

A Survey of Skill Level of Architects in ICT in Various Professional Jobs: A Case Study in Manado, Indonesia

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Abstract: In the era of the industrial revolution, 4.0 practitioner in architecture should have enough skill in the practice of ICT, including mastering various types of software that commonly used in their professional work. Softwares for practice in the field of architecture are not only for art and building design purposes but also as an analytical tool in order to guarantee the quality of the architectural philosophical, plan and its construction. The software is also for designing an acoustic room, lighting, structure, mechanical and electrical of buildings. The objective of this study is to describe the level of skill in ICT practice of architects. The methodology used is descriptive qualitative. Perceptive questionnaires were distributed to as many as 100 architects as respondents. The questionnaire contained questions about the level of skill in operating various software. The architects as respondents are expected to be able to assess the ability of themselves at what level in terms of mastery of various computer programs which are commonly used in architectural projects or urban planning. The results show that in general the architects in Manado city were quite right in recognising some software. Even among the software, they claim very well in operating it.

1 INTRODUCTION

In the current 4.0 industrial revolution, the development of information and communication technology is very rapid. We are all expected to master and be able to practice information and communication equipment well. The development of architecture and urban planning is inseparable from the role of informatics experts who have developed various creativities in information and communication technology. Various computer software has been developed to improve the quality of planning, calculation, design and construction industry as well. Many governmental organisations have endeavoured to develop a roadmap for the specific purpose of research and development of information technology for the construction industry (Hosseini et al., 2012). Building Information Modeling (BIM), Augmented Reality (AR), Rapid Prototyping (RP) and Virtual Reality (VR) are some of the new technologies that can actively contribute to the construction industry (Leal et al., 2018).

Architects, in general, are artists with additional expertise in construction and planning. Architecture education combines the fields of art, social and engineering. The facts show that innovation in

information and communication technology also plays a vital role in the development of the arts and social fields, in addition to engineering. Therefore, architects must adapt to sophisticated technology and keep following the developments in the field of information technology, so as not to miss information on the development of current informatics architectural practices. The jobs of architects may cover various branches of built environment field. Some of them focused on being a professional practitioner in building design, urban planning, landscape designer, interior designer, construction industry and supervisors of construction. Besides, some are interested in education, research or bureaucracy. Almost all kinds of work done by architects require good skill in information and communication technology. The application of information technology in the architectural field, among others, is the use of various software as a tool for design aid. Computer programs are needed in solving various problems of design or planning process rapidly and precisely. The use of software in the area of architecture has long been developing for decades ago. It has proven to have shown many advantages over conventional methods (manual or traditional drawing practices), including among

others: drawing-precision, animation, budget calculation, calculation of construction-duration, and for compiling building technical data. Computer programs that are generally used in the professional practice of architects, in general, can be divided into three parts from the viewpoint of its purposes:

- 1) General and office purposes: Word processing, Spread-sheet, Report-presentation
- 2) Art, design developments & technical drawing: CAD (Computer-Aided Design), Animation, Moviemaker
- 3) Scientific & Engineering design aid: Structure, Acoustic, Thermal, Lighting, GIS (Geographical Information System)

The level of skill in mastering information technology then becomes a measure of the success of someone in his work environment (Lopez-Bassols, 2020). From an employability perspective, having ICT skills could be seen as a necessary quality in the labour market (De Hoyos et al., 2013). Likewise, architects who have the ability to operate various computer programs will be beneficiary, because they can use it as a tool to produce outputs and designs with better quality and relatively faster (Amir, 2011).

Manado is the capital of the province of North Sulawesi in Indonesia. The city, which has a population of around 400 thousand people, is currently growing, where construction of buildings and city infrastructures are ongoing. In this city, there are more than 500 hundreds of architects who work in various tasks of the architectural job. Architecture education has been carried out at universities of the city for about 30 years. To control and accelerate city development, we need a thoughtful and appropriate planning and design strategy. The use of computer programs is one of the mechanical parts of the planning and design strategy. The process or scheme direction that takes place in urban architectural planning and design requires drafters, technicians, and experts who mastery in information technology or can operate computer programs with reasonable skills. Professionalism in the field of architecture has changed where the use of computer programs has become a design tool that is commonly used. Many people also know that by operating a computer program, it can print pictures of buildings that are also beautiful, precise and attractive. Through this paper, we describe the level of competences of architects in the city of Manado about their skills in operating various computer programs.

2 METHODOLOGY

The methodology used in this study is descriptive qualitative by distributing perceptive questionnaires to as many as 100 architects who were respondents. The questionnaire contained questions about the level of skill in operating various software. The architects as respondents are expected to be able to assess the ability of themselves at what level in terms of mastery of various computer programs which are commonly used in architectural projects or urban planning. They filled out or answered the questionnaire by writing down the scale of the ability to master the software, which is stated by the numbers from 0 (lowest) to 10 (best) (Table.1).

Table.1. Classification of scale/ level and perception of competence in operating software

Scale	Perception	Level of Competency/ Skill
0	I Never Heard	
1	I Have Heard in Various Discussions/ Meetings	
2	I Have Little Information from My Own Search	bad/low
3	I Have Tried Little and Not Interested or Unable to Continue	
4	I am Pretty Interested, Have Tried the Demo Version	
5	I Continue to Practice and Try to Apply for Specific Cases	not so good/ middle
6	I Am Quite Mastery and Sometimes Apply to Simple Projects	
7	I am pretty good at it and sometimes use it for complex projects	
8	I Master Well, But Not Always Implement it in My Projects	good & very good
9	I Master Well, and Always use it in My Projects	
10	I Master Very Well and may Become Instructor for my Colleagues	excellent

Scales of mastery in information technology can be measured in level categories. The lowest level is on the scale of one, while the medium level scaled as five. The highest is valued as ten (Ministr and Ntevko, 2010). In addition, according to Nur Aisyah, Information and Communication Technology skills

can be measured in 5 levels, namely from the lowest scale with the value one which belongs to the novice category, up to a scale of 5 which signifies that is very mastering (Nur Aisyah, 2013). The respondents were grouped according to their professional work experience, their level of education and their types of professional job (Table.2 and 3). Computer programs or software that are subject to questionnaires were also grouped according to the functions and purpose of use (Table.4). The investigation was carry-out in months February and March 2019.

Table.2. Year experiences of respondents

Professional Experiences of Respondents	Number of Respondents with Education Background		
	Undergraduate/ Bachelor	Graduated/ Master	Total
A More than 20 years	2	8	10
B 5 to 20 years	18	12	30
C 0 To 5 years	60	0	60
Total number of respondents			100

Table 3. The professional job of respondents

Professional Jobs	Number of Respondents with Education Background		
	Undergradt /Bachelor Degree	Gradt /Master Degree	Total
A Educator/ Research	-	12	12
B Administrative /Government/ Bureaucracy	-	10	10
C Practitioner/ Consultant/ Construction work	73	5	78
Total Number of Respondents			100

Table 4. Grouping of the software

Purpose	Commercial name
General Office	MS-Office: Word, PowerPoint, and Excel
Technical Drawing and Art Graphical	Auto-CAD, Archi-Cad, Corel Draw, Photo-shop, Sketch Up
Animation	3D Studio Max, Movie Maker
Scientific and Engineering	SPSS, Energy+, Velux, Dialux, Arc-GIS, Envi-Met, SAP2000

3 RESULTS

The results of the questionnaire are compiled in Table 5. It shows the percentage of the respondents according to their classification of skills in operating computer-programs. Skills or competencies in operating software for office and administrative purposes are generally quite satisfying, where around 50% of respondents master well excellent, except for mastering spreadsheet program (Fig.1). Respondents are less accustomed to using spreadsheets because the scope of their tasks as architects is more dominated by activities leading to art and presentations, rather than quantitative analysis and making graphics, charts or tables.

Respondents, according to their own perceptions, feel that they mastery computer programs for technical drawing with good and excellent skill-fully, namely for AutoCAD and Sketch-Up software. However, there are still those who feel have not mastered computer programs for art drawing purposes (Fig.2). In the curriculum and process of architecture education in Indonesia, students have been introduced to a variety of computer programs for design tools, including Auto-CAD and Google Sketch Up (Amir, 2011). Likewise, in Manado, students and architect practitioners are also familiar with both software.

Almost all respondents stated that they did not have the skills or deficient capacity in operating several computer programs for scientific purposes (Fig.4). It is understandable because almost respondents as architect-practitioners do not have the capacity as researchers or experts who are usually involved in the matter of construction calculations or mathematical and physical analysis of building performance. The scientific software that was asked to the respondents are generally used to calculate the structure, lighting, energy, micro-climate, and there is also software commonly used for analysis in the geological mapping process. Respondents who have a master-degree education, in general, have higher skills in using scientific software than those who still have a bachelor's degree. Some respondents even claimed to have the skills in the "good & very good" category in using some software (Fig.5).

Table.5. Percentage of ability to operate software by respondents

Commercial Software	Skills Classification			
	Low/Bad	Not So Good/Middle	Good & Very Good	Excellent
MS Word	0%	31%	51%	18%
MS Excel	14%	42%	40%	4%
MS Power Point	0%	31%	50%	19%
Auto CAD	8%	19%	53%	20%
Archi CAD	37%	32%	25%	6%
Sketch Up	5%	24%	61%	10%
Photo Shop	20%	22%	44%	14%
Corel Draw	40%	35%	23%	2%
3 DsMax	47%	33%	19%	1%
Movie Maker	32%	41%	25%	2%
SPSS	76%	22%	2%	0%
Energy++	88%	12%	0%	0%
Dialux	77%	14%	9%	0%
Velux	75%	16%	9%	0%
Arc GIS	67%	21%	12%	0%
SAP2000	92%	8%	0%	0%
EnviMet	89%	11%	0%	0%

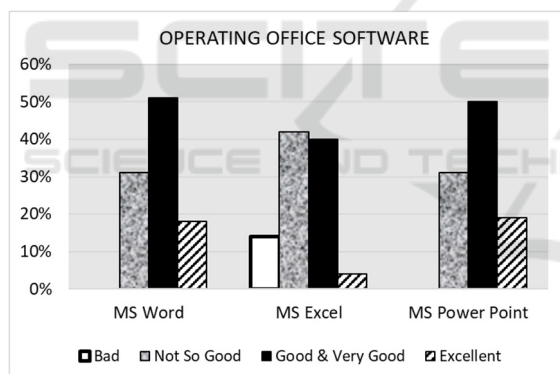


Figure1. Level of skills in operating office software

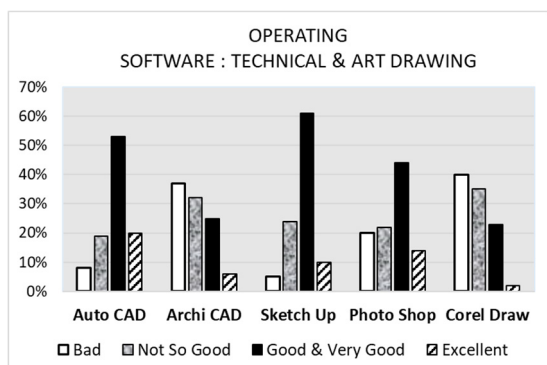


Figure 2. Level of skills in operating software for technical and art drawing

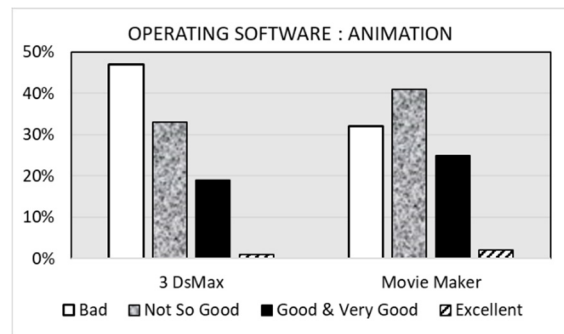


Figure 3. Level of skills in operating software for design animation

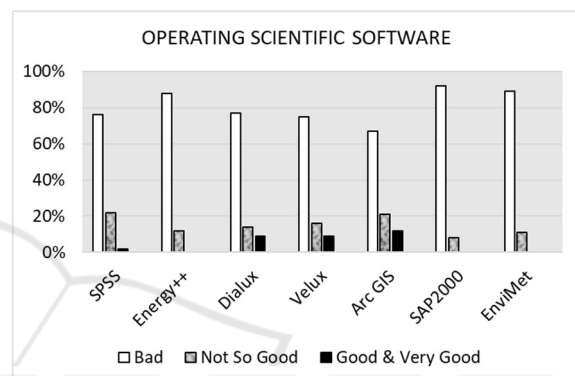


Figure 4. Level of skills in operating software for scientific purposes

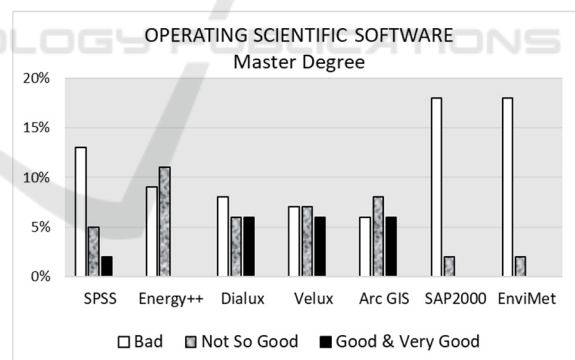


Figure 5. Level of skills in operating software for scientific purposes of those who have master degree education.

4 CONCLUSION

There is a linear relationship between the development of software and the availability of employment for those who have higher skills in the field of information & communication technology (ICT). Professionalism or job in the field of architecture cannot be separated from the level of

information and communication technology skills. Mastery of various software is a way to be able to compete in current employment. In this study, in the city of Manado, Indonesia, from the results of the questionnaire, the architects, in general, were quite right in recognising some software. Even among the software, they claim enough good in operating it. However, they should not be easily satisfied because they still need to develop themselves by following the development of information technology that is very rapid. They still have to improve their skills in mastering various types of information technology, software and undergo specialised training to increase their capacity.

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