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Analyzing Productivity Enhancement and Task Replacement Rates in Digitized Construction Supervision Process: A Comprehensive Study with Construction Supervision Checklists in South Korea

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Abstract: This study aims to facilitate the integration of digital technology into construction supervision by leveraging construction supervision checklists, a fundamental tool for inspections in this field. To achieve this, this research analyzed the tools and practices used in construction supervision, identifying 12 key supervision task types. These task types formed the basis for developing four distinct digital technologies, each tailored to specific inspection tasks based on practical feasibility. A checklist development process followed with the use of predefined criteria. Checklist items from the Ministry of Land, Infrastructure, and Transport of South Korea were analyzed and categorized according to the identified inspection task types. Digital technologies were then integrated for each task type, with corresponding supervision locations documented. This process enhanced the checklist's effectiveness by incorporating methods for digitizing tasks. The findings suggested that approximately 61% of traditional tasks could be potentially replaced by digital technology, highlighting the potential for successful digitization implementation. In addition, surveys among industry professionals provided insights into the level of productivity enhancement achievable through technology adoption compared to traditional practices, offering a basis for predicting productivity improvements across various disciplines. In conclusion, this research supports the effective integration of digital technology into construction supervision through an enhanced checklist. It also sheds light on practitioners' perceptions of technology usage and aids in developing strategies for technology adoption in this domain.

Key words: Construction supervision process, Digital technology integration, Checklist, Productivity

1. INTRODUCTION

1.1. Research Background and Purpose

Amid the recent Fourth Industrial Revolution, there is significant focus on utilizing advanced technologies such as digitization, automation, and ICT to enhance productivity (Hossain and Nadeem, 2019; Stoyanova, 2020). Particularly, in the domestic construction industry, where sustained decline in labor productivity poses various challenges, efforts to enhance productivity through the adoption of new digital technologies are gradually expanding (Kim, 2019). Among these efforts, the introduction of digital technology in construction supervision is evaluated as an effective means for productivity enhancement (Cho, 2022). However, practical application of digital technology is constrained by factors

such as infrastructure and strategic absence (Son et al., 2019; Lee et al., 2019). Therefore, support for practical technology utilization beyond mere adoption of digital technology is required.

This study aims to support the effective introduction of digital technology from the perspective of practitioners through research and development. Considering the data relied upon by practitioners when performing construction supervision inspection tasks, and recognizing that checklists are fundamental to inspection activities, the study aims to develop checklists that can be efficiently utilized when introducing digital technology. Through checklist development, the intention is to enhance productivity in supervision tasks by facilitating more practical utilization (implementation) of digital technology. Additionally, to demonstrate the practical effects of digital technology adoption, the study seeks to analyze the extent to which tasks can be replaced when digital technology is introduced into the current construction supervision checklist, and to analyze the expected level of productivity enhancement, thereby supporting decision-making for the introduction of digital technology in supervision tasks.

1.2. Research Scope and Method

This study was conducted targeting the current construction supervision checklist of the Ministry of Land, Infrastructure, and Transport, and the scope of the study involved the development of checklists for a total of 20 construction types, ranging from foundation work to superstructure work.

The study aimed to analyze the tools used in inspection tasks and derive key inspection task types, and based on this, to organize effective digital technologies for productivity enhancement when introduced according to the type of task. Subsequently, the study intended to develop the existing checklist by reflecting effective digital technologies for each checklist item and methods for digitizing tasks upon technology adoption.

Ultimately, the study aimed to analyze to what extent digital technology could replace existing tasks and to ascertain, through practitioner surveys, the level of productivity enhancement resulting from technology adoption in terms of reduction in workload compared to existing tasks.

2. DEVELOPMENT OF A DIGITAL TECHNOLOGY-BASED CHECKLIST

2.1. Analysis and Definition of Functions for Construction Supervision Inspection Tools

The substitution of digital technology for construction supervision tasks in construction projects refers to the utilization of digital technology instead of conventional tools or actions used in supervision tasks. Therefore, this study aims to identify the main task types of construction supervision through the functional analysis of tools used in supervision tasks and to compile digital technologies capable of replacing tasks of these types. Ultimately, the goal is to classify and compile digital technologies that can be introduced for each task type, and to develop a digital technology-based construction supervision checklist reflecting this information.

In this study, an initial analysis was conducted on the inspection tools used in construction supervision tasks. A request was made to practitioners working at ITM Engineers and Architects for a list of inspection tools used in their tasks based on the current checklist inspection items provided by the Ministry of Land, Infrastructure, and Transport. A total of 39 inspection tools were received in response. Subsequently, a visual inspection task that does not require the use of tools was included as one tool, resulting in a total of 40 inspection tools. Definitions of the tools were then created to understand the actions performed by each tool. The aim is to analyze the functional capabilities of the previously listed inspection tools to understand the tasks they represent. This involves simplifying the definitions of the tools' functional capabilities into a morphological form such as 'subject (verb) tool (machine)', in order to define their functions. The definition of the 'visual' tool was established based on the current checklist items, resulting in the definition of 31 functional capabilities. In total, 70 functional capabilities were defined, and the details are presented in Table 1.

Table 1. Definition of Inspection Tool Functional Capabilities

	Tool	Definition	
1	Leveling rod	Level	Measuring
2	Ruler	Length	Gauging
3	Laser distance meter	Distance	Measuring
4	Calipers	Outer/Inner diameter, thickness, depth	Measuring
5	Micrometer		Measuring
6	Plump bob	Vertical	Verifying
7	Level	Inclination	Measuring
8	Transit	Angle	Measuring
9	Level gauge	Horizontal	Verifying
10	Vertical gauge	Vertical	Verifying
11	Horizontal gauge	Horizontal	Verifying
12	Chalk line	Line	Marking
13	Marker	Line	Drawing
14	Leveling instrument	Baseline	Leveling
15	Ink marker	Line, gap	Indicating
16	Thermometer	Temperature	Gauging
17	Barometer	Temperature, humidity	Measuring
18	Hygrometer	Humidity	Measuring
19	Anemometer	Wind direction	Measuring
20	Pressure gauge	Pressure	Measuring
21	Humidity meter	Moisture ratio	Measuring
22	Schmidt hammer	Concrete strength	Measuring
23	Compression strength tester	Compression strength	Measuring
24	pH meter	Hydrogen ion concentration	Measuring
25	Chloride meter	Chloride ion concentration	Measuring
26	Air pressure gauge	Air content	Measuring
27	Slump tester	Concrete workability	Measuring
28	Analytical balance	Weight	Gauging
29	Electronic balance	Weight	Gauging
30	Material tester	Mechanical properties	Testing
31	Insulation fastening gas gun	Insulation material	Attaching
32	Optical microscope	Magnifying	Observing
33	Spectrometer	Light	Inspecting
34	Optical displacement gauge	Displacement	Measuring
35	Heater	Air or water	Heating

	Tool	Definition	
36	Pressurizer	Material	Adhering
37	Soil compactor	Surface	Smoothening
38	Drilling machine	Hole	Piercing
39	Refractometer	Refractive index of light	Guaging
40	Naked eye	Acceptance criterial for processing	Verifying
		Bonding state	Verifying
		Post-inspection treatment	Verifying
		Reinspection decision	Verifying
		Cutting section	Verifying
		Finishing surface	Verifying
		Finishing gap	Verifying
		Defective area	Verifying
		Pressure of crack	Verifying
		Format	Verifying
		Method	Verifying
		Personnel arrangement	Verifying
		Number of workers	Verifying
		Condition	Verifying
		State	Verifying
		Interior cleaning	Verifying
		Material preparation	Verifying
		Pump truck rotation radius	Verifying
		Location	Verifying
		Construction site	Verifying
		Gradient space	Verifying
		Construction surface	Verifying
		Timing	Verifying
		Related documents	Verifying
		Specification compliance	Verifying
		Report and invoice	Verifying
		Test data	Verifying
		Test records	Verifying
		Structural drawings	Comparing
		Direction of hooks	Verifying
		Number of reinforcement bars	Verifying

2.1. Derivation of Major Inspection Task Types in Construction Supervision

The purpose of defining the functional capabilities of inspection tools used in construction supervision tasks in this study is to derive the major task types in construction supervision based on the functions of the tools. Deriving major task types aims to categorize and classify the extensive range of supervision tasks, thereby listing them. Through this process, it becomes possible to match digital technologies that can be introduced for each task type in construction supervision, and based on this, to outline the introduction and application of digital technologies for each checklist item in the future.

Initially, the functional capabilities of the previously defined tools were classified into similar task types. Among the 70 functional capabilities, those representing tasks unique to specific construction projects and those with overlapping meanings were excluded, resulting in the classification of 59 functional capabilities. Consequently, the major task types in construction supervision were defined as 12, described as follows: "Material property verification, Construction defects inspection, Review work methods, Review construction locations, Review construction areas, Review legal compliance of documents, Compare site conditions with design drawings, Review quantity and orientation of materials, Other items (specific tasks or visual inspection)". These details are presented in Table 2.

Table 2. Major Task Types in Construction Supervision According to Functional Capability Classification

#	Key Tasks of Construtuion Supervision	Definition
1	Measure the dimensions of the component	Measuring the level, measuring the length, measuring the distance, measuring the outer diameter, measuring the inner diameter, measuring the thickness, measuring the depth.
2	Measure the angles of the site and components	Checking verticality, measuring slope, measuring angle, confirming horizontality.
3	Mark (and review) standards	Drawing lines, marking lines, setting baselines, indicating intervals.
4	Review the site environment	Measuring temperature, measuring humidity, measuring wind direction.
5	Verify the properties of the materials	Measuring pressure, measuring moisture content, measuring concrete strength, measuring compression strength, measuring hydrogen ion concentration, measuring chloride ion concentration, measuring air content, weighing, testing mechanical properties, observing under magnification, measuring displacement, smoothing surfaces, drilling holes, measuring refractive index of light.
6	Inspect construction defects	Checking for quality control in processing, verifying bonding state, confirming post-inspection treatments, confirming reinspection necessity, inspecting cut sections, inspecting finishing surfaces, inspecting finishing gaps, inspecting defective areas, checking for presence of cracks.
7	Review construction methods	Checking/verifying the method, confirming the timing of the method.
8	Review construction sites	Confirming personnel arrangements, verifying cleanliness, checking material preparation, confirming boundaries.
9	Review construction areas	Verifying construction locations, checking gradient spaces, confirming construction surfaces.
10	Review the legal compliance of documents	Checking related documents, verifying compliance with specifications, confirming reports and invoices, checking test data, reviewing test records.
11	Compare the site with the design documents	Comparing structural drawings.
12	Review the quantity and orientation of materials	Checking the direction of hooks, verifying the number of reinforcements.

2.3. Digital Technology Correspondence for Major Task Types in Construction Supervision Process

Through consultation with research practitioners, digital technologies that can be introduced for each of the major task types in construction supervision were matched one-to-one. Most of the 12 task types were assessed to have potential for digitization, and applicable technologies were identified for each

task. Ultimately, four digital technologies were defined to replace construction supervision tasks: Object Recognition Algorithms, 3D Vision Technology, PDF Drawing Management System, and Construction Document Digitization. These technologies were selected based on factors such as high frequency of use, relevance to the research project, among others (Table 3).

Table 3. Applicable Digital Technologies and Methods for Task Digitization

#	Types of Applied Digital Technology	Method of Digitizing Tasks	Alternative(Existing) Actions
1	Object Recognition Algorithm	• Utilizing object recognition technology enables discernment of component types • Partially applied depending on the required precision level and acceptable margin of error	• Determining component types • Determining component quantities • Determining component existence
2	3D Vision Technology	• Utilizing 3D vision-based image data analysis technology enables measurement of component dimensions.	• Measuring component dimensions
3	PDF Drawing Management System	• PDF drawings digitized for review, including construction details and standards depicted on the drawings.	• Digitizing construction detailed drawings • Digitizing construction standards • Digitizing construction specifications
4	Construction Document Digitization	• Digitizing construction components and detailed construction drawings and specifications for each trade allows for detailed review of construction methods on-site.	• Digitizing construction detailed drawings • Digitizing construction standards • Digitizing construction specifications

Subsequently, the four digital technologies were applied to the major task types, as detailed in Table 4. In addition to the 12 task types, the major task types also encompass "Miscellaneous Items," representing tasks specific to certain trades. Thus, there are a total of 13 major tasks identified. Among these, eight tasks were deemed suitable for the application of digital technologies. For the remaining five tasks, it was determined that applying the defined four digital technologies would be challenging, necessitating the continued performance of inspection tasks as usual.

Table 4. Digital Technology Correspondence for Major Tasks

#	Key Tasks of Construtuion Supervision	Types of Applied Digital Technology
1	Measure the dimensions of the component	3D Vision Technology
2	Measure the angles of the site and components	X (same as existing)
3	Mark (and review) standards	PDF Drawing Management System / Construction Document Digitization
4	Review the site environment	X (same as existing)
5	Verify the properties of the materials	X (same as existing)
6	Inspect construction defects	X (same as existing)
7	Review construction methods	Construction Document Digitization
8	Review construction sites	Construction Document Digitization
9	Review construction areas	PDF Drawing Management System
10	Review the legal compliance of documents	Construction Document Digitization
11	Compare the site with the design documents	PDF Drawing Management System
12	Review the quantity and orientation of materials	Object Recognition Algorithm
13	Other items (specific tasks or visual inspection)	X (same as existing)

2.4. Development of Construction Supervision Checklist

The study focused on developing a construction supervision checklist based on the current checklist provided by the Ministry of Land, Infrastructure, and Transport. The scope covered the entire spectrum of construction work, from foundation construction to finishing work, encompassing a total of 20 construction types and a 26-page checklist. The checklist development followed a 4-step structured process:

1) Classification of checklist Items by major task type, 2) identification of digital technologies applicable to each major type of task, 3) note criteria and references and 4) incorporation into the checklist.

Initially, an analysis of the Ministry's checklist items was conducted, categorized according to the identified major task types. Subsequently, the digital technologies identified in Table 6 were incorporated into the checklist based on the respective major task types. For checklist items where digital technologies were introduced, a section titled "Criteria, Reference" was added to specify the inspection areas. Finally, the developed content was integrated into the existing checklist to complete the development process.

The anticipated outcome of the developed checklist is depicted in Figure 1, representing an enhanced version of the existing checklist with two additional columns: "Technology Adoption Status" and "Adopted Technologies." Moreover, the previously empty "Criteria, Reference" column now includes information regarding inspection areas specifically for checklist items where digital technologies are introduced, aiming to enhance the understanding of field practitioners when implementing digital technologies.

□: PDF Drawing Management System, ▦: 3D Vision Technology, ▧: Object Recognition Algorithm, ▥: Construction Document Digitization

Supervision Checklist by Construction Work						Document number			
Work		Formwork				Detailed Work	–		
Area		Floor				Location			
Division		Checklist Items	Adoption of Digital Technology	Digital Technology	Standards, Notes	Test Results O	Test Results X	Measures	
Primary Task	Marking	Confirm the roughness of each floor.	□	PDF Drawing Management System	Floor of each level				
		Verify the roughness of the basic foundation at each point of the bottom sole concrete.	□	PDF Drawing Management System	Base concrete at each point				
		Check whether there is roughness on the flat surface of the square corner of the rebar column during erection	▧	Object Recognition Algorithm	Square corner of the rebar column				
		Check the marking going up from the bottom with a plumb bob	X	-	-				
		Check tolerance from marking to each member based on each floor	▥	Construction Document Digitization	From the roughness standard of each floor to each component				
	Formwork	Verification and review of vertical assembly of scaffolding (floor height, openings, etc.)	X	-	-				
		Confirmation and review of scaffolding interior dimensions	▦	3D Vision Technology	Formwork inner size				
		Verification and review of spacer size and spacing between scaffolding and rebar	X	-	-				
		Confirmation and review of placement of dressing separators in case of offering finish	▧	Object Recognition Algorithm	Dressing separator				
		Confirmation and review of allowable error in scaffolding, support, construction drawings, and cross-sectional dimensions	▦	3D Vision Technology	Allowable tolerance for cross-sectional dimensions				
		Confirmation and review of allowable error in distance from the standard roughness of each floor to each component	▦	3D Vision Technology	From the roughness standard of each floor to each component				
		Confirmation and review of level of floor panels and beams underneath (floor height, panel thickness, gaps, cross-sections, horizontality, central bulging)	▦	3D Vision Technology	Level of floor panels, beams underneath				
	Scaffolding ledger during assembly	Confirmation of support and scaffolding inspection	□	PDF Drawing Management System	Support, scaffolding inspection				
		Verification of absorption or deflection status / joint surface / top surface of the scaffolding	□	PDF Drawing Management System	Absorption or deflection status of the scaffolding / Joint surface / Top surface				
		Confirmation if paste around the joint finish is leaking	□	PDF Drawing Management System	Finish around the joint				
	Scaffolding retention period	Confirmation of concrete strength when removing scaffolding supports	X	-	-				
		Confirmation of retention period (In this case, strength tests must also be confirmed)	▥	Construction Document Digitization	Retention period				
Contractor inspection date		year month day			General construction manager	(signature)			
					Construction manager by work	(signature)			
Supervisor inspection date		year month day			General supervision manager	(signature)			
					Architectural license	(signature)			
Attached document									

Figure 1. Expected Output of the Developed Checklist

3. EVALUATION OF THE DIGITAL TECHNOLOGY-BASED CHECKLIST

3.1. Assessment of Work Replacement Rate upon Introduction of Digital Technology

The purpose of this study is to demonstrate the practical effectiveness of utilizing the checklist developed based on digital technology. Accordingly, the evaluation aims to assess to what extent the digital technology can replace the current construction project supervision checklist.

The assessment of replacement rate was conducted covering the entire checklist developed in this study, which consists of a total of 523 items across 20 construction projects. The list of projects includes: excavation work, foundation work, steel frame construction, brick/block and ALC panel construction, tiling and terracotta work, carpentry work, insulation work, waterproofing work, roofing and guttering work, metalwork, finishing work, window and door installation, glasswork, curtain wall installation, painting work, and finishing work.

For each item within each project, one of the four digital technologies selected in this study was applied. If it was deemed that the item could not be replaced by digital technology, it was categorized as "Not applicable (same as current)." The matching results were validated through consultation with field experts.

The analysis of work replacement rate for four construction projects revealed that the potential work replacement rate upon the introduction of digital technology is 61% (318 out of 523 total items).

Breaking down the replacement rate by technology, 'Digitalization of Construction Documents' showed the highest rate among the four technologies, with 136 items (26.00%) out of 523 items being replaced. Following this, 'PDF Drawing Management System' (24.67%), '3D Vision Technology' (5.93%), and 'Object Recognition Algorithm' (4.21%) showed replacement rates in descending order. These findings are summarized in Table 5.

Table 5 Checklist Task Replacement Rate for each Digital Technology

Checklist Item	Adoption Rate	Legend	Note
318	61%	O	Possible to adopt digital technology
205	39%	X	Not applicable (same as existing)
523	100%	Total	

Checklist Item	Adoption Rate	Legend	Note
22	4%	▧	Object Recognition Algorithm
31	6%	▦	3D Vision Technology
129	25%	□	PDF Drawing Management System
136	26%	▥	Construction Document Digitization
318	61%	Total	

When analyzing the frequency of digital technology work replacement by construction type, reinforced concrete recorded the highest frequency with 57 out of 123 tasks being replaced by digital technology, among the 20 projects. This was followed by steelwork (40 items), tiling and terracotta work (32 items), brick/block and ALC panel construction (31 items), and excavation work (22 items). The main reason for these results is the relatively high number of tasks for these types of construction in the checklist. The analysis of task replacement rates for each construction type revealed that "Excavation Works" recorded the highest task replacement rate at 91.67%, followed by "Formwork Works" at 79.17%, "Steel Structure Works" at 78.43%, "Earthworks" at 78.26%, and "Brick/Block and ALC Panel Works" at 73.81%. Conversely, "Waterproofing Works" exhibited the lowest task replacement rate at 27.27%, followed by "Metal Works" at 40.00%, "Reinforced Concrete Works" at 46.34%, "Stone Works" at 46.67%, and "Carpentry Works" at 53.85%. This information is summarized in Figure 2.

With a work replacement rate of 61%, it can be anticipated that the introduction of digital technology into the supervision tasks will yield a remarkable level of effectiveness. This allows for the assessment of supervision tasks where successful technology adoption is expected. Additionally, predictions can be made regarding which technology would be most effectively applied across all construction types. Furthermore, by analyzing the construction types and technologies that appear to be more effective, it is possible to identify the items that should be prioritized for implementation to achieve high effectiveness when introducing technology.

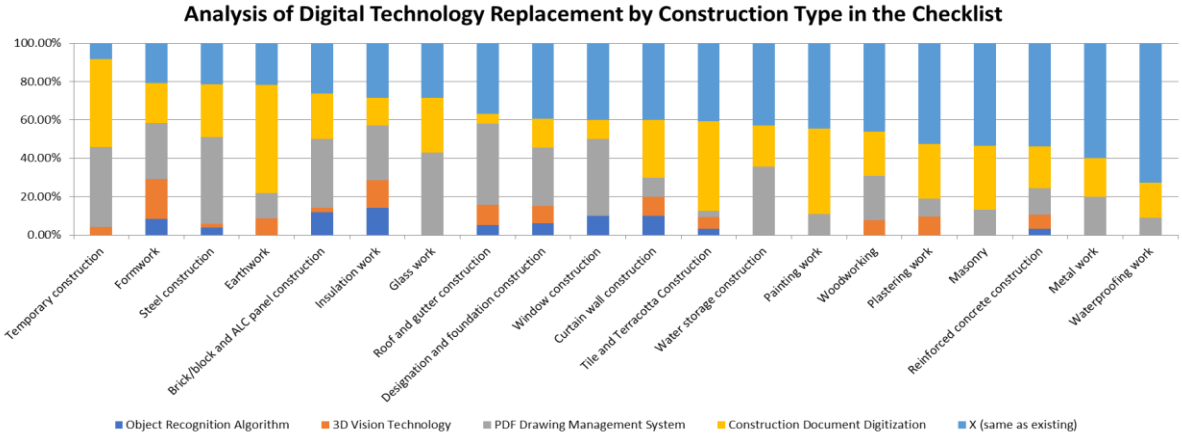

Figure 2. Analysis of Digital Technology Replacement by Construction Type in the Checklist

3.2. Evaluation of Productivity Enhancement in Construction Supervision Tasks due to the Adoption of Digital Technology

The purpose of introducing digital technology in construction supervision process can be described as an attempt to enhance construction productivity. Therefore, this study aims to evaluate the effectiveness of the digital technology-based checklist developed in this research by assessing the level of productivity enhancement when digital technology adoption and the utilization of the developed checklist are compared to conventional tasks. For this purpose, a survey of industry experts was conducted, and productivity enhancement evaluation was carried out after the adoption of technology.

The survey was conducted based on the current construction supervision checklist of the Ministry of Land, Infrastructure and Transport (MOLIT). To ensure the quality of survey responses and considering the vast quantity of checklist items for all trades, the scope was narrowed down to include five trades: formwork, designated and foundation works, earthwork, scaffolding, and reinforced concrete work. Twenty key checklist items were selected for these five trades to conduct the survey.

These five trades were chosen because their inspection rates represent more than 50% of all 20 trades based on the main office's icis (itm Construction Project Management Information System) database. Therefore, it was deemed that they could represent the overall productivity enhancement level of the entire checklist. Based on this rationale, 20 high-importance and high-workload checklist items were selected as the scope of this study. The 20 checklist items are composed of the following construction disciplines and tasks:

Table 6 Checklist Items by Construction Discipline

Number	Discipline	Task
1	Formwork	Formwork alignment, benchmark, formwork fencing
2	Earthwork	Excavation planning, excavation foundation
3	Designated and Foundation Work	Pile driving plan
4	Scaffolding	Installation, scaffolding assembly, setting up the scaffolding foundation, dismantling the scaffolding
5	Reinforced Concrete	Reinforcement assembly, reinforcement specification certificate, concrete mixing, installation preparation, concrete strength test

This study aims to identify effective digital technologies for improving productivity in each construction supervision task and to assess the level of productivity enhancement compared to existing tasks through the use of a digital technology-based checklist developed in this study. To achieve this, a survey was conducted to assess the productivity enhancement level compared to the existing workload after the introduction of digital technology for each of the 20 checklist items. The survey consisted of 46 questions, including two questions regarding the workload before and after the introduction of technology for each checklist item, as well as six questions related to respondent demographics.

The practical expert survey was conducted with 25 experts who have experience in the construction industry and architectural supervision work. The results were compiled to evaluate the level of improvement in architectural supervision work productivity due to the introduction of digital technology.

It was predicted that the introduction of digital technology would result in a reduction in workload (productivity improvement) ranging from 14% to 23% across all construction disciplines. This improvement in productivity was expected to be most effective in the following order: earthwork, reinforced concrete work, foundation/designated work, formwork work, and temporary structure work. Furthermore, when comparing the effects of different technologies, a workload reduction (productivity improvement) ranging from 16% to 28% was predicted for all technologies. This was anticipated to be most effective in the following order: object recognition algorithms, 3D vision technology, construction document digitization, and PDF drawing management systems. This information is summarized in Figure 3.

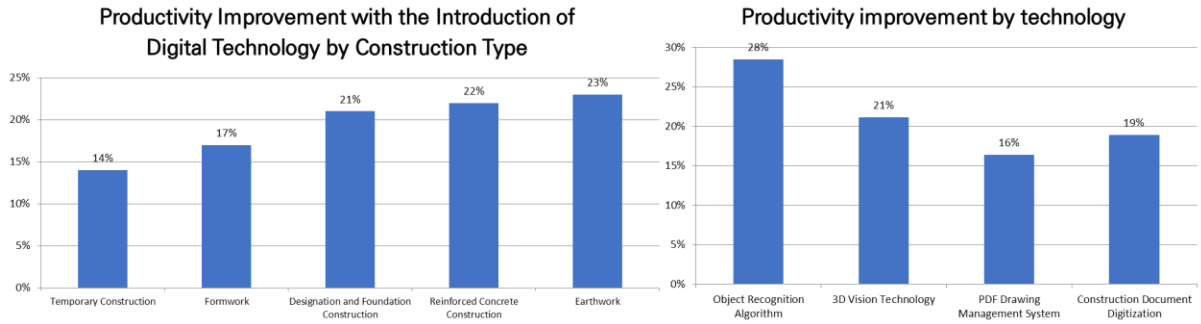

Figure 3. Productivity Improvement Evaluation Results by Construction Discipline and Technology

4. CONCLUSION

The purpose of this study is to support the effective introduction of digital technology into inspection tasks. Recognizing that the foundation of inspection activities relies on checklists, particularly considering the perspective of construction supervision practitioners, the aim is to develop checklists that can be efficiently utilized when introducing digital technology.

To successfully replace inspection tasks with digital technology, it was deemed necessary for the functionalities of the technology to correspond one-to-one with the tools or actions required for

conventional inspection tasks. Thus, an initial analysis of tools used in inspection tasks was conducted, identifying 12 key inspection task types. Based on these identified task types, effective digital technologies for productivity enhancement upon their introduction were organized. Four digital technologies were drafted, each corresponding to the 12 task types based on their feasibility for utilization. Subsequently, checklist development was carried out based on the defined criteria. Initially, the checklist items from the Ministry of Land, Infrastructure, and Transport were analyzed and categorized according to the identified key task types. Then, effective digital technologies and methods for digitizing tasks were reflected for each checklist item where technology was introduced, documented under the criteria and reference sections.

Ultimately, an evaluation of the developed checklist was conducted to demonstrate its practical effectiveness. Through analysis, it was determined that digital technology could replace over half of the existing tasks, indicating the potential for successful adoption. Subsequently, through practitioner surveys, the level of productivity enhancement resulting from technology adoption was assessed in terms of reduction in workload compared to existing tasks. This assessment could predict productivity improvements across all disciplines, expecting successful effects of technology adoption in inspection tasks. In conclusion, this study supported the effective introduction of digital technology into inspection tasks through the development of a digital technology-based checklist. Additionally, it aimed to understand practitioner perceptions of technology usage and formulate effective technology adoption strategies.

The development of the digital technology-based checklist in this study was conducted through theoretical approaches aimed at improving existing checklist formats. While surveys were conducted to reflect practitioner perceptions, the evaluation scope included not all construction types but extended up to reinforced concrete work. Future research aims to apply the developed checklist in practical settings to actively incorporate practitioner opinions and achieve more refined results. Furthermore, future endeavors aim to expand the evaluation scope of the developed product to yield more reliable outcomes.

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