

INFORMATION DISSEMINATION IN THE AGE OF GLOBALISATION: WHAT ARE THE BARRIERS AND HOW CAN WE HELP? ANALYSIS OF THE RESULTS OF A MESSAGE-GAME EXPERIMENT

Hiroko Oe, Bournemouth University
Yasuyuki Yamaoka, The Open University of Japan
Kosuke Sato, The University of Tokyo

ABSTRACT

In today's global business world, the ability to provide the expected goods and services with a shared corporate philosophy, an adherence to quality and a consistency across the procedures is a key issue that can determine the survival of the company. To achieve this, each company must share a unified runbook among its global branches, which provides the basis of a unified quality maintenance and sustainability strategy for the business. The runbook essentially presents a repository of know-how for a company, a corporate competency in itself. However, there are a number of cases where the instructions using the runbook have worked well in the home nation (Japan) but did not necessarily translate well to the branches in other countries or regions. The question remains as to why this should be. To answer this question, a message-game experiment involving graduate students was conducted, and it was found that unfamiliar words can cause significant information attenuation, i.e., unfamiliar words cannot be remembered and certain aspects of the instruction that the leader aims to get across may not be understood at all by the information receivers. In the experiment, an empirical test was conducted according to our previously developed 'information propagation model' (Yamaoka & Oe, 2021) aimed at better understanding the characteristics of the way information flows in the global age. As a result, it was confirmed that simply translating the runbook into Japanese and applying it to employers experiencing different socio-cultural contexts will not achieve the desired goal, and the introduction of the concept of a universal design was thus proposed as one solution.

Keywords: Runbook, Information Propagation, Communication Bottleneck, Message-Game Experiment, Universal Design

INTRODUCTION

Background of the Study

In the global age, numerous nations are extrinsically involved and a situation may arise where in attempting to achieve a common goal, the different experiences, languages and cultures of the members of any given company may lead to some inconsistency. How to provide the expected quality of goods and services through a shared corporate philosophy and appropriately consistent procedures is a key issue for the survival of the company (Gunasekaran et al., 2019).

One common example relates to the so-called runbook, which essentially provides a single source of know-how for the company that is aimed at ensuring an effective corporate competency. However, it is not always the case that specific instructions using the relevant work standards are well understood both in the nation of origin and the branches in other countries or regions. Indeed, it has been widely noted that despite the direction of members

who have reached a certain level of education using the runbook in their own language, the expected results are not always achieved (Choo et al., 2020).

Aim of the Study

The failure to achieve the desired goal may be related to how the members of the domestic firm do not behave in the way that the firm implicitly expects. In other words, it can be hypothesised that the home country's culture and customs come into full play when the members of the other country/region, who are the recipients of the information, are unable to accept the intentions of the sender or find that the information attenuation is not sufficient for encouraging appropriate response behaviour. To test this hypothesis, a message-game experiment involving business graduate students was conducted, with the results analysed with the aim of extracting suggestions regarding the communication and information dissemination in the global age.

THEORETICAL DISCUSSIONS

History of Multinational Companies

Thomas Friedman, a reporter from the New York Times, once made the following shocking statement: 'The world is flat' (Friedman, 2007), arguing that the global internet information network had saved remote countries from information deprivation in terms of economic power. Furthermore, Friedman suggested that we have entered an era of fierce intellectual and industrial competition between researchers and technicians from countries that had previously been stifled and described as third-world countries.

The statement, 'the world is flat', is an iconic statement that effectively describes the present time in a few words, and even without Friedman's announcement, the 'fierce' competition would have commenced throughout the globe. No country is an exception to this state of play, and none can escape the global intellectual and industrial competition.

Looking back at the history of multinational companies in, for example, Europe, multinational companies first emerged in the 1920s to the end of the 1930s by means of 'decentralised association' (Wang et al., 2021). The background at that time was one where high trade barriers existed between countries and high logistical costs were common due to the underdeveloped logistics technology and networks. Given these constraints, the companies incorporated within each country had no choice but to operate as effectively as possible within the context of their own national system. The advantage of this approach was that it was strategically aimed at preventing the growth of local competitors through being decentralised and self-sufficient within the company's home nation (Lopez, 2021).

Meanwhile, the form of multinational enterprise that emerged in the United States in the 1940s and late 1950s can be described as 'cooperative'. Here, while the strategic direction came from the home country, the subsidiaries in each country developed their business by coordinating their own competencies with those of the home country (Bartlet & Ghoshal, 2002). However, the employees, facilities and equipment were allocated on a country-by-country basis, with the strategic aim of transferring the home country's technological and management processes to each country (Mukherjee et al., 2021).

Later, this model was extended to other parts of the world. For example, multinationalisation emerged in Japan in the 1960s and late 1970s. This was known as the 'central hub model', with the strategic direction originating from Japan, the home country (Gereffi et al., 2021). Here, the subsidiaries in each country were not allowed to disobey the directives protracted from the home nation, nor were they allowed to propose locally adapted business models. In short, the competencies were 'owned' by the head office. This was largely related to the traditional Japanese approach, wherein back-end processes are pulled into upstream processes, and the strategic objective of pursuing global efficiency and ensuring a uniformity

of cost and quality assurance systems through data-driven strategies for globalised value creation has received greater attention, especially within the context of the post-COVID era (Rengarajan et al., 2022).

Modelisation of the Globalised Impact on Business Strategies

The characteristics of the behaviour of multinational companies in modern society undoubtedly differ from those of previous eras. Today, trade restrictions have become less restrictive, and the development of logistics technology and networks has made global distribution possible. In terms of intellectual property, it has become more difficult for one company to monopolise the technology and open standards have become increasingly common. Indeed, the advent of basic software (OS) has resulted in the source code of the core being made public, meaning engineers throughout the world can refer to it and, on identifying any potential improvements, can suggest them to the code control board. The most famous example here is Linux, a family of open-source operating systems that was developed on the basis of UNIX to compete with Microsoft (Maney et al., 2011)

Meanwhile, relatively cheap and well-educated labour is already available in the world market in terms of the reserve currency. In other words, just as water flows from a high place to a low place, or just as wind blows from a high-pressure area to a low-pressure area, if the same level of work can be carried out, it is natural for the work to flow from high-cost areas to low-cost areas. In accordance with this, assuming the existence of a global market, it is possible to procure human resources, equipment and raw materials from the most optimised location at the production site and deliver goods and services using a global distribution network. The next generation of strategic multinationals must be able to harness the best minds and skills, both internally and externally, to ensure that they are what Palmisano (2006), the former CEO of the global company IBM, termed a ‘globally integrated enterprise’.

Discussion Point and Experimental Design for Communication Bottlenecks

The question remains as to why new forms of multinational enterprise, i.e., globally integrated groups of companies with educated and trained human resources sourced from global markets, create information transmission bottlenecks. This phenomenon is different from the problem that occurred, for example, in Japan in the 1960s and 1970s with the ‘centralized hub’ model. The latter issue occurred because, at that time, the diversified level of education and the different cultural backgrounds of the company members in the destination country differed greatly from those of the headquarters in the home country, which often meant the communication regarding basic aspects was not good and the quality level and productivity expected by the headquarters could not be achieved in the destination country (Leonavičienė & Burinskienė, 2022).

The more serious issue of today differs in that in the new multinational corporate paradigm, the level of education and training of the members in the destination country is not necessarily low. However, bottlenecks in the transmission of information continue to hinder operations. This is in stark contrast to how the communication between companies that share the same culture, region and industry rarely results in information transfer discrepancies (Kasperson & Kasperson, 2022), with effective communication generally ensuing using a minimum of words (Oe & Yamaoka, 2021; Weeks et al., 2021).

METHODOLOGY

Basic Model for the Game Design

In the design of the information message game adopted in this study, the theory of the human sensory scale (Stevens' power law) devised by Stevens (1957a) was used as a source of reference. According to Stevens, the level of sensation (E) is proportional to the constant (K) and the stimulus intensity (I) multiplied by (n), where (n) is the number of stimulus types and should vary according to the type of stimulus:

$$E = K * I^n \dots\dots\dots (1)$$

Message-game Experiment

A verbal communication experiment involving a number of graduate students was conducted to determine the rate of decay of the degree constant (a) at which the information was transmitted to the subject. The experiment was conducted in January 2022 with a total of 60 university graduate students, with the aim of investigating the degree of information degradation or 'clouding' caused by human intervention during the propagation of the information. The team was divided into three groups consisting of three, seven and ten individuals, respectively. The process was as follows:

- 1) The first team members gathered in front of the podium.
- 2) The first team member watched and memorised the text for 15 seconds.
- 3) The first member returned to each row and listened to the second member.
- 4) The message had to be delivered once only in oral form.
- 5) The test was carried out four times in total using different texts.

The following four task sentences were devised for the transmission under two conditions: i) the sentence must consist of separate components and ii) the sentence must contain verbs, nouns, adjectives, adverbs and numerals:

- (1) The man/ ruled/ the vast/ plains/ wearing/ a red/ foreign/robe (8) (Studio Ghibli, 1984).
- (2) An astronomical/ elaborate/ clock/ was made/ in the ancient/ Greek/ city of Antikythera/ in/ the first century/ BC (9) (Rybczynski, 2001).
- (3) The Contemporary Culture Research Center/ actively/ promoted/ research projects/ on the theme of/ youth/ subculture/ in the late 1970s (8) (Yoshimi, 2001).
- (4) A study conducted/ in 1990/ suggested/ 450 grams/ of Saharan/ dust / per 0.4 hectares/ were falling/ on the Amazon River/ every year (10) (Gore, 2007).

Finally, each team compared the breakdown between the original text and the transmitted text, with the breakage point method used based on the following rules:

- Misalignment between the source text and the word (-1 point/word)
- Replacement with a similar word (-1 point/word)
- Omissions (-3 point/word)
- Context/meaning unclear (-3 point/word).

The experiment was carried out at the Faculty of International Studies at a university in Tokyo Japan, with the help of postgraduate students with experience of working in multinational companies. Video and photographic backup data of the experiment were obtained after confirming the participants' willingness to participate and obtaining their

written consent. The results of the verbal collapse of the message game were saved in Excel format, which were visible to the participants on the spot and used as material for discussion with the students as a part of the module practices. All data from the game were anonymised and coded for data analysis and made available for quantitative analysis. It should be noted that the participants in the game consisted of multinational students with experience of working in English, with all the materials used in the game and the text of the messages used in the game presented in this language.

FINDINGS AND ANALYSIS

Exploring the Impact of Transmitted Energy

The level of sensation (E) can be the first trigger of behavioural change and it is feasible to suggest that a certain level of sensation will lead to the next behavioural step. However, exactly when the behavioural change is triggered remains unclear. In this respect, the model of behavioural excitation proposed by Oe and Yamaoka (2008a), wherein the focus is on the interaction between the information sender and the receiver, was used. In terms of the reception and transmission of information, the transmitted energy is inversely proportional to the square of the distance and decay; however, if disseminated within a certain distance, it will influence others in terms of, for example, some form of behavioural change. This energy can be termed the ‘threshold’ of the information. If the receiver receives energy that is higher than the threshold, excitation occurs, and the influence of the information on the receiver is complete (DeVito, 1986). Fukada (1998) argued that communication is established when the information changes the receiver's own thinking and behaviour, who then feeds back to the sender.

The main research question in this paper is why, despite the use of a work standard that is effective in the home country, the desired project objectives may not be achieved in a given foreign branch. As such, the aim was to ascertain why the work standards do not bring about the expected behavioural change (Kim, 2021).

Here, Eq. 2 was proposed as a hypothetical model of behavioural change based on Eq 1, with the stimulus intensity (I) in the latter replaced by the education and training level (x) of the partner firm and the constant (K)—the degree to which the information was transmitted to the partner—replaced by the constant (a). The number n , which should be different depending on the intensity of the stimulus, was assumed to be $n = 2$ for convenience.

In addition, an index of differences in culture and customs (ϕ) was introduced, which indicated whether there were more or less differences between the culture and customs of the partner country and the culture and customs of the home country. A maximum value of 1.0 was given when there was zero commonality, with the number decreasing as the number of common elements increased. The cultural and customary difference index (ϕ) is an intrinsic factor that leverages (a), (x) and (n).

$$Y = ax^2 / \phi \dots\dots\dots (2)$$

Next, the state of behavioural change was investigated, with the implications of Eq. 2 as follows:

- i. The behavioural change of the subject is (y).
- ii. The degree constant of the information transmitted to the subject is (a). The maximum value = 1.0.
- iii. The degree of education and training of the subject is (x). The maximum value = 1.0.
- iv. The power (n) is assumed to be 2.
- v. In the first section of Eq. 2, ax^2 denotes the basic information content.
- vi. The difference index of the partner's culture and customs is defined as (ϕ). When there is no cultural common denominator between the partner country and the home country, the maximum value = 1.0 and the minimum value = 0.1.

In summarising Eq. 2, the ax^2 in the first section divides the amount of basic information by the difference index of culture and customs (ϕ), which means that (ϕ) can be leveraged for the amount of basic information. If there is no difference in culture and customs, (ϕ) takes the minimum value of 0.1, which means that the amount of basic information ax^2 can be leveraged by a factor of 10. In other words, we can increase the behavioural change (y) by a factor of $10\times$.

Example 1: Let us assume a group of full-time employees who have received higher education and above and are well trained internally. Here, the employees will exchange information in a high-texture manner, also known as '*Aun no Kokyu*'. Meanwhile, in this example, it is assumed that the degree constant (a) is 0.9, which is as close as possible to the perfect number 1.0. Next, the degree of education and training (x) is assumed to be 1.0 since it meets or exceeds the level expected by the company. Finally, the cultural and customary differences index (ϕ) is set to the minimum value of 0.1 since the countries are identical and there are no cultural differences.

On substituting these hypothetical numbers into Eq. 2, the following result could be obtained:

$$Y = 0.9 * 1.02 / 0.1 = 0.9 / 0.1 = 9.0$$

Example 2: Let us assume a group of regular employees from the partner country and a group of regular employees at the headquarters who are advanced in terms of both education and internal training. Let us also assume that the degree constant (a) is 0.8, which is the degree to which the information is transmitted to the partner. Next, the degree of education and training (x) is assumed to be 1.0 since it exceeds the level expected by the company. The cultural and customary difference index (ϕ) is then assumed to be 0.3 for the partner country and the home country (Japan).

On substituting these hypothetical numbers into Eq. 2, the following result could be obtained:

$$Y = 0.9 * 1.02 / 0.3 = 0.9 / 0.3 = 3.0$$

This example implies that while the employees' education and internal training are both advanced, the degree of behavioural change (y) in the other party through communication will be lower in each country.

Example 3: Here, the pattern of education and internal training is assumed to pertain to regular employees of the partner country who have an intermediate level education (high-school level and basic training internally) and regular employees at the headquarters. The degree constant (a) is assumed to be 0.7, which is the degree to which information is transmitted to the partner, while the degree of education and training (x) is assumed to be 0.6 since it is slightly below the level expected by the company. The cultural and customary difference index (ϕ) is then assumed to be 0.3 for the partner country and the home country (Japan).

On substituting these hypothetical numbers into Eq. 2, the following result could be obtained:

$$Y = 0.7 * 0.62 / 0.3 = 0.252 / 0.3 = 0.84$$

Example 3 indicates that when the education and internal training of the partner country employees is intermediate, the degree of behaviour change (y) of the partner will decrease, even if the cultural and customary difference index (ϕ) is the same.

Example 4: Here, the focus is on dealing with a foreign country with a different culture and religion for the first time. It is assumed that the training of the employees of the other country and the internal training are of an intermediate level, while the degree to which the information is conveyed to the other party is assumed to be $(a) = 0.5$ and the degree of education and training (x) is assumed to be 0.6 since it is slightly below the level expected by the company. The cultural and customary difference index (ϕ) is then assumed to be 0.8 for the partner country and the home-nation headquarters.

On substituting these assumptions into Eq. 2, the following result could be obtained:

$$Y = 0.7 * 0.62 / 0.8 = 0.252 / 0.8 = 0.315$$

Example 4 indicates that even under the same conditions as in Example 3, where the education and internal training of the partner country employees is intermediate, the degree of behavioural change (y) of the partner will drop by almost 50% when the culture, customs and religion of the partner country are different.

Having outlined the information propagation equations under these hypothetical conditions, the results of the experiment carried out with the help of voluntary participants can now be outlined and discussed. It should be noted that the degree of education and training of those undergoing the test under the four different pattern conditions outlined here was not assumed in this pilot study, while the experiment was conducted with the cooperation of a total of 60 individuals to confirm the validity and operationalization of the basic model. In the experiment, the number of people in each group was varied and different message texts were prepared, with a critical discussion of the results of the experiment subsequently conducted.

Outcome of the Experiments

The breakage among the four types of communicative sentences was determined, as shown in Table 1. Since each example sentence consisted of eight to ten syllables, the data was normalised to have ten syllables.

The constant (a) was obtained using the following formula: if all the syllables are completely broken, the result is 10 (syllables) multiplied by -3 points, i.e., -30 points. Using this as the denominator, the resultant score was divided by the -30 points.

Finally, the result was subtracted from 1 to give the following:

$$a = 1 - (result / -30) \dots\dots\dots (3)$$

The constant (a) should diminish along the information decay curve. As expected, the three-person group had the lowest breakage of 0.68, while the 7–8-person group returned a value of 0.49 and the 9–10-person group a value of 0.37. The constant (a) for all teams across all the tasks was 0.51 (Table 1).

The fact that the constant (a) was less than half of the expected value suggests that verbal communication has a higher degree of information attenuation than expected. Meanwhile, Figure 1 shows the mean values of (a) for each team across the four tasks. Here, there was a significant variation among the teams, with some teams with a smaller number (3 members) returning a constant (a) similar to that of teams with 7–8 members. Overall, the coefficient clearly decreased as the number of transmitters increased (Figure 1).

Table 1 RESULTS OF THE MESSAGE-GAME EXPERIMENTS							
Member amount and team name	1st task	2nd task	3rd task	4th task	Team Ave.	Retention of the original information	Ave. retention of the original information
10-A	-27.50	-22.22	-23.75	-23.00	-24.12	0.20	0.37
10-B	-17.50	-16.67	-17.50	-11.00	-15.67	0.48	
9-C	-25.00	-16.67	-12.50	-14.00	-17.04	0.43	
7-D	-22.50	-17.78	-12.50	-17.00	-17.44	0.42	0.49
8-E	-8.75	-15.56	-21.25	-15.00	-15.14	0.50	
7-F	-12.50	-16.67	-12.50	-12.00	-13.42	0.55	
3-G	-10.00	-8.89	-1.25	-4.00	-6.03	0.80	0.68
3-H	-3.75	-16.67	-11.25	-4.00	-8.92	0.70	
3-I	-7.50	-24.44	-12.50	-11.00	-13.86	0.54	
Average	-15.00	-17.28	-13.89	-12.33	-14.63	0.51	0.51

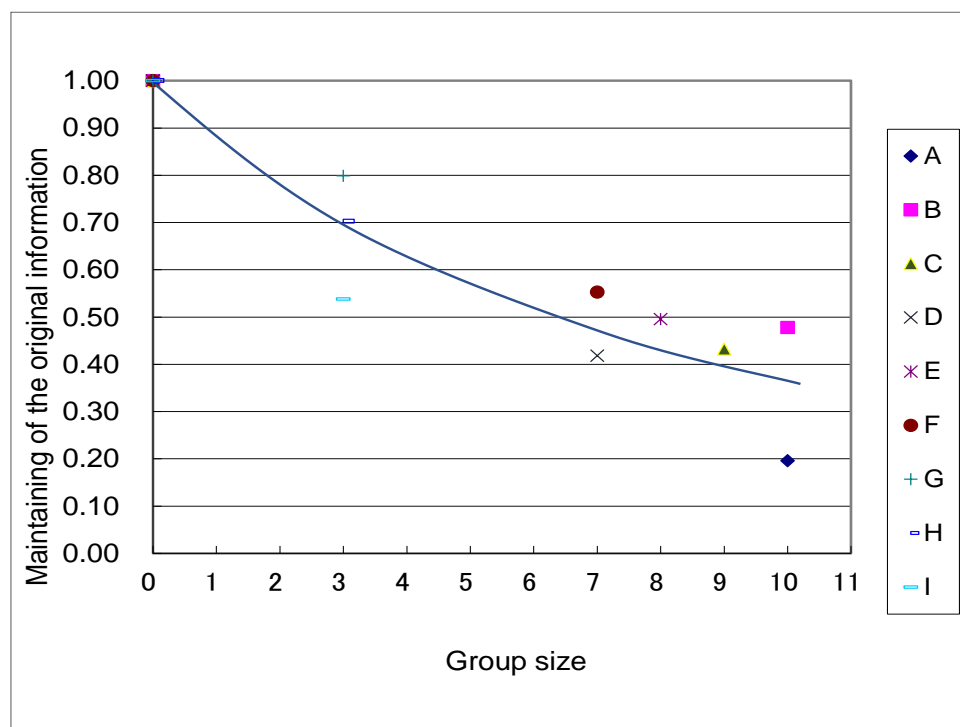


FIGURE 1
CURVE INDICATING THE WORD COLLAPSE IN RELATION TO THE SIZE OF THE GROUP

Continuous Cognitive Collapse

What is noteworthy here is the interesting cognitive sequence collapse that occurred in the second task. The hypothesis that emerges from this is that when an individual comes into contact with an unfamiliar word, the recipient of the information misses not only the word but also the sequence of a number of syllables that follow it. The text of the second task was as follows:

An astronomical/ elaborate/ clock/ was made/ in the ancient/ Greek/ city of Antikythera/ in the first century/ BC.

The name of the city of Antikythera is unfamiliar to the participants, while it is not common knowledge that astronomical clocks were already made in the BC period. When we listen to another person's words, we try to read the context in terms of a culturally based 'expectation' since this helps to minimise the processing carried out by the brain.

However, the five components outside of *an astronomical/ elaborate/ clock/ city of Antikythera/ BC* were consistently missing, with the exception of in one of the three-person teams. Such a situation was not found in terms of any of the other tasks.

Based on the results of this experiment, it can be inferred that people are more likely to fall into incomprehensible situations when they are confronted with contexts that are unfamiliar to them, as was the case with the second task in this study. This phenomenon is termed 'continuous cognitive collapse'.

The Future of Work Standards Based On Empirical Experiments

Making Tacit Knowledge Visible

The items to be described in a work standard are the tasks to be performed by the members cut out, decomposed, stepped and reconstructed on a time axis. Naturally, there is the presumption that actions and weights should be given in detail. However, matters that are recognised by the designer of the standard as known by the other party are not addressed. In fact, they are generally not mentioned at all since the designers themselves do not consider them as items for consideration.

In addition, as in the second task of the experiment, when a completely unfamiliar word appears and the surrounding context is far removed from one's own common sense, the continuous cognitive collapse phenomenon may occur. From the point of view of members of different cultures with different languages and customs, this can lead to them making judgments based on their own cultural criteria.

One of the ways to prevent this is to make tacit knowledge visible. In other words, that which the standard designers take for granted can be checked with multiple eyes, thus preventing any omissions.

What can be gained from the concept of universal design?

Mace (1985) defined the concept of universal design as the creation of products and environments that are accessible to all people, regardless of size, age or disability.

The seven principles of the concept are as follows: (i) fair use, (ii) flexibility of use, (iii) simplicity and intuitiveness of use, (iv) clarity of information, (v) tolerance for error, (vi) low physical burden, and (vii) accessibility, including size and space for use.

In Japan, the term 'barrier-free' has been used since the 1990s, implying that a given aspect includes certain measures for people with disabilities. However, the concept proposed by Mace is far broader.

Elsewhere, Nakagawa (2015) stated that the notion that universal design is a special concept is a misconception; rather, it is simply a way of thinking that respects the values of ordinary people. This is indeed an important issue for society. For example, the use of universal symbols has emerged at construction sites where many foreign workers work, with the symbols essentially used to prevent industrial accidents caused by the 'unexpected' behaviour of foreign workers who do not understand the local staff. The use of such symbols has become possible since headquarter supervisors have realised that what they thought was 'normal' is not, in fact, normal in a universal sense. Even when dealing with highly educated

foreigners, it is important to carry out the design with this realisation in mind.

CONCLUSION

Implications and Theoretical and Practical Contributions

It is not such a bad thing for a worker or employee to be interrupted or to stop working because what he or she wants to express is not communicated properly. Indeed, proceeding according to one's own judgment can present a greater risk. Returning to Eq. 2 presented in this paper, it is clear that the amount of basic information (ax^2) is affected by the cultural and customary difference index φ . When the cultural/customary difference (φ) is large, we cannot expect the leverage to affect the basic information quantity (ax^2). In other words, it was hypothesised that, in the absence of sufficient knowledge and experience, individuals may not carry out the given task correctly using their own initiative alone.

Furthermore, based on the results of the experiment involving the 60 graduate students, it was specifically confirmed that when the recipient of information is exposed to information that is not in accordance with their own common sense or is unknown to them, the sensitivity toward the subsequent information will be significantly reduced, and the degree constant (a) to which the information has been transmitted to the recipient will decrease according, meaning the continuous collapse of recognition phenomenon will occur.

When creating a runbook for well-trained engineers, it is possible that the information-sending or instructing side does not present detailed instructions as a matter of course due to an assumption regarding the knowledge level of the other side. In fact, in certain cases, the instructing party may omit specific matters in consideration of the other party's feelings (Natek & Lesjak, 2021). As Nakayama et al. (2021) noted, a knowledge management that includes how to share tacit knowledge among workers has been a major agenda for several decades in the global market.

Developing effective working standards using a runbook to support knowledge transference and sharing is undoubtedly crucial to creating a more seamless business environment. Here, the importance of clarifying basic concepts such as universal design and creating universal work standards using symbols is clear, while in order to promote smooth and accurate communication within a group of companies in the global age, ingenuity and wisdom are unquestionable prerequisites. Considering the culture, customs and common sense surrounding the communication subject and understanding the other party will lead to respect for the other party's culture, with the end result being smoother communication and a shortcut to encouraging others to change their behaviour. Within this context, as suggested by Oe & Yamaoka (2021), it may be useful to consider the socio-cultural factors of each market and aim to change the behaviour of employers by driving the so-called 'nudge effect'.

Further Research Opportunities

This study presented a small experiment involving a small group of volunteer participants, each of whom had diverse backgrounds, experiences and nationalities. To validate the suggestions made herein and to develop concrete recommendations for implementation, a future aim is to conduct a large-scale experiment with the cooperation of several multinational companies. Specifically, the validity of the proposed equation (Eq. 2) will be closely examined in terms of parameters other than the degree constant (a), while the model will be further developed.

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