ = Severity index factor, for i = 1, 2, 3,….., n

μ_{ij} = is the frequency of variable factor j under ranked variable factor position i. Thus, equation (A) becomes the set of equations below

$$f(1) = \mu_{11}\frac{\sigma_1}{n} + \mu_{12}\frac{\sigma_2}{n} + \mu_{13}\frac{\sigma_3}{n} + \text{- - - -} + \mu_{1n}\frac{\sigma_n}{n} \text{ ....(1)}$$

$$f(2) = \mu_{21}\frac{\sigma_1}{n} + \mu_{22}\frac{\sigma_2}{n} + \mu_{23}\frac{\sigma_3}{n} + \text{- - - -} + \mu_{2n}\frac{\sigma_n}{n} \text{ ....(2)}$$

$$f(3) = \mu_{31}\frac{\sigma_1}{n} + \mu_{22}\frac{\sigma_2}{n} + \mu_{33}\frac{\sigma_3}{n} + \text{- - - -} + \mu_{3n}\frac{\sigma_n}{n} \text{ ....(3)}$$

$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots$$

$$f(n) = \mu_{n1}\frac{\sigma_1}{n} + \mu_{n2}\frac{\sigma_2}{n} + \mu_{n3}\frac{\sigma_3}{n} + \text{- - - -} + \mu_{nn}\frac{\sigma_n}{n} \text{ ....(n)}$$

$$\begin{bmatrix} f(1) \\ \cdot \\ \cdot \\ f(n) \end{bmatrix} = \begin{bmatrix} \mu_{11} & \cdot & \cdot & \mu_{1n} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \mu_{n1} & \cdot & \cdot & \mu_{nn} \end{bmatrix} \begin{bmatrix} \sigma_1/n \\ \cdot \\ \cdot \\ \sigma_n/n \end{bmatrix} \text{ ....(SIMO)}$$

$$\begin{bmatrix} P(1) \\ \cdot \\ \cdot \\ P(n) \end{bmatrix} = \begin{bmatrix} f(1) \\ \cdot \\ \cdot \\ f(n) \end{bmatrix} \text{ ....(B)}$$

Where $f(1) > f(2) > f(3) > .... > f(n)$

P(1) is the highest severity position
P(2) is the 2nd highest severity position……P(n) is the severe position
Stage 2: Threshold Value (Demarcation Line)
The Threshold value which is the Midhinge in the matrix of equation (A)
$= ½[h_1 + h_2]$.....(C)
$D_1 = ¼[n + 1]$.....(D)
$D_3 = ¾[n + 1]$.....(E)
Where
h_1 is the corresponding value of D_1
h_2 is the corresponding value of D_3
n is the total number of observations under consideration in equation (B)
D_1 and D_3 are within the matrix of equation (B)
Rules for D_1 and D_3 are as follows [xii, vi]:

- If D_1 or D_3 is an integer, the numerical observation or item corresponding to the position of that integer in the matrix of equation (B) is chosen for either D_1 or D_3.
- If D_1 or D_3 is halfway between two integers, the average of the corresponding items or observations is chosen.
- If D_1 or D_3 is not an integer or halfway between two integers; then the resulting value should be approximated to the nearest integer, and the corresponding item or observation is chosen.

This threshold value defines the demarcation line between major factors and the minor factors (see Tables 7). Using Table 7 for example:
$D_1 = ¼ (17 + 1) = 4.5$ and $D_3 = ¾ (17 + 1) = 13.5$
N.B. D_1 and D_3 are halfway between two integers.
Therefore, using the second itemized rule for D_1 or D_3 above: $D_1 = 4.5$ and $D_3 = 13.5$.
Average of corresponding items to D_1 in Table 7 = $h_1 = ½ (22.52 + 19.73) = 21$ and
$D_3 = h_2 = ½ (9.1 + 7.34) = 8$.
Threshold value = $½ [h_1 + h_2] = ½ [21 + 8] = 14.5$
Thus, the demarcation line is between the magnitudes P (8) = 17.21 and P (9) = 9.71 (see Tables 7).

RESULTS

Table 3. Ranked Frequency Positions of External Variable Factors influencing Labor Productivity

Variable Factors	**Ranked Positions Frequencies of Variable Factors**																	**Severity Index**
f (j)	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)	P(11)	P(12)	P(13)	P(14)	P(15)	P(16)	P(17)	**S.I.**
f1	1	0	0	0	0	0	0	0	0	2	0	1	0	1	2	5	16	1
f2	0	1	0	0	0	0	0	0	0	0	3	1	1	1	7	11	3	0.94
f3	0	0	1	0	0	0	0	0	0	2	2	2	2	6	9	2	2	0.88
f4	0	2	0	1	0	1	6	13	4	0	0	0	0	1	0	0	0	0.82
f5	2	0	1	0	1	0	6	5	12	0	0	1	0	0	0	0	0	0.77
f6	0	1	0	0	0	1	0	0	0	2	4	2	8	6	2	1	1	0.71
f7	0	0	0	0	0	0	1	0	0	3	4	4	8	6	0	2	0	0.65
f8	18	2	1	3	1	0	0	2	1	0	0	0	0	0	0	0	0	0.59
f9	1	0	0	0	0	0	0	0	1	4	1	11	3	1	4	1	1	0.53
f10	0	0	2	0	2	2	10	4	7	1	0	0	0	0	0	0	0	0.47
f11	1	14	4	3	1	0	1	1	0	2	1	0	0	0	0	0	0	0.41
f12	0	6	16	1	0	2	1	0	1	0	0	1	0	0	0	0	0	0.35
f13	0	0	0	0	0	0	0	0	0	6	7	2	4	4	1	3	1	0.29
f14	0	0	0	0	0	2	0	1	0	5	6	3	2	2	2	2	3	0.24
f15	0	0	1	3	6	13	1	2	1	0	0	0	0	0	1	0	0	0.18
f16	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	17	9	0.12
f17	4	1	1	13	6	1	1	0	0	0	0	0	0	0	0	0	1	0.06

$$\begin{bmatrix} f(1) \\ . \\ . \\ f(n) \end{bmatrix} = \begin{bmatrix} \mu_{11} & . & . & \mu_{1n} \\ . & . & . & . \\ . & . & . & . \\ \mu_{n1} & . & . & \mu_{nn} \end{bmatrix} \begin{bmatrix} \sigma_{1/n} \\ . \\ . \\ \sigma_{n/n} \end{bmatrix} .....(SIMO)$$

Table 4. Result from Severity Index in Matrice Order (SIMO)

$f(1)$		1	0	0	0	0	0	0	0	0	2	0	1	0	1	2	5	16	1	4.45
$f(2)$		0	1	0	0	0	0	0	0	0	0	3	1	1	1	7	11	3	0.94	5.81
$f(3)$		0	0	1	0	0	0	0	0	0	2	2	2	2	6	9	2	2	0.88	7.34
$f(4)$		0	2	0	1	0	1	6	13	4	0	0	0	0	1	0	0	0	0.82	17.34
$f(5)$		2	0	1	0	1	0	6	5	12	0	0	1	0	0	0	0	0	0.77	17.21
$f(6)$		0	1	0	0	0	1	0	0	0	2	4	2	8	6	2	1	1	0.71	9.23
$f(7)$		)	0	0	0	0	0	1	0	0	3	4	4	8	6	0	2	0	0.65	9.1
$f(8)$		18	2	1	3	1	0	0	2	1	0	0	0	0	0	0	0	0	0.59	25.7
$f(9)$	=	1	0	0	0	0	0	0	0	1	4	1	11	3	1	4	1	1	0.53	9.68
$f(10)$		0	0	2	0	2	2	10	4	7	1	0	0	0	0	0	0	0	0.47	17.76
$f(11)$		1	14	4	3	1	0	1	1	0	2	1	0	0	0	0	0	0	0.41	23.5
$f(12)$		0	6	16	1	0	2	1	0	1	0	0	1	0	0	0	0	0	0.35	23.49
$f(13)$		0	0	0	0	0	0	0	0	0	6	7	2	4	4	1	3	1	0.29	9.11
$f(14)$		0	0	0	0	0	2	0	1	0	5	6	3	2	2	2	2	3	0.24	9.71
$f(15)$		0	0	1	3	6	13	1	2	1	0	0	0	0	0	1	0	0	0.18	19.73
$f(16)$		1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	17	9	0.12	4.05
$f(17)$		4	1	1	13	6	1	1	0	0	0	0	0	0	0	0	0	1	0.06	22.52

Table 5. Results arranged in descending order of magnitude

$P(1)$	$F(8)$	25.7
$P(2)$	$F(11)$	23.5
$P(3)$	$F(12)$	23.49
$P(4)$	$F(17)$	22.52
$P(5)$	$F(15)$	19.73
$P(6)$	$F(10)$	17.76
$P(7)$	$F(4)$	17.34
$P(8)$	$F(5)$	17.21
$P(9)$	$F(14)$	9.71
$P(10)$	$F(9)$	9.68
$P(11)$	$F(6)$	9.23
$P(12)$	$F(13)$	9.11
$P(13)$	$F(7)$	9.1
$P(14)$	$F(3)$	7.34
$P(15)$	$F(2)$	5.81
$P(16)$	$F(1)$	4.45
$P(17)$	$F(16)$	4.05

Table 6. Severity Index Results and Demarcation Line

$P(1)$	$F(8)$	*Enabling technology and logistics*	25.7
$P(2)$	$F(11)$	*Procurement of material & Equipments*	23.5
$P(3)$	$F(12)$	*Adequate technical skills and services*	23.49
$P(4)$	$F(17)$	*Financial crisis*	22.52
$P(5)$	$F(15)$	*Health and safety regulations*	19.73
$P(6)$	$F(10)$	*Environmental factors (climate, Weather conditions)*	17.76
$P(7)$	$F(4)$	*Public sector's impact*	17.34
$P(8)$	$F(5)$	*Stakeholders' impact*	17.21
$\rightarrow\rightarrow$	$\rightarrow\rightarrow$	$\rightarrow\rightarrow\rightarrow$ Demacation Line $\rightarrow\rightarrow\rightarrow$	$\rightarrow\rightarrow\rightarrow$
$P(9)$	$F(14)$	*Site logistics (accommodation, transportation, site distance)*	9.71
$P(10)$	$F(9)$	*Work variations*	9.68
$P(11)$	$F(6)$	*Urgent situation work in construction*	9.23
$P(12)$	$F(13)$	*Organization structure*	9.11
$P(13)$	$F(7)$	*Site and construction constraints*	9.1
$P(14)$	$F(3)$	*Inadequate planning*	7.34
$P(15)$	$F(2)$	*Ambiguity (lack of clarity) of work*	5.81
$P(16)$	$F(1)$	*Lack of Information*	4.45
$P(17)$	$F(16)$	*Nationality and immigration*	4.05

Table 7 Major Factors in descending order influencing Labor Productivity in UAE

$$\begin{bmatrix} F(8) \\ F(11) \\ F(12) \\ F(17) \\ F(15) \\ F(10) \\ F(4) \\ F(5) \end{bmatrix} = \begin{bmatrix} Enabling\ technology\ and\ logistics \\ Procurement\ of\ material\ \&\ Equipments \\ Adequate\ technical\ skills\ and\ services \\ Financial\ crisis \\ Health\ and\ safety\ regulations \\ Environmental\ factors\ (climate,\ Weather\ conditions) \\ Public\ sector's\ impact \\ Stakeholders'\ impact \end{bmatrix}$$

DISCUSSION

Enabling technology and logistics were identified by respondents in this research as the most severe factor impacting on Labor productivity in UAE construction projects. It is obvious that to keep up the pace of development in comparison to other sectors there are needs for greater awareness and appreciation of contemporary technologies and advances in logistical techniques. While the UAE construction industry may seem to be typically aware of relevant technologies and logistics, there is no evidence to suggest that they are well appreciated or integrated into mainstream construction projects. This inadequacy in the UAE is gravely impacting on labor productivity in construction, particularly in areas of efficiency and effective delivery of projects. At the moment, in the UAE construction industry, there is an unprecedented level of unskilled labor from the Indian subcontinent (the southern region of Asia). This is despite there being enormous resources at the disposal of the country for the acquisition of the best technology and logistics. Poor logistics (equipment, materials, and tools) management logically results in project delays and cost escalations. This is because equipment, materials and tools account for over three quarter of the average construction project budget[13,14]. So it isn't surprising that project delays and cost escalations are common occurrences in most UAE construction projects and this suggests poor logistics management and ineffective delivery processes. Again, one can argue that the country's construction labor productivity is low and uncompetitive despite huge investment in the construction sector. If Labor productivity is considered as being the rate of GDP on the numbers of hours worked, any reduction in the number of hours worked without changes in total output would imply an improvement in labor productivity. But this can only be possible when there are enabling technologies and efficient logistical systems to compensate the shortfall in human working hours. A shortfall in working hours could be due to job cuts, which is certainly not the case in the UAE construction sector due to the regular influx of cheap, low-skilled migrant workers from India, Pakistan, Nepal, Bangladesh, etc. In fact, the numbers of working hours in the construction industry is increasing by the day resulting in low productivity in the UAE.

Procurement of materials and equipment was rated second amongst major factors impacting on construction labor productivity in the UAE. Procurement is the process of acquiring goods, works and services necessary for carrying out a project, excluding consultancy services[15]. Works in context refers to the acquisition and installation of equipment and materials but it also encompasses all construction, reconstruction, demolition, repair or renovation of structures, site preparation, excavation, erection, building, decoration and finishing, as well as services incidental to construction such as drilling, mapping, satellite photography, seismic investigations and similar services provided pursuant to the procurement contract. Investment in equipment (machinery) and materials formed an indispensable

part of the previous factor (enabling technology and logistics) identified as the most important factor in this study and discussed in the preceding paragraph. Without procuring or acquiring the right facilities and materials, the aspiration for advanced technological and logistical frameworks is futile. This is particularly true since application and dispersal of the latest state-of-the-art construction technologies and logistics obviously boost labor productivity. This is very evident in countries where higher equipment and material investments impact on labor productivity and generate higher productivity growth rates. If a comparison was to be made with countries like the USA, Japan, United Kingdom, Turkey and even Saudi Arabia for instance, the UAE investments on equipment (heavy construction machinery) and materials as a percentage of Gross Domestic Product (GDP) will be lower and ineffective in terms of competitiveness and growth in the construction sector.

Adequate technical skills and services were the third major factor identified by respondents in order of severity impacting on UAE construction labor productivity. This factor is synonymously related to both factors previously discussed above and presented in order of severity, which was: "enabling technology and logistics"; "procurement of materials and equipment". Enabling technology and logistics requires the right frameworks, materials, state of the art equipment (machinery), and much evolved technically-skilled workforce for application and sustainability purposes. At the moment, foreigners comprise about 99 percent of the private sector workforce in the UAE[16]. However, most of these jobs, especially those in the construction industry are very low-skilled and often characterised by poor remuneration and working conditions. This is perhaps not surprising because the *'Emiratis'* (nationals) are naturally very proud people and show a reluctance to take up low-skilled or basic labor intensive jobs. The consequent low-skilled labor influx, also the major result of immigration policies designed to compensate for the shortfall created by the prevailing social attitude, has severely impacted on the country's labor productivity. This is true because it has become much cheaper and attractive in the UAE to employ, acquire or secure a foreign workforce than devoting resources to capital intensive equipment/facilities and logistics that could improve construction labor productivity. Even the global financial crisis has not helped matters; the immigration of low-skilled labor is still ongoing.

The global financial crisis was the fourth most significant factor revealed in this investigation which impacted on construction labor productivity in the UAE. As stated previously, labor productivity is a function of Gross Domestic Product (GDP) and productive hours of work. Therefore what affects GDP significantly affects labor productivity. Further, the apprehensions of the global economic downturn (like the financial crisis), slow down businesses and potentially reduce the market value of goods and services. This directly impacts on construction and its labor productivity. For instance, the emirates of Dubai in the UAE is currently witnessing a slowdown in economic growth and plummeting asset prices which has been further exacerbated by GCC countries declining oil prices and demand. The UAE is worst hit amongst the GCC countries during this crisis given its close links with global equity and credit markets[17].

The declining value of assets and oil prices and a decline in demand for both, reduced assets' marketability (liquidity) conditions and reduced investors' confidence. Global liquidity shortages caused in part by Lehman's collapse in September 2008 further intensified the GCC financial sector imbalances. This situation severely impacted on Dubai in particular and the UAE construction industry in general.

The fifth most significant factor identified in this study that influenced labor productivity was health and safety regulations. Productive hours can be seriously reduced if a workforce is unsure about health and safety issues. When accidents occur on site due to poor adherence to health and safety, time is wasted both on site and in the time taken for staff to return to work after any injury. In the absence of

enabling technology and advance logistical frameworks, the amount of real GDP will greatly depend on manual working hours. So to some extent, poor adherence to health and safety could impact on a country's labor productivity. In the emirates of Dubai, for instance, there is evidence to suggest that some construction companies do not adequately adhere to health and safety regulations notwithstanding the cosmetic prevalence of 'safety first' signage, especially at the entrance to construction sites. The laborers themselves are often complicit with this practice in their desperation to find work and do not prioritise their health and safety. This is clear anecdotal evidence of the degree of poverty in some countries within the Indian subcontinent and how the quest for survival potentially overrides rationality. The desperation reaches such levels that some of these laborers are prepared to work as usual even in adverse climatic and weather conditions.

The climatic and weather conditions factor is sixth in the hierarchy of severity identified by respondents amongst factors that influence labor productivity. Extreme weather conditions during the months of July and August in the UAE mean the maximum temperature sometimes reaches 50 degrees Celsius; this is without considering the high humidity levels in these areas. Under such conditions, productive hours are significantly reduced which directly impacts on GDP.

Another factor which impacts on UAE labor productivity is the public sector. In any country, the public sector takes responsibility for the provision of goods/facilities and services, regulations, enactment of statutory regulations, monitoring and enforcements. No doubt these responsibilities make it the most important stakeholder in any country. But it sets the benchmark for other sectors to follow. Except for climatic and weather conditions, the public sector directly influences all the other factors discussed above. Its influence significantly affects the working environment; which in turn impacts on the country's labor productivity

RECOMMENDATION

This paper recommends that an appropriate regulatory framework which encourages collaborative partnerships amongst construction firms be established. This is to create circumstances in which it would be advantageous for large construction firms to merge, pooling their resources to execute large projects within and outside the country. The right financial incentives and support packages should be provided by the government to encourage such mergers given their potential benefit to the economy by way of job creation and its direct impact on GDP. These firms are also to be encouraged to efficiently compete with other firms both within the UAE and with developed and developing nations. This is very important given the fact that landmark projects, and the multinational construction firms able to build them, are no longer the exclusive preserve of developed countries. As an example, in the latest ranking of the world's biggest contractors, a developing country like Turkey now accounts for about 33 out of 225 of the biggest global construction firms; next to China, which has approximately 52 such firms[18]. Surprisingly, only 26 of these firms originated from the US (the world's economic and military superpower). This was unheard of two decades ago; a clear indication that developed countries are now losing their dominant grip on the global construction market. Thanks to the favourable conditions in Turkey, the country's construction and building materials manufacturing firms now rank amongst the best in the world, and Turkey's GDP has witnessed greater growth than most developed and developing countries between 1980 and 2012; all attributable to the growth of its construction sector. The Turkish model incentivises, empowers and encourages the private sector; where resources are pulled together for the benefit of all.

Another recommended area of policy development in the UAE is in its greater understanding of - and participation in - the global competitive market, where an equal playing field exists, usually without heavy bias. While adhering to the spirit of collaboration, promoting activity in a healthy international

competitive environment could encourage better, more competitive practices within local, large construction firms in the UAE.
Furthermore, the UAE government could enforce a compulsory, structured human resource development program to boost its current skills gap in construction and other relevant sectors.

CONCLUSION

The success of Turkey's construction industry can also be replicated in the UAE construction industry if enough public-sector support is provided. All the factors identified in this study directly or indirectly depend on the government / public sector. An appropriate regulatory framework to incentivize and promote collaborative partnerships can only be possible and enforced through the backing of the government. Thus, the authors are of the view that the financial investments and size of the UAE construction industry is enormous and deserves to be properly regulated and supported to enhance its labor productivity. With improvements in labor productivity in the construction industry, construction projects are more likely to be completed successfully on time, to budget and the required quality standards. This, in turn, would provide a great boost to confidence in the economy and international competitiveness.[19]

ACKNOWLEDGEMENTS

My sincere gratitude also goes to our great friend and associate Tim Parker, British Broadcasting Service (BBC) who selflessly undertook the task of proofreading this manuscript.

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