The Propriety and Limitations of Relying on Artificial Intelligence And Digitalization in the Field of Quantity Surveying, Sri Lanka

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Abstract -. *This specific study is carried out to determine to which extends the Artificial Intelligence can intervene within the field of Quantity Surveying and the tasks accommodated with the field within the Sri Lankan context. The Objectives of this research is to identify the tasks and duties that a conventional Quantity Surveyor may perform which are most critical and vulnerable towards being artificial intelligence based in the future. These identified tasks and duties will be then directed towards a population of Quantity Surveyors and related professionals to gain their understanding on this matter in both qualitative and quantitative manners.The interviews were put through content analysis process and the gathered Quantitative data were analyzed through Likert scale. The questionnaires were incorporating with RII analysis. The conclusions further denoted that most of the Quantity Surveying related tasks and duties were compatible to be associated with Artificial Intelligence and digitalized means which could lessen the actual Quantity Surveying personnel involvement in the future. The most conventional and essential Quantity Surveying practices were at the most risk of being replaced by AI systems such as Estimating practices, Cashflow, labour and material management to name a few. The analysis also proved to show which are the most vulnerable Quantity Surveying duties they could be. Given the proprietary of these each duty to be incorporated with Artificial Intelligence or not, the limits they could be associated with and the reasons why are lastly presented as in recommendations and implications which denoted that it is more probable for Quantity Surveyors to incorporate the AI systems rather than having to face the risk of become replaced by the systems themselves..*

Keywords— **Quantity Surveyor, Artificial Intelligence, Propriety, Limitations, Digitalization.**

I. INTRODUCTION

Artificial Intelligence and Digitalization has spread over almost every field and industry throughout the past few decades. What began spreading through more information technology-based industries and fields, the introduction of technologies like automation proved that the spread of Artificial Intelligence and Digitalization is going to become something inevitable throughout every industry imaginable. The past decade demonstrated that the construction field did shift towards digitalization even though it is among the industries which are least digitalized in the 21st century. From the year 2020 and onwards, more research studies have been carried out in figuring out the correlation between job displacement and the implementation of Artificial Intelligence in several different industries (Omotayo, Tan and Ekundayo, 2023). The construction industry being slowly digitalized, and artificial intelligence based, there is a high probability of complete or partial displacement in several professions or profession related duties at least. This could mean to be both good and bad depending on the point of view. It is apparent that the incorporation of machines in construction could mean delivering much more effective and fast delivery of a project. The contracting parties are more likely to benefit from this phenomenon. But for the Professionals involved this could be a bad thing, since there is no reason not to incorporate machines and technology instead of humans when it is more appealing towards the contractors. But there are several different tasks that might need more of a creative and a rational thinking process which machines and Artificial Intelligence would not be able to achieve, or at least in the few decades to come. So, we must establish boundaries within digitalization and the incorporating Artificial Intelligence in Construction. (Ade-Ojo, 2023)Quantity Surveying is such a vital profession in the Construction industry since they are vested with the responsibility of handling financial matters throughout the

whole construction process, from Preconstruction to Post construction. The digitalization of the Quantity Surveying could be rooted back to the 1980's where the rise of Building Information Modelling has been incorporated. These new innovations within Construction whether it was related to Quantity Surveying profession or not, has only been incorporated more and more as the years passed to a point where the machine has seen advancements even enough to rival the human capabilities (Seidu et al.,2022). In the current day and age, advancements in Artificial Intelligence such as the infamous ChatGPT for an example, has already proved to be proposing a threat to professionals in the IT industry with the risk of job replacement where anyone can request to code from an Artificial Intelligence based system rather than relying on humans (Akinshipe et al., 2021). In a similar context, this research is based upon which aspects of the Quantity Surveying could be automated without the need of humans, which cannot be done without humans themselves (limitations) and the question at hand, should we rely on machines over humans in the field of Quantity Surveying?. In order to tackle these questions this research study will first identify which are the most susceptible Quantity Surveying practices towards the risk of being replaced and would be ranked according to their vulnerability towards the replacement itself. After ranking the causes, they shall be further discussed in order to debate their propriety and limitations with several industry experts.

II. Literature survey

A. Artificial Intelligence and Digitalization and origins
Throughout the world history 3 total number of industrial revolutions has taken place. One thing incommon or the main driving factor behind every and each one of these industrial revolutions were to make tasks more efficient and easier. Subsequently, through the years 1765, 1870 and 1969 humans have experienced these phenomenons (Haupt and Naidoo, 2016). The fourth industrial revolution is something that is currently taking place unbeknown to many people. The fourth industrial revolution started taking place with the introduction of the computer allowing professionals in almost every industry to work with more ease and in an efficient manner (Sharifi, Ahmadi and Ala, no date) In current world, it is apparent that the Artificial Intelligence or the (AI) and the rapid digitalazation of sectors is something that has become very apparent even to a degree where several profesions already have or are at the risk of job replacement with the machines and technology instead of relying on the humans (Theben and Gunderson, no date) In the early 2020's the Artificial Intelligence took the world by storm with systems like ChatGPT, DALL-E, Stable Diffusion ETC. (Seidu, Young and Adamu, no date) The digitalization and the use of Artificial Intelligence has not only been incorporated with the pysicial aspects of industries but with the decision making as

well(Weerasooriya et al., 2021).

B. Limitaitions and the propriety in incorporating AI in Construction
In the past few decades the human mind's rational thinking process and decision making abilities could not be mimicked by machines to a degree where it became appropriate to implement within such industries (Musa, Oyebisi and Babalola, 2010). According to Drew Smith, vice-president of Global Data and Analytics of Little Caesars Enterprises, Inc. and Ilitch Companies, it was expected in the past that the Artificial Intelligence would show business leaders how the deceisions made by the Artificial Intelligence systems would proved to be wrong over human intelligence. But within a decade the rapid development and improeevements in the Artificial Intelligence proved this very statement wrong (Grace Chang, Founder and CEO of Kintsugi). Another important factor in determining the Limitations and Propriety in different industries would be the industries themselves (Llale, no date). The construction industry has always been among the industries which incorporated with modern technology. (Ekanayake et al., 2022). Within the construction industry, Quantity Surveying plays a prominent role which includes a wide area of expertise and duties(Olanrewaju and Anahve, 2015a). Over the past decade the utilization of computer softwares has proved to make the Quantity surveyor's work more effective and accurate (Ebenezer Olowolayemo et al., 2022). But the computer based systems has advanced to such a degree that the human intervention in the duties themselves are getting less and less as the years pass by (Seidu, Young and Adamu, no date; Musa, Oyebisi and Babalola, 2010). To predict the future and the very nature of limitations and propriety in incorporating with the Artificial Intelligence the most effective method to be counselled by the industry experts themselves.

C. Quantity Surveying and Artificial Intelligence
Quantity Surveying as a profession is known to many in many different ways be it the Construction cost manager, Cost engineer, Commercial manager etc. The main and utmost responsibility in this profession lies within the management of the finance and the contractual relationships between the parties throughout the Project Inception to Hnadover (Nwazodoni and Adekunle, 2022). But according to the Pathway guide Quantity Surveying and Construction – RICS (2018), Quantity Surveying practices do not solely revolve around a specific area, Quantity surveyors are such professionals who could perform in a vast array of fields such as Law, Valuations, Project Management, Accounting principles and procedures, Business Planning, Conflict avoidance, Management and Dispute resolution procedures to name a few. But regardless of the vastness of field of expertise, most Quantity Surveyors do practice their professions under the conventional path within a Construction Project (Ayarkwa et al., 2020) From paper based systems to

Electrnoic means and Information Technology and the recent 5D BIM phenomenon is as far as the Sri Lankan construction sector has evolved through the time (Adesi et al., 2018). But it has become evident that the decision making and coordination inconstruction sector has been more productive with the implimantation of Artificial Intelligence in several countries. The Quantity Surveyor plays a major role in management of the Project Time, Cost and Quality to a greater degree. the compatibility in relying on Artificial Intelligence to perform Quantty Surveying tasks depends on the duties and their nature(Akinshipe, Ikuabe and Aigbavboa, 2022). The following suggests more common and susceptible duties that might someday fall in the hands of machines and technology. These Quantity Surveying related duties were established by the majority of the literature reviewed and several specific research articles those were intentionally employed to determine the duties themselves (Mbachu, no date; Olanrewaju and Anahve, 2015a, 2015b, 2015c; Yo Wanda and Haupt, 2016; Nur Aishah Mohd Noor, Uzairiah Mohd Tobi and Radin Salim, 2020; Zainordin et al., 2020; Ebenezer Olowolayemo et al., 2022). And with the expertise of the industry experts within the Sri Lankan construction Industry as well.

The Considered Quantity Surveying practices are as follows,

1.Liasing with client needs

2.Cashflow management

3.Tender and Contract documentation

4.Estimating practices

5.Identifying and remedying Financial risks

6.Complying with legal requirements

7.Valuation of works carried out

8.Management of Labor and material

9.Subcontractor management

10.Complying with other professions within a project

III. METHODOLOGY

The tasks and duties connected to the narrowed-down profession of quantity surveying from the literature review are analyzed in the Sri Lankan setting in the methodology, thus achieving the three main goals of this research. In this section, the approach for doing research to produce the desired results is further explored. This includes picking a population for data collection, selecting sample methodologies, and developing the study philosophy. The selected Quantity Surveying related duties from The literature review would then be quantified using the Likert scale in order to satisfy the requirements of the quantitative analysis that would be performed using the RII approach.

A. Data Collection Methods

Semi-structured interviews and a questionnaire survey were used to gather the primary data for the succeeding research. To establish the Quantity Surveying duties which were susceptible towards the risk of being replaced by AI systems, a thorough Literuture survey was conducted. While the interviews were conducted both face-to-face and over the phone and the questionnaires were distributed both electronically and physically.

Eight (8) interveiwees participated in the interviewing sessions after being chosen through expert sampling. A total of 41 respondents from various professions, with quantity surveying being the primary one, answered the questionnaires.

After the Questionnaire was finished, this was the primary approach used to collect data in order to meet the Objective #2. Semi-structured interviews were chosen since the information needed to be acquired did pertain to a certain area of competence, and the questions could be prepared to ensure that. The open-ended nature of the inquiries made it possible to learn a lot about the subject from the contractor's perspective.

B. Data Analysis Methods

1. Relative Importance Index (RII)

By using the RII, it was possible to rank the selected Quantity Surveying duties in order and determine which duties were most susceptible to digitalization and Artificial Intelligence influences. The Primary data is calculated by RII with an output ranging from 0 to 1 The greater RII score implied a significantly vulnarable duty towards digitalization and Artificial Intelligence systems comparison to other causes.

$$RII = \frac{\sum W}{AN} = \frac{5_{n5} + 4_{n4} + 3_{n3} + 2_{n2} + 1_{n1}}{5n}$$

Equation 01: RII Value

Source: (Shahsavand et al., 2018)

Were,

W = Weightage given by the respondents

A = Highest weight (5 in this study)

n = Total no of respondents

IV. DATA ANALYSIS

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The main focus of this section is on 10 tasks related to Quantity Surveying that could eventually be automated or dependent on artificial intelligence systems. These ten Quantity Surveying responsibilities will be examined using the RII (Relative Importance Index) method. The data analysis techniques outlined in The methodology will be used with incorporating the raw data acquired through questionnaires and interviews with construction industry related professionals. Semi-structured interviews and Likert-scaled questionnaires were used to obtain the data.

A. Respondent's profile

The Following Table represents the Interviewee's Profile along with their respective Profession, the number of Interviwees and their years of experience in the industry

Table 1- Interviewee's profile

Profession	No of Interviewees (Nos)	Industrial Experience (Years)
Charted Quantity Surveyor	2	15+
Quantity Surveyor	3	10-15
Project Manager	1	15+
Senior Software Engineer	2	10-15

I. Designation:

40 responses

II. Years of experience

74 responses

B. Ranking according to RII values

Table 2- RII Values

| QUESTIONNAIRE			
#Ref	Quantity Surveying Duty	RII value	Rank
QSD1	Liasing with client needs	0.624390244	7
QSD2	Cashflow management	0.741463415	2
QSD3	Tender and Contract documentation	0.624390244	7
QSD4	Estimating practices	0.746341463	1
QSD5	Identifying and remedying Financial risks	0.614634146	8
QSD6	Complying with legal requirements	0.629268293	6
QSD7	Valuation of works carried out	0.585365854	9
QSD8	Management of Labor and material	0.726829268	3
QSD9	Subcontractor management	0.63902439	5
QSD10	Complying with other professions within a project	0.687804878	4

With the data analyzed which were gathered through the questionnaire, it became clear that most of the time all RII higher-ranked Quantity Surveying related duties were almost related to the core responsibilities that comes with the profession itself. All the Quantity Surveying duties proposed did not indicate a much of a difference in the RII values which did suggest that it is most professional's idea that to a some degree Artificial Intelligence could replace almost everything a human is capble of. But this however might strongly depend on how each individual might foresee the future and what future itself might mean to them personally. So the information gathered through the processed data here proposes a high influence on the idea itself what Quantity Surveying and Artificial Intelligence and Automation based on a collective biased perspective of the population.

DISCUSSION

This specific research was conducted through semi structured interviewing sessions to acquire the industry expert's knowledge and creative ideas to back up this study. Since AI is still a novelty in the Sri Lankan construction industry, two Senior Software Engineers were also incorporated in interviewing sessions. Since most of the construction industry professionals were not that familiar with the voncept of the Artificial Intelligence systems, a few number of the interviewees had polar opposite ideas to when it came to the majority. Since this reason, the "recommendations and implications" section was conducted through considering the average and most well rounded opinions on the subject matter.
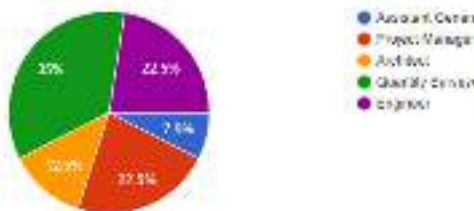
V. CONCLUSION

The research results obtained from the previous section in accordance with the methodology are summarized in this section. An overall conclusion, recommendations on the topic, implications, and ideas for conducting additional research for future studies will be presented using the information obtained from data analysis. Brief examples of how the main goals of this study were met are provided below.

Objective 1: To Identify basic Quantity Surveying Duties and establish them as the base of the Research study

Achieved by, Referring more than 20 Research articles, Interviews and articles published by authorized Quantity Surveying bodies

Objective 2: To rank them in a way that would propose each QS dutiy's, exposure towards being automated in the future

Achieved by, a Likert scaled Questionnaire and incorporating the values through RII data analysis method with MS Excel software package

Objective 3: To Identify the Propriety and limitations in incorporating the Quantity Surveying duties with Artificial Intelligence

Achieved by, conducting Semi Structured Interviewing sessions for 8 industry professionals for further analysis.

RECOMMENDATIONS AND IMPLICATIONS

The implementation and usage of Artificial Intelligence has not been always a new thing in many industries. According to the ideas of professionals and the advancement of Artificial Intelligence, it is getting better at itself a little by little over the past few deacdes.

Judging by the RII values, it seems to be that the automation of all of the duties of a Quantity Surveyor are justified in their own ways. Certain duties tend to propose more appropriate to be incorporated with Artificial Intelligence than others. For an example, QSD5, Identifying and remedying Financial risks is raked lower than others since to be able to foresee future and think in a logical manner would be quite hard for a computer based system with the state they are in now. But QSD2, Cashflow Management suggests that duties like these, or at least managing and keeping track of the cash that has already been spent or received could definitely be a duty that a computer based system could handle.

Furthermore, certain Quantity Surveying duties requires relying on the human instincts rather than following the theory even if it may seem wrong theoratically. A computer based system to have the equivalent of a human thinking capacity in a profession based manner is highly complicated matter to consider as in the year 2023. Still QSD10's comparatively higher RII might have suggested that through various platforms might make it easier to work with other professions within a project who are humans, a system itself cannot be bargained or negotiated in a similar manner and still at the end. Even though AI could take over the job itself (which is very unlikely) , it is most proffessional's idea that a human interaction is still indeed to certify and take responsibilities.

It was most professional's view that the Artificial Intelligence could not be a bad thing after all since there is a very low possibility of relying solely on a computer based system when it comes to the professions like Quantity Surveying. There are already professions such as Doctors that would basically prescribe something upon the data gathered by the patients but that does not mean these professions are under the risk of job replacement anytime soon or even not at all. According to the majority, the implementation of Artificial Intelligence could only mean that the duties associated with Quantity Surveying might become easier and more effective in the future but not be replaced by Artificial Intelligence based systems entirely.

LIMITATIONS AND FUTURE WORK

The Limitations of conducting a research on this specific content were plenty. The major issue that had to be dealt with was to find the relevant research articles that had the subject matter of Quantity Surveying and Artificial Intelligence that were merged together. However, there were a very little number of research articles which were published within the Sri Lankan context that proved to be a foundation to the literature reviewed. In recommendations and Implications, several professionals had different perspectives on the subject matter since the Artificial Intelligence were still a novelty to most of them. Considering the research conducted with these limitations, future research studies could be conducted with the actual statistics of job or profession related replacements in the industry in the near future since the AI has already begun to either replace or help the Quantity Surveying practices in Sri Lanka.

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ABBREVIATIONS AND SPECIFIC SYMBOLS

AI-Artificial Intelligence
QS- Quantity Surveyor
RICS- Royal Institution of Chartered Surveyors
RII- Relative Importance Index

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