THE DRAWINGS DIGITALIZATION EFFECTIVENESS IN INTERIOR FABRICATION IN A PHILOSOPHICAL CONTEXT

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Abstract: Architectural digitization has been carried out substantially, at the design stage and also at the implementation. Not only related to the design of the building's facade but also to the interior of the building. The goal indeed is to simplify and accelerate the architect's work. In fact, the current digitalization drawings, specifically in the realm of interior fabrication, require several additional steps becomes a product.

This research uses literature study method with descriptive evaluative analysis to describe as broadly as possible issues related to the effectiveness of digitalization drawings in interior fabrication in philosophical studies based on ontology, epistemology and axiology. The study was carried out using empirical and theoretical phenomena as well as examining the ideas behind the effectiveness of digitizing drawing (in interior fabrication) to its application.

The final result shows that the research concept on the effectiveness of digitizing drawings in interior fabrication is empirical, rationalist, and measurable research as a logical science and is a part of science.

Keywords: drawing digitalization, interior fabrication, drawing philosophy

1. Introduction

Digitization of drawings in interior fabrication, especially in large-scale projects, has become an obligation. Beginning at the tender stage up to the project implementation, everything is done by computing. Even a task will not be able to be carried out before the computation of the drawing is approved by the relevant parties. At the implementation stage of the interior work, a detailed engineering design drawing from the architect is given to the contractor complete with board material, as a reference. By this, it is expected that the final drawings can be produced immediately. The fact, it is still necessary to carry out several stages of revision and adjustment of drawings which must be approved by the interior architect. This stage causes a lot of time, especially if verbal communication between the contractor and the architect did not exist properly.

Interior digitization drawings is not just changing the style and way of drawing from manual to computerization. It is expected that an effective digitization system will be able to provide more benefits, specifically in product fabrication to on site installation. Here, it is necessary to have a deep philosophical understanding related to the effectiveness of digitizing drawings in interior fabrication. Through the perspective of the philosophy of science, the phenomenon of the effectiveness of digitizing drawing in interior fabrication will be studied to provide learning, how to understand and analyse it judiciously in order to provide an understanding of logic and reasoning, as a source of explicit contextual knowledge. The ultimate goal of this research is to provide a conceptual understanding of the effectiveness of digitizing drawings in interior fabrication through the

perspective of the philosophy, especially on the ontological, epistemological and axiological aspects.

2. Study Literature

Philosophy plays an important role for a science, because philosophy provides views about anything (complexity, discussing and testing validity) and accountability of thoughts and ideas that can be scientifically and intellectually justified [1]. On the other hand, the philosophy of science is considered a form of rational study that provides an understanding of ontology, epistemology and axiology of phenomena that exist in human life [2]. There are several stages of approach in constructing a research into a science: ontology, epistemology and axiology approaches [2].

3. Research Method

This study uses a qualitative paradigm, with an inductive method, in which the research variables are not determined at the beginning of the study but are explored comprehensively on the research object. The qualitative method is the opposite of the quantitative analysis approach or positivism from August Comte [2]. Ontologically, this category has the quality of critical realism that uses positivist and constructivist approach to provide thorough explanation of ontology and epistemology [3] measures the causal relationship of the problem to understand and suggest strategy recommendation to solve the problem [4][5].

This study attempts to combine secondary data from literature such as journals, research, and books related to the philosophy of science, digitizing drawing, fabrication, interior design, and primary data based on a comparison of digital design drawings with site conditions. The focus of the study analysis includes the concept of the effectiveness of digitizing drawings in interior fabrication through a philosophical perspective on ontological, epistemological, axiological and theoretical debates, as well as discussions related to the effectiveness of digitizing drawings in interior fabrication.

4. Result and Discussion

Philosophy is the science of essence that seeks the original and pure truth, the investigation of the causes and the ultimate principles of everything that exists [6]. Philosophy is also trying to find the principles and causes of existing reality, trying to learn about existence 'as things exist' (being as being) or 'as they are' (being as such) [7].

Philosophy becomes the starting point and culmination of all knowledge which includes four questions: What can we know? Which is metaphysics. What should be done? Which is ethics. Where is our hope? Which is religion. What is human nature? Which is Anthropology [6].

The philosophy of science tries to discuss science as an object rationally (critically, logically and systematically), comprehensively and fundamentally [8].

From the definitions of philosophy that have already come before, it can be concluded that philosophy is a knowledge and effort that becomes the first source in providing an assessment of an object that is studied wisely in accordance with beliefs to prove curiosity about the existence of truth. Philosophy is the opening and closing of science. Philosophy is the mother of science. Philosophy can stimulate the origins of a number of curiosities from philosophical findings to various branches of science through several stages of approach: ontology, epistemology and axiology.

4.1 Ontology of The Effectiveness of Digitizing Drawings in Interior Fabrication

Ontology is a science about the existence of something or a science that seeks the essence and the ultimate existence.

There are three views of existence. Those views are existence in terms of quantity, existence in terms of quality and existence in terms of processes, events or changes.

There are also three different views of existence based on the number of philosophical theories produced as the answer, which are monism, dualism and pluralism. Monism is a category which states that there is only one fundamental reality in this world, which can be a soul, element, God or other unknown substance. The figures of this category include Thales with his single substance theory of water, Aniximander with his single substance theory of aperion (something that is infinite), Anaximenes with his single substance theory of air and, B. Spinoza with his single substance theory of God. Dualism is a category which assumes that there are two substances, each of which is able to stand alone. The figures of this category are Plato, with his theory of substance dualism, namely the world of the senses (shadows) and the world of ideas (a world open to human reason), Rene Descrates with his theory of substance dualism, particularly mind and breadth,

Leibniz with his theory of substance dualism, which are the real world and the possible world, and Immanuel Kant with his theory of substance dualism, namely the world of symptoms (phenomena) and the real world (noumena). Pluralism is a category that does not recognize the existence of one substance or two substances but rather many substances to investigate existence. The figures of this category are Empedocles with his theory of pluralism that the nature of reality consists of air, fire, water, and earth, and Anaxagoras with his theory of pluralism that the nature of reality consists of innumerable elements, as many as the number of properties of objects and all of them are controlled by a force called nous [7].

Existence can be conducted in terms of quality, resulting in 2 major theories, which are spiritualism and materialism. Spiritualism, also known as idealism, means that the deepest reality is spirit (Pneuma, Nous, Reason, Logos), which is the spirit that underlies and fills the entire universe. The figures of this category include Plato with his theory of ideas and souls. While materialism is a view which states that something real is material. The figures of this category are Democritus with his belief that the universe is composed of atoms that have form and body, and Thomas Ahobbes with his belief that everything that happens in the world is the motion of matter [7].

Existence can be categorized in terms of processes, events or changes that produce several streams, which are the flow of mechanisms, theology and vitalism. The mechanism views the existence that all phenomena can be explained on the basis of mechanical principles. The figures of this category were Leucippus and Democritus who stand that nature could be explained based on atoms moving in an empty space. Theology views the existence that everything that happens in natural events is not a causal rule, but from the beginning there has been a will or force that directs nature to a goal. The figure of this category is Aristotle, who thinks that to see the true reality we must understand four causes, those are material causes, formal causes, work causes (efficient causes), and final causes. Vitalism reveals that in picturing life, it cannot be completely physico-chemical, because its essence is different from the non-living. The figure in this category is Henry Bergson who says that elan vitality is the source of the causes of work and development in nature [7].

The ontological basis understands the scope of the work area of science nature as its object and target, and it is necessary to know about the target of scientific activities to be pursued/achieved [8].

From the number of theories that already mentioned before, it can be concluded that ontology is about what or the existence of a science, both from the quantity point of view, quality and the process of its formation, which in interpreting a science requires an initial understanding of how the condition of the object's origin, knowledge of its characteristics, knowledge of the nature of what is desired to be studied and the gaps that really wanted to be explored.

Tabel 1: The stages of ontology **(author's analysis, 2020)**

Stage	General Description	Its Relation with Effectiveness of Digitizing Drawing in Interior Fabrication
Ontology	About the nature of object studied	Object studied is science of drawing, science of digitizing drawing, interior science and the science of effectiveness
	About the true nature of object studied	essential form related to drawing, digitization of drawings, interiors and effectiveness
	About the relationship between the object studied and human comprehension as to produce knowledge	human thoughts in capturing what drawing is, digitizing drawings, interior fabrication and effectiveness

The term effectiveness is the relationship between the output and the goals to be achieved [9], is a key element to achieve the goals that have been determined in each organization, activity or program. It is called effective if the goals and objectives are achieved as determined [10].

Work effectiveness is the degree of how far the ability of a person or group is in carrying out their main tasks to achieve the desired goals [11]. The scale of effectiveness includes productivity, alertness, efficiency, earnings, growth, stability, accidents, morale, motivation, cohesiveness and adaptation flexibility [11].

The effectiveness approach is used to measure how effective the activity is. There are several approaches used for effectiveness, namely the goal approach, the system resource approach and internal process approach [12].

Something is said to be effective as long as its objectives are met, ranging from achieving specific outcomes to very general results [13]. Effectiveness indicators focus on measuring changes in outcomes that reflect program objectives [13].

From several theories about effectiveness that have already been mentioned before, it can be concluded that effectiveness in general involves an effort to achieve goals and objectives appropriately by going through a process, source and goal approach, where the benchmarks include the achievement of results or outputs that are desired.

The term digitization has the meaning of using digital technology in certain activities. There are some roles of using digital technology in the field of architecture, which are as a tool for representing architectural designs, as a simulation tool, as an evaluation tool, as a link between the design process to the construction stage and as a translator of digital information into the manufacturing process [14]. The areas of digital technology performance that can be developed in architecture, which are: (1) data-based research, (2) modeling and simulation, (3) computer programming, (4) multimedia presentation, (5) knowledge and information management [15].

Based on the theory that mentioned above, it can be concluded that the general meaning of digitization is the use of tools in the form of a computer system to simplify, speed up and streamline architectural performance, at all stages of design from data retrieval to product fabrication.

The term of drawing in this study has the meaning of technical drawings which are more considered as the design of a technological product (operational unit) in the operating process [16] or a reference for the implementation of work in the field, so that it becomes easy to carry out and technically controlled, both in terms of time and quality of work [17].

The function of technical drawings is as an instrument of conveying detailed and precise information from the designer to the competent one, as an instrument of preserving, storing and using information for future plans, and as an instrument to improve the thinking power of planner [18]. Technical drawing as a universal language for technicians in graphic form are two-dimensional representations of three-dimensional objects that provide information about the shape, size, surface, quality, materials, manufacturing process, etc., of an object [19].

There are four important utilities of technical drawings, which are (1) Used on ships for navigation, (2) For the manufacture of machinery, automobiles, etc., (3) For the construction of buildings, roads, bridges, dams, electrical and telecommunication structures, (4) For the manufacture of electricity equipment such as TV, telephone, computer, etc. [20].

Technical drawings need to communicate the product design and manufacture information in a reliable and unambiguous manner, regardless of the language in accordance with internationally accepted standards [21].

Drawing literacy represents a certain conception of what drawing is and what it is for, for example drawing as a design, drawing as a perception, drawing as an experience, drawing as a self-expression, and drawing as a graphic idiom [22]. Design drawings are used to visualize and communicate the features of a three-dimensional object or interior space and construction drawings are used to accurately describe what materials will be used and how the object or space will be constructed [23].

Digitizing drawing techniques focus on the speed and efficiency, which means getting the job done immediately, with the fewest mouse clicks, and being able to edit the image when it is necessary, allowing representation to be an iterative process, creating elements that can be altered or modified [24]. It is important for a designer to understand the specific hardware and software used to create digitizing drawings in order to find a combination of hardware and software that reliably and comfortably function [24]. The efficiency of digitizing drawing can be increased by several methods of automation, portability, replication, and transformation [24].

From the theoretical description that has already been discussed above, it can be said in general, that digitization drawing is a structured drawing pattern with a universal language that can be accepted in various disciplines, with certain rules and standards, using computational media to simplify, speed up and be effective in its operation.

Fabrication is an effort to process raw materials into something that is used in the manufacturing process and the process is referred to as a chain or chain net [25]. Regarding the fabrication in architecture, architects must understand the central role of digital technology in the fabrication of modular components, including Building Information Management (BIM), Computer-Aided Design (CAD),

Computer-Aided Manufacturing (CAM), and Computer Numerical Control (CNC) **[26]**.

From the theory that has already been explained before, it can be concluded that fabrication is a series of efforts to realize the planning drawing into a product according to the stages of the production process which are carried out separately at the factory with the support of equipment, systems and man power.

Interior design is a layout and space planning in a building that aims to develop function, aesthetic enrichment and increase the psychology of the room **[27]** or how to arrange indoor spaces that are able to meet the requirements of comfort, safety, and the need of satisfaction. Interior design combines creative expression with practical application [28]. Interior is the architecture of the future, the architecture of change, the architecture of perception, the architecture of emotional culture, the architecture of cultural history and the architecture of responsibility **[29]**.

Interior in general is the arrangement of the indoor space including wall, ceiling and floor elements, in accordance with the expression of each architect which serves to provide beauty, comfort and form a positive space psychology.

From several theories about the elements of the object of study that explained above, ontologically the initial understanding regarding the effectiveness of digitizing drawings in interior fabrication is an operating unit in the process of realizing a complete and detailed visual image of planning and interior spatial design, as a reference in the implementation of realizing a finished product, which is in accordance with certain standards and rules, using technological aids in its process and presentation, where in its current implementation the level of effectiveness will be tested.

Related to the quantity and nature of its existence, ontologically, the object of this study existence is included in the category of pluralism. In line with the theory of Anaxagoras that the reality of the object study is quite a lot, including factors that affect the effectiveness of digitizing drawings in interior fabrication, the performance of digitizing drawings in effective interior fabrication, along with the outputs obtained on the object study of effectiveness of digitizing drawings in interior fabrication.

Related to quality, ontologically, the existence of the object of this study is included in the category of materialism, which is a view that states that real existence is in the form of matter. In this case, the output of the effectiveness of digitizing drawings in interior fabrication is something that is structured in terms of systems, performance and rules as a reference for the formation of an effective digitization of drawings in interior fabrication.

In terms of processes, events or changes, the existence of the object of this research ontologically can be categorized in mechanism, which has the view of seeing an existence in which all symptoms can be explained based on mechanical principles. The mechanical principles in the effectiveness of digitization drawing in interior fabrication are based on the efficient cause (the current state of digitizing drawing on interior fabrication is not yet fully effective) against final causes (how the basic concept of digitizing drawings is effective in interior fabrication).

Ontologically, the character of drawings digitalization in interior fabrication is that the drawings presented are drawings whose designation is specific for interior layout product (includes wall, ceiling and floor work), as well as supporting elements such as lighting, ventilation, acoustics and furnishing. So that the drawings are presented in specific formats and standards using specific software that can be understood internationally in terms of standard lines, scales, letters, numbers, symbols, units and projections.

Ontologically, the gap discussed regarding the digitization of drawings in interior fabrication currently does not explain thoroughly on how effective the interior production process is. Therefore, how and to what extent this effectiveness value needs to be studied with the possibility of obtaining other values found from the object of study to answer the research question.

4.2 Epistemology of The Effectiveness of Digitizing Drawings in Interior Fabrication

The epistemological foundation provides a basis for discussion of how science works in an effort to realize scientific activities **[8]**, along with a way to get the right knowledge.

Epistemology emphasizes the nature of relevant steps/methods/means in acquiring knowledge, and tries to answer the question of what can be known from the object of study. This view has implications for the right way to obtain the truth. Related to the tools used to achieve the truth of the object of study **[30]**.

Epistemology is a method or way of studying knowledge to match with scientific principles. The method in this study is adapted to the characteristics of the object of study. To get the correct method

epistemologically in understanding the object of study is to know its characteristics **[30]**. The methodology in the philosophy of science is how researchers find knowledge **[31]**.

It can be interpreted from the theories that mentioned above that epistemology is how the order and workings of a science can be realized into a scientific truth through predetermined rules, related to tools, working mechanisms, data methods and steps of its analysis.

Table 2 : The stages of epistemology **(author's analyzation, 2020)**

Stage	General Description	Its Relation with Effectiveness of Digitizing Drawing in Interior Fabrication
Epistemology	Process that allows knowledge to be obtained	Research methodology used in the study of the effectiveness of digitizing drawings in interior fabrication is qualitative, positivism approach
	Procedure to obtain knowledge Tools, method, technique to obtain knowledge	Research method used in the study of the effectiveness of digitizing drawings in interior fabrication is grounded research method
	Matter that must be noticed to obtain knowledge correctly The meaning of its truth The criteria of truth	In relation to the steps, method and procedure to conduct a research with grounded research method related to object of study on the effectiveness of digitizing drawings in interior fabrication

In relation to the object of study in the form of the effectiveness of digitizing drawings in interior fabrication that is rational and empirical to reconstruct the theory used in understanding the current phenomenon of digitizing drawings, therefore epistemologically, this research is seen with a post-positivism paradigm using a qualitative approach.

Qualitative research paradigms are inspired by the philosophy of rationalism which requires a holistic, systemic discussion, and explains the meaning behind sensual empirical facts. Qualitative research is also called the natural paradigm, because it explains reality without taking standard and definite measurements that researchers try to describe social phenomena holistically without manipulative treatment.

In the object of this study, it can be seen generally that the effective mechanism for digitizing drawings in interior fabrication has been patterned. Therefore, epistemologically, the method that is considered appropriate in revealing the truth in accordance with the aim of assessing the effectiveness of digitizing drawings in interior fabrication is the grounded research method. The general objective of grounded theory research is to inductively obtain the data needed for theoretical development by taking into account a number of evaluative criteria **[32]**.

The stages of systematic design in grounded research are (1) determining the formulation of research problems that originate from the identification of phenomena, (2) identifying the process regarding changes in conditions, responses to changes, consequences that arise and the description of consequences as part of conditions, (3) participant preparation regarding permission and protection, (4) conducting theoretical sampling, (5) coding data in several stages, such as open coding, or sorting data from interviews; axial coding for choosing one category as the core of the research phenomenon; and selective coding that is the process of unifying and perfecting the theory, (6) validating the theory by comparing it with similar research in the literature or asking external researchers or participants to check the validity of the theory and the last one is (7) writing research reports.

4.3 Axiology of The Effectiveness of Digitizing Drawings in Interior Fabrication

The axiological foundation becomes the basis for discussion to find related values in scientific activities. In addition to the value of truth, it is necessary to realize that there are various useful values that can be found in science as an implication [8]. Axiology emphasizes the function of carrying out the study by stating what goals to be achieved and the convenience of the knowledge gained **[8]**.

As can be seen from several theories above, it can be concluded that axiology is a discussion of the final value, purpose and versatility of a science that is explored from various points of view which is not only

physically characterized, but contains versatility value with its safety and security, the value of synergy and the compatibility of functions with other equipment, the value of aesthetic expression and the value of

benefits that do not cause moral (ethical) concerns and have positive impact on humanity in accordance with the criteria that apply in society and the value of the flexibility of these criteria.

Table 3 : The axiological stages **(author's analyzation, 2020**)

Stages	General Description	Its Relation with Effectiveness of Digitizing Drawing in Interior Fabrication
Axiology	Science function	The objective of the study on the effectiveness of digitizing drawings in interior fabrication
	Relation between the usage method and moral code	the benefits of the object of study on the effectiveness of digitizing drawings in interior fabrication
	Determination, object of study based on moral preference	the performance of the object of study on the effectiveness of digitizing drawings in interior fabrication (in terms of both good and bad)

The axiology of the object of study is pictured from the versatility value of safety both from unintentional harm and safety from intentional harm [33]. That the concept of the effectiveness of digitizing drawings in interior fabrication must be carried out by considering aspects of function and usability without compromising the aspects of security and safety in all sectors of work, both for designers, fabricators, installers and users. The achievement of these goals and benefits must meet the elements of unintentional security and coercive criminal efforts, such as illegal and unauthorized efforts.

An empirical example related to the versatility value of safety both from unintentional and safety harm of digitalization drawings, as shown in Figure 1. It is necessary to adjust the design drawing by adding several supporting legs to the floor, to ensure it can be installed and is useful in safety and security.
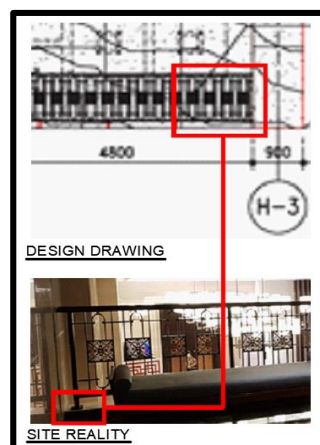
From the value of synergy and compatibility with other equipment, the axiology of the object of study is pictured, starting from the detailed drawing, collection and understanding of equipment requirements and other requirements [33]. That the concept of digitizing drawings in interior fabrication must be carried out to provide the benefit of the final result of interior products of their own use or its use based on the equipment that is accommodated effectively according to their respective prerequisites. An empirical example related to the value of synergy and compatibility of digitalization drawings in interior fabrication is shown in Figure 2. It is necessary to adjust the original screen pattern from the design drawing to ensure it can be processed by machines such as laser cutting or CNC.
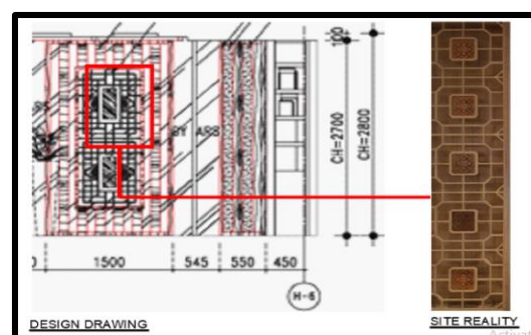

Figure 2. Adjustment to Fit the Machine
Source: author's analysis, 2021

Figure 1. Adjustments for Safety and Security
Source: author's analysis, 2021

Regarding the value of aesthetic expression, the axiology of the object of study, requiring architects not to underestimate the power and importance of aesthetics and to be prepared to do what is necessary for the integrity of the design [34]. That the concept of digitizing drawings in interior fabrication must be carried out by considering the importance of aesthetics without compromising the integrity of the design even though there are various ways and mechanisms to achieve the level of effectiveness.
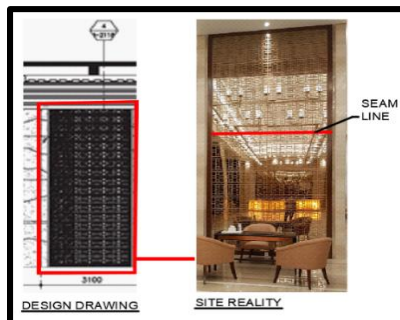

Figure 3. Adjustments for Aesthetics
Source: author's analysis, 2021

An empirical example related to the aesthetic expression value of digitalization drawing in interior fabrication is shown in Figure 3. Without changing the aesthetic concept in the original design drawing, several adjustments were made by cutting it, according to the existing materials on the market and the efficiency of the materials.

The axiology of the object of study is viewed from actions that do not cause moral (ethical) concerns, must connect the idea of responsibility to society with various considerations relevant to individual character and happiness regarding virtue, compassion, loyalty and strength, self-confidence, imagination, humour and optimism [34]. The concept of the effectiveness of digitizing drawings in interior fabrication must be carried out by providing positive benefits with considerations relevant to the character and happiness of individuals in all sectors for designers, fabricators, installers and users without injuring and raising moral concerns.

An empirical example related to the moral value of digitalization drawing in interior fabrication is shown in Figure 4. Without changing the aesthetic concept of the original design drawing, several adjustments were made by cutting it, according to the maximum capacity of goods transportation and the ease of vertical access to the location. Guarantee the implementation of the process of installing it without disturbing the surrounding environment.
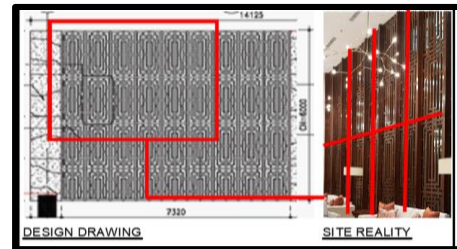

Figure 4. Adjustment to Install on Site
Source: author's analysis, 2021

From the value of flexibility of achievement with certain value criteria point of view, the axiology of the object of study, considering some flexibility in the choice of imagination and creativity for good effect [34]. The concept of digitizing drawings in interior fabrication must be carried out with the aim of making the production process easier and faster. Business aspects and standardization can be done with some consideration of flexibility that is not rigid in achieving effectiveness values.

An empirical example related to the flexibility value of digitalization drawing achievement in interior fabrication is shown in Figure 5. Without changing the aesthetic concept in the original design drawing, several adjustments were made in the form of a removable panels system to provide easy maintenance.
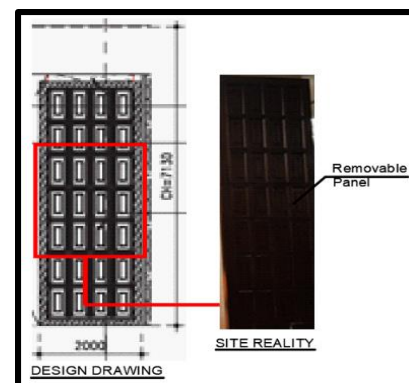

Figure 5. Adjustments for Maintenance
Source: author's analysis, 2021

Holistic axiology towards the study of the effectiveness of digitizing drawings in interior fabrication, provides a reference for understanding the reality that occurs related to the object of study. Such as what factors affect the digitization of drawings in interior fabrication, what are the effective forms of digitizing drawings in interior fabrication and what are the outputs of effective digitization of drawings in interior fabrication.

5. Conclusion

Based on the philosophical context studied, epistemologically the position of the object of study on the effectiveness of digitizing drawings in interior fabrication, is categorized in qualitative research using a grounded research method with a post-positivism approach. Data collection based on field studies that have been patterned to obtain theoretical gaps or novelty of research results.

Ontologically, the object of the study of digitizing drawings in interior fabrication that has occurred so far has not been fully proven effective, so its existence needs to be studied with empirical research, through knowledge derived from science and theory that can be accepted logically, with the data processing stage carried out with a measurable approach.

Axiologically, the results of the study of the effectiveness of digitizing drawings in interior fabrication will contribute directly to the practice of interior work from the planning, design, implementation to the fabrication process, and provide benefits for future scientific developments. The axiology obtained must still consider (1) the value of using effective drawing digitization in terms of safety and security, (2) the value of synergy and compatibility of the drawing digitization function with other equipment, (3) the value of aesthetic expression in effective drawing digitization, (4) the value of the benefits of digitizing effective drawings without causing moral (ethical) concerns, and (5) the value of flexibility in achieving the results of digitizing effective drawings with certain value criteria.

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