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Calibrating Managers' Trust in ICT-Enabled Visualized Information: A Case Study of Heat Illness Prevention at Infrastructure Maintenance Sites

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ABSTRACT

In infrastructure maintenance, where worksites are geographically dispersed, ICT systems that visualize workers' heat illness risk are increasingly introduced, yet how managers trust and utilize the visualized information remains insufficiently understood. Regarding the system as an automation technology, this study examined the process by which managers calibrate their trust, based on the human factors concepts of "trust in automation" and "appropriate reliance." For a three-month trial introduction at an expressway maintenance and repair company, we combined a questionnaire survey (29 managers and 100 workers) with interviews (5 managers) in a mixed methods design. In the questionnaire, managers' change in safety management awareness was significantly above the scale midpoint, and the M-GTA analysis of the interviews derived a process in which managers calibrated their trust through comparison with experiential knowledge and recognition of measurement limitations, and reconstructed their hazard recognition while adjusting their reliance under that trust. The calibrated trust appeared to connect to changes in management behavior through the justification of interventions, and as numerical information became a shared criterion for judgment, the reconstructed hazard recognition was beginning to be shared within the organization. These findings suggest that proactive and continuous trust calibration by managers can contribute to realizing the value of system introduction.

Keywords: Trust calibration, Trust in automation, Appropriate reliance, Digital transformation (DX), Human-centered design, Safety management, Heat illness

INTRODUCTION

At geographically dispersed infrastructure maintenance worksites, it is difficult for managers to grasp conditions in real time, and heat illness risk fluctuates in complex ways with weather, workload, physical condition, and the passage of time. With the mandating of countermeasures under the revised Industrial Safety and Health Regulations effective June 2025 (Ministry of Health, Labour and Welfare, 2025), conventional management relying on

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morning briefings and the wet-bulb globe temperature (WBGT) index (ISO, 2017) has difficulty capturing rapid changes, and there is a need to resolve the information asymmetry between worksites and offices and to establish arrangements enabling organizational responses. Although the introduction of ICT that visualizes risk from physical activity levels and the surrounding environment is advancing in response, the extent to which managers trust and utilize the information remains insufficiently understood. This study therefore takes heat illness prevention at infrastructure maintenance worksites as a case, regards the system as an "automation technology" responsible for information acquisition, information analysis, decision and action selection, and action implementation (Parasuraman et al., 2000), adopts "trust in automation" and "appropriate reliance" in human factors as its theoretical framework (Lee and See, 2004; Parasuraman and Riley, 1997), and uses a mixed methods design to clarify how managers calibrate their trust in the visualized information and adjust their reliance, and how trust calibration connects to the reconstruction of hazard recognition, changes in management behavior, and organizational embedding. The contributions of this study are that it theorizes managers' acceptance process from field data with trust calibration as its axis (theoretical contribution) and that it presents key points for the operational stage that support calibration from the perspective of human-centered design.

RELATED RESEARCH AND THE POSITIONING OF THIS STUDY

Previous research on ICT utilization in the construction field—risk estimation (Hwang and Lee, 2017), device design (Nnaji et al., 2021), and reviews of application domains (Awolusi et al., 2018)—has placed emphasis on supply-side logic such as measurement accuracy, and the receiver-side perspective, in which information reorganizes managers' cognition and judgment and connects to organizational action, has been lacking. In the field, discrepancies in interpretation readily arise between "objective data" and "experiential knowledge" (Bresnen et al., 2003; Brown and Duguid, 1991), and technology acquires its meaning and functions within organizational practice (Orlikowski, 1992). The effect of introduction is thus not determined by device performance alone but depends on the extent to which managers trust the information and incorporate it into practice. In the human factors field, the utilization of automation is strongly influenced by "trust in automation": overtrust leads to misuse, and distrust leads to disuse (Parasuraman and Riley, 1997). It is therefore essential to achieve "appropriate reliance" through "trust calibration," which aligns trust with the system's actual capability (Lee and See, 2004). In this study, we distinguish between "trust," which is the object of calibration, and "reliance," which is the degree to which one depends on the visualized information under that trust, and we refer to changes in the level of the latter as "adjustment of reliance." Under this framework, explaining changes in awareness and behavior requires elucidating both the process by which trust is calibrated and the process by which it leads, through appropriate reliance, to updates in cognition and judgment and to behavioral change.

However, research on ICT utilization in field safety management has not empirically examined the process by which managers calibrate their trust; elucidating it is essential for identifying the conditions under which the value of introduction is realized, and herein lies the significance of this study. Note that this framework has mainly been developed on the assumption of a dyadic relationship between automation and an operator who performs tasks through direct operation (Lee and See, 2004; Parasuraman and Riley, 1997); this study applies it to the analysis of managers who conduct safety management remotely.

METHODS: RESEARCH DESIGN AND RESEARCH QUESTIONS

This study is a single-case study of an ICT system introduced on a trial basis (June 21 to September 20, 2025) at Company A, which performs maintenance and repair work on the Metropolitan Expressway, and we adopted a mixed methods design centered on qualitative analysis (Creswell and Plano Clark, 2017). In Phase 1, a questionnaire survey of 29 managers and 100 workers captured trends of change in safety management awareness and related items; in Phase 2, semi-structured interviews with managers were analyzed using the modified grounded theory approach (M-GTA) (Kinoshita, 2007) to theorize the transformation process centered on the calibration of trust in the visualized information. The primary object of analysis is the "managers"; the data from the "workers," who wore the devices, are positioned as reference data that complement self-reports concerning outreach and capture the burden and acceptance of wearing the devices. We first define the key concepts. "Change in safety management awareness," measured by the questionnaire, refers to the change in attention and concern that managers subjectively perceived after introduction; it is a single-item measurement and does not comprehensively measure hazard recognition, which consists of the identification and evaluation of hazard factors. In contrast, "reconstruction of hazard recognition" refers to the updating of understanding concerning the tasks, locations, and situations in which heat illness risk concentrates, and corresponds to the identification of hazards and their subjective evaluation in risk perception research (Slovic, 1987). These are related but are not regarded as identical constructs. "Management behavior" is defined as behavior that includes communication behaviors such as calling out as well as interventions such as instructing rest breaks and suspending work. In the framework of the previous chapter, changes in awareness and behavior correspond to outcomes that follow trust calibration and the adjustment of reliance; accordingly, this study starts from the outcome side in Phase 1 and traces the underlying process retrospectively in Phase 2. Based on the above, we set the following three research questions in correspondence with the theoretical framework. RQ1: After the introduction of the ICT system, how did managers perceive that their awareness of safety management had changed? RQ2: How do managers calibrate their trust in the visualized information, and how do they adjust their reliance under that trust? RQ3: How does trust calibration connect to the reconstruction of hazard recognition, changes in management behavior, and organizational embedding?

Overview of the ICT System and Visualized Information

The ICT system addressed in this study consists of a helmet-mounted ICT device, a cloud platform, and a management screen. The device acquires an estimated WBGT and estimates each worker's physical activity level from acceleration and other data. The calculation and determination of heat stress levels and abnormal states are based on the manufacturer's predefined algorithm; when a threshold is reached, the worker is prompted to rest by an alert sound, while the manager is presented with a status display and an e-mail notification upon detection of an abnormality. Hereafter, the immediate presentation to the worker is referred to as an "alert," the status displays and e-mail notifications to managers as "visualized information," and, among the latter, the displays and notifications indicating that a threshold has been reached or an abnormality detected as "system warnings" (Figure 1). As noted above, the system is positioned as an automation technology: sensor measurement, estimation of physical activity levels, determination of heat stress levels and abnormal states, and the alerts to workers and the status displays and e-mail notifications to managers correspond, in order, to "information acquisition," "information analysis," "decision and action selection," and "action implementation." Note that the object of analysis in this study is not the estimation accuracy of the algorithm but the operational process through which the visualized information connects to management behavior via managers' cognition and judgment.

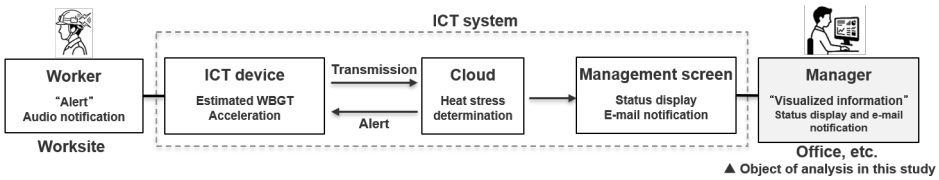


Figure 1: Overview of the ICT system.

Data Collection and Analysis Methods

In Phase 1, a questionnaire survey using five-point Likert scales was administered to all participants after the trial ended. The measured items were four items for managers (K1–K4) and four items for workers (S1–S4); the content of the items is shown in Table 1. In the analysis, a one-sample Wilcoxon signed-rank test was applied to the difference between each response value and the scale midpoint (3) to confirm significant deviations, and the effect size r was calculated for each item (Table 1). The primary item is K1 (safety management awareness), which corresponds to RQ1; K2–K4 and S1–S4 are positioned as exploratory and reference items. In Phase 2, to reflect the diversity of management functions, five managers were selected through purposive sampling based on age, years of experience, position, and worksites in charge (all male; two in their 50s, two in their 40s, and one in his 30s; 10–14 to 25 or more years of experience; one at site director level, two at section chief level,

and two at staff level), and the first author conducted semi-structured interviews of approximately 60 minutes within one month after the trial ended. The five were among the 29 managers who had responded to the questionnaire. Based on the Phase 1 results (see below), the analytical theme was set as "how managers calibrate their trust in the visualized information of the ICT system and how this leads to the reconstruction of hazard recognition and changes in management behavior," and the analytical focus person as "a manager who utilizes visualized information and conducts safety management remotely"; concepts were generated from the verbatim transcripts and integrated into categories using M-GTA. Note that the first author belongs to the parent company of Company A, the target company, and was a party involved in jointly planning this trial introduction. The concepts and categories were generated by the first author; to limit arbitrariness of interpretation, the generated concepts and interpretations were confirmed with the interviewees. The analysis was concluded when no new concepts were generated, at which point theoretical sufficiency was judged to have been reached. In addition, to confirm the measurement limitations recognized by managers, supplementary measurement of heat stress levels incorporating heart rate information was conducted with the same five workers, comparing the distributions between the period without heart rate use (August 1–28) and the period with heart rate use (August 29–September 19). Prior to the survey, the anonymity of responses and the prohibition of use for any other purpose were explained, and consent was obtained.

PHASE 1 RESULTS

The main results are shown in Table 1 (response rate 100%, no missing data). Managers' change in safety management awareness (K1) was $M = 3.72$, and its deviation from the scale midpoint of 3 was statistically significant ($p < 0.001$, $r = 0.848$). Among the reference items, increase in outreach to worksites (K2) was above the scale midpoint but not significant (Table 1), with large variability in responses across managers. In contrast, workers' perception that outreach had increased (S2) was significant, showing a difference from K2; however, because the respondents, question wording, and sample sizes differ, direct comparison is not possible, and since the 95% confidence interval of K2 (Table 1) includes the mean of S2, this difference may reflect differences in statistical power arising from sample size. Workers' change in safety awareness (S1) and psychological burden (S4) were also both significantly above the scale midpoint, indicating the coexistence of stress accompanying the feeling of being watched over. Regarding usability, the intelligibility of the management screen (K3) and the battery endurance (S3) were evaluated positively, whereas ease of grasping risk (K4), which corresponds to usefulness, was not significant.

The above confirmed the heightening of awareness change corresponding to RQ1, but the process of that change cannot be revealed by the quantitative

data. Phase 2 therefore qualitatively analyzes the trust calibration process underlying this heightened awareness (RQ2) and the connection to behavioral transformation and embedding indicated by the difference between K2 and S2 (RQ3).

Table 1: Results of the questionnaire survey (K1–K4: managers, N = 29; S1–S4: workers, N = 100).

Classification	No.	M	SD	95% CI	p	r	Decision
(a) Change in safety management awareness	K1	3.72	0.84	3.40–4.04	<0.001***	0.848	Reject H_0
(b) Increase in outreach to worksites (workers)	K2	3.34	1.01	2.96–3.72	0.102	0.438	Fail to reject H_0
(c) Usability (intelligibility of the management screen)	K3	3.59	0.91	3.25–3.93	0.003**	0.688	Reject H_0
(d) Ease of grasping risk	K4	3.14	0.95	2.78–3.50	0.449	0.181	Fail to reject H_0
(e) Change in safety awareness	S1	3.42	0.77	3.27–3.57	<0.001***	0.858	Reject H_0
(f) Increase in outreach from managers	S2	3.56	1.04	3.35–3.77	<0.001***	0.690	Reject H_0
(g) Usability (battery endurance)	S3	3.47	1.13	3.25–3.69	<0.001***	0.517	Reject H_0
(h) Psychological burden	S4	3.43	1.13	3.21–3.65	<0.001***	0.501	Reject H_0

Note: All items used five-point Likert scales (3 = scale midpoint); for S4, higher values indicate greater burden. p is from a one-sample Wilcoxon signed-rank test (two-tailed) with the scale midpoint as the test value; the effect size is $r = Z/\sqrt{n}$. Managers (K) and workers (S) differ in respondents, question wording, and sample size, and are not statistically compared. ** $p < 0.01$; *** $p < 0.001$.

PHASE 2 RESULTS: CATEGORY STRUCTURE AND CORRESPONDENCE WITH THE RESEARCH QUESTIONS

The M-GTA analysis derived five categories, four subcategories, and 12 concepts from the verbatim transcripts (Table 2; [ ] = categories, " " = subcategories, < > = concepts). The five categories constitute a stepwise process originating from the visualized information: [Calibration of Trust in Visualized Information] and [Adjustment of Reliance Accompanying Trust Calibration] correspond to the process of trust calibration (RQ2), and the remaining three categories correspond to the destinations to which calibrated trust connects (RQ3). Note that what [Calibration of Trust in Visualized Information] updates is trust in the system, whereas what [Reconstruction of Hazard Recognition] updates is cognition of hazards in the field; both arise from the same practice of comparison but are distinguished because the objects of updating differ. The storyline is

described along Figure 2 (concrete examples of each concept are given in Table 2). Managers do not accept the visualized information as given; they first engage in [Calibration of Trust in Visualized Information]. In "trust formation," they form trust in the data by repeatedly confirming agreement between experiential knowledge and data and correcting gaps between assumptions and measurements, while in "suppression of overtrust," they discern, through recognition of measurement limitations, situations in which physical strain is difficult to capture. The trust calibrated through these two directions first manifests behaviorally as [Adjustment of Reliance Accompanying Trust Calibration]: in "establishment of reliance," managers treat the absence of abnormalities as a cue for watchful waiting and refrain from excessive intervention under the reassurance of being able to grasp conditions even remotely, and in "suppression of excessive monitoring," some managers deliberately distanced themselves from the information and adjusted their monitoring distance (the frequency of accessing information and the frequency of intervening in the field) on their own. Under this adjusted reliance, managers arrive at [Reconstruction of Hazard Recognition], reinterpreting with data as cues the tasks and locations in which hazards concentrate and updating their own cognition. In [Connection to Practice], interventions are justified on the grounds of "warnings indicated by the machine" and interpersonal friction is suppressed; in [Organizational Embedding], numerical information becomes a shared criterion for judgment and—through the irreversibility whereby, once the usefulness of data-based management has been experienced, it becomes difficult to return to conventional intuition-based management—safety management utilizing visualized information was perceived by managers as becoming embedded as an organizational practice.

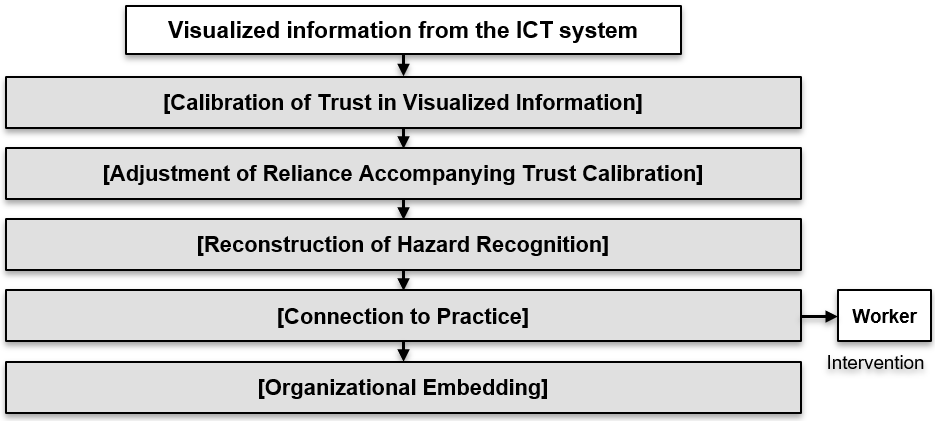


Figure 2: Conceptual diagram of the transformation process.

Table 2: Categories and concepts constituting the process of trust calibration.

(Category]	"Subcategory"	<Concept>	Example	n
(Calibration of Trust in Visualized Information]		<corroboration of experiential knowledge by visualized information>	"For me it's 'yeah, it really is hot.' For example, daytime landscaping work is sometimes done under the blazing sun in places with no roof, where the reflection off the asphalt and the like is strong, so naturally you think, of course it's hot."	4/5
	trust formation'	<correction of gaps between experiential estimates and numerical data>	"[A gap between what I had assumed— 'this is just ordinary work' —and the harshness I saw in the actual data] does exist. It does, and above all those numbers are right there in front of you, so for better or worse you start paying attention."	2/5
	"suppression of overtrust"	<recognition of the measurement limitations of visualized information>	"[For the painting crew and the crack-repair crew, the amount of movement] drops." "But [because the work is in an enclosed space inside the scaffolding, in reality] it is tough for the people on site."	3/5
[Adjustment of Reliance Accompanying Trust Calibration]		<formation of reassurance through confirming normal values>	"We couldn't really tell what was going on at the site, so I felt uneasy. […] When I felt uneasy, I would call and ask." "Being able to see it is reassuring. [...] What is good is that you can also see when things are not abnormal."	4/5
	"establishment of reliance"	<data-based justification of "watchful waiting">	"The judgment that if there is no word from the site, there is probably no particular problem." "If there is none [no alert], you can take it that things are still all right."	3/5
	"suppression of excessive monitoring"	<stress from excessive monitoring and deliberate distancing>	"I don't keep the monitor [the management screen] up all the time. I open it for the things that worry me. Basically, I think that's fine." "The moment you tell managers they absolutely must watch it. stress hits the maximum."	2/5

(Continued)

Table 2: Continued.

(Category]	"Subcategory"	<Concept>	Example	n
[Reconstruction of Hazard Recognition]	–	<re-recognition of hazardous work in the field>	"From my point of view, landscaping work—work done outside—gets direct sunlight, so tremendous values came out. I think this is dangerous. It made me think again that it really is hazardous [re-recognition]."	4/5
	—	<inference of work content based on abnormal values>	"Everyone's average is high, but when someone spikes way up, you can imagine, 'Is this, say, someone collecting concrete debris [waste material]?'"	3/5
[Connection to Practice]	–	<instructions grounded in system warnings>	"Without that, if you phone them, they'll say, 'What do you know about the site?'" "The numbers show it's dangerous, so […] it's not me saying it—that alert is saying it, so you have to hold off a bit. […] You can give cautions as if it were coming from a third party."	3/5
	–	<data-based justification of work suspension>	"Part of me thinks, 'Come on, push on a little longer,' but when it actually reads 'forty-something degrees' […] you think, 'All right, it really is hot.' Then you can step on the brake for them."	4/5
(Organizational Embedding]	–	<formation of a common reference standard based on numerical information>	"It beats arguing from gut feeling. Intuition matters too, but numbers are more persuasive. 'We are stopping today'—we stopped because of this number; you convey it as a criterion for the decision. […] It is not proof, but it becomes one factor in the explanation."	5/5
	–	<reliance on visualized information and irreversible embedding>	"If it turned out we didn't have it next year, the feeling is we'd rather have it. This time we have come to know it, haven't we? Once you realize it can be used this way, you feel uneasy without it."	5/5

Note: The numbers of applicable interviewees (n) are approximate indications and do not represent the importance al the concepts. [Reconstruction of Hazard Recognition]. [Connection to Practice], and [Organizational Embedding] have no subcategories because each consists of two concepts forming a single cluster. The examples are excerpts of representative utterances.

DISCUSSION: CALIBRATION OF TRUST IN VISUALIZED INFORMATION AND ADJUSTMENT OF RELIANCE

As a concrete example of "suppression of overtrust," in painting work inside enclosed, confined scaffolding that had been recognized from experience as harsh, the heat stress level calculated from physical activity was low because of limited movement, and the sense of incongruity at this discrepancy can be interpreted as having led to the recognition of a measurement limitation, namely that estimation based on physical activity has difficulty capturing physical strain. This recognition was a lowering of trust limited to the situations concerned, and because use continued, it did not lead to disuse; it can thus be interpreted that managers calibrated their trust so as to fall into neither overtrust nor distrust. The calibrated trust manifested at the level of reliance—in the differentiated use of intervention and watchful waiting and in the self-adjustment of monitoring distance—which can be interpreted as the practice of appropriate reliance. In the supplementary measurement incorporating heart rate, undertaken from the recognition of measurement limitations, the proportion of occurrences in the high heat stress range (level 3.0 or above) reached approximately 2.4 times that of the period without heart rate use. Although strict control of environmental conditions is difficult, this difference in tendency is consistent with the experiential knowledge that work inside scaffolding is harsh, suggesting the prevention of overtrust in values based on physical activity alone. Prompted by this recognition, the heat stress thresholds were also reset on the system side at an interim review one month after introduction—a concrete instance in which opportunities to grasp measurement limitations and recalibrate trust were built into operation, consistent with the theory of continuous trust calibration (de Visser et al., 2020).

Reconstruction of Hazard Recognition and Organizational Embedding

As the information asymmetry was mitigated, managers interpreted abnormal values by comparing the visualized information with their experiential knowledge and, by continually referring to it as material for judgment, re-recognized the tasks and locations in which hazards concentrate, such as outdoor work under direct sunlight. That is, [Reconstruction of Hazard Recognition] can be interpreted as an updating of cognition that occurred as the visualized information was incorporated into judgment under calibrated trust. This qualitative finding is consistent in direction with K1. Whereas K1 captures changes in attention and concern with a single item, [Reconstruction of Hazard Recognition] describes concrete updates of understanding based on the narratives. Both are self-reports and their correspondence has not been independently verified, but the updating of hazard recognition is considered to have arisen not through the automatic presentation of information alone but through managers' calibration and reinterpretation. Note that K4 asks about the identification of time periods of high heat illness risk and does not measure updates of understanding concerning the tasks and locations in which hazards concentrate; therefore, the fact that K4 was not significant does not contradict this interpretation. Calibrated trust also led to changes in management behavior, as shown by [Connection to Practice]. With numerical

information serving as grounds for intervention, the discrepancies in interpretation that readily arise vis-à-vis experiential knowledge appear to have been mitigated and interpersonal friction suppressed. This change was also perceived on the workers' side (S2), whereas no significant increase was found in managers' self-reports (K2); this difference is considered to stem from differences by role in the extent of calling out, but it cannot be determined from this study, and the qualitative findings and S2 only suggest changes in management behavior and do not indicate an increase in outreach among managers as a whole. It was suggested that, as numerical information becomes a shared criterion for judgment, the reconstructed hazard recognition may be shared within the organization and become embedded as a foundation for safety management. However, the irreversibility indicated by <reliance on visualized information and irreversible embedding> includes the danger that, if reliance deepens while awareness of the system's measurement limitations (see the previous subsection) fades, it may turn into overtrust—entrusting to the system even hazards that the system cannot capture—and, by extension, into misuse. Still, this irreversibility is a prospect based on the narratives of the five managers during the three-month trial and does not demonstrate long-term embedding. The setting of the monitoring distance involves both monitoring stress on the managers' side and psychological burden on the workers' side (S4), indicating the coexistence of safety benefits and worker burden. Taken together, the heightened safety management awareness (K1) can be interpreted as managers' perception, as a change in attention, of the process of reconstructing hazard recognition originating from trust calibration, and it was suggested that this may proceed through management behavior toward organizational embedding.

Practical Implications and Limitations

The findings offer four practical implications for the human-centered operation of the technology. First, because trust calibration is considered to arise from the comparison of visualized information with experiential knowledge, opportunities for such learning should be organizationally designed and provided at the time of introduction. Second, measurement limitations should be made visible and continuous feedback such as the threshold resetting in this case should be incorporated, developing an operational environment in which managers can periodically recalibrate their trust. Third, because psychological burden on the workers' side (S4) was confirmed and managers' burden of constant monitoring and the risk of over-intervention were also suggested, guidelines for adjusting the monitoring distance and consideration of privacy in data acquisition (Nnaji et al., 2021) are necessary. Fourth, because <instructions grounded in system warnings> contributed to suppressing interpersonal friction, visualized information should be incorporated into operational design not only as a warning function but also as a starting point for dialogue and intervention. These measures do not replace conventional practices such as patrols and health checks but add, on that basis, a means of capturing changes in site conditions. On the other hand, this study has three limitations. First, generalizability is

limited because this is a single-case study. Second, both phases constitute an interpretive model based on retrospective self-reports, lacking objective usage logs and outcome indicators (e.g., the number of heat illness cases); the effect of the regulatory revision cannot be separated from that of system introduction, and temporal order and causal chains cannot be determined. Third, because Phase 2 is based on managers' self-reports alone, verification of the appropriateness of reliance from workers' perspectives, and assessment at the organizational level, remain tasks for future research. Additionally, the setting unique to this study, in which the outcomes of trust calibration extend not to the user but to others (the workers), differs from the conventional operator assumption, and elucidating its implications also remains a task for future research.

CONCLUSION

Taking heat illness prevention at infrastructure maintenance worksites as a case, this study examined the process of managers' calibration of trust in visualized information through three research questions. Regarding RQ1, the change in safety management awareness was significantly higher than the scale midpoint, and this heightening is not inconsistent in direction with the process from trust calibration to the reconstruction of hazard recognition. Regarding RQ2, it was suggested that managers calibrated their trust so as to fall into neither overtrust nor distrust through comparison with their experiential knowledge and recognition of measurement limitations, adjusted their reliance by differentiating between intervention and watchful waiting, and conducted calibration continuously through operation. Regarding RQ3, under calibrated trust and adjusted reliance, managers re-recognized the tasks and locations in which hazards concentrate and reconstructed their hazard recognition, and a path was also suggested by which that trust connects to changes in management behavior via the justification of interventions. As numerical information becomes a shared criterion for judgment, the reconstructed hazard recognition is beginning to be shared within the organization and can serve as a foundation for safety management. The processes above could be described consistently with the core concepts of "trust in automation." These findings suggest that the value of introducing an ICT system is not determined by measurement accuracy alone, and that proactive and continuous trust calibration by managers is one of the important conditions for realizing that value. This study offers a perspective that reframes the DX of safety management not as the introduction of devices and tools but as a transformation of managers' cognition and operation.

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