1. Introduction

What is the essence of Japanese management? A good answer to this question may be found in a comment by Mr. Taiichi Ohno, a former vice president of Toyota, who invented Toyota's well-known Just-In-Time (JIT) production system. Mr. Ohno [22] acknowledges that Toyota designs its organization to function like a human body. Subsequently, in Toyota's production system, each employee exercises delegated authority to make important production judgments (e.g., halting a production line when an unexpected problem is perceived). Within the Toyota production system employees appear to function like the autonomic nerves of a human body. Is it really true? Is it possible to design organizational decision processes, so that they can maintain the capacity to be as flexible, resilient and inventive as the function of a human brain?

To reply to these questions regarding Japanese management and business practices, this article proposes a new organizational paradigm referred to as “Holographic Intelligence (HI).” In short, HI can be defined as a set of organizational intelligence activities for totally handling organizational creativity, supporting both gradual improvement and innovation. This study constructs its argument upon the premise that, as mentioned by Mr. Ohno, the success of Japanese management and business

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practices depends upon how each organization can effectively design its management like the human nervous system [16,23].

It is important to note that this article is aware of the numerous articles and books related to Japanese management, decision-making and business practices; e.g., Ouchi's "Theory Z"[26], Throow's "Producer Economics" [38], Imai's "Kaizen (Gradual Improvement)" [4], Nakane's "Tate Shakai No Ronri (Hierarchical logic in Japanese Society)" [19], and Wofleren's "Stateless Nation" [39]. This article attempts to provide a concise theory of Japanese management, focusing upon organizational creativity, learning, improvement and innovation, all of which are not sufficiently explored in the conventional literature.

Organizational Intelligence (Matsuda): The HI concept proposed in this article fully utilizes Organizational Intelligence (OI), first proposed by Matsuda [11,12,13,14,15], as a theoretical benchmark. His OI concept provides a holistic perspective concerning total intellectual problem handling capabilities in Japanese management. All underlying concepts incorporated within OI can serve as a theoretical basis for describing gradual improvement and innovation in Japanese organizations. [His contribution is visually documented in Figures 2 and 3 of this article.]

Holographic Intelligence: Unfortunately, there is a theoretical shortcoming related to Matsuda's OI paradigm. The concept indeed provides a systematic perspective of organizational activities, but it does not provide the strategies and principles utilized by Japanese organizations to effectively achieve gradual improvement and innovation. Therefore, this article extends Matsuda's OI paradigm by incorporating Japanese strategies and principles into the OI framework, all of which are described metaphorically from the perspective of various creative functions of a brain. Consequently, this study can formally describe Japanese group-oriented decision-making processes that are designed to function like the autonomic system of a human body. The final conceptual framework, combining OI and the brain's various functions, is our proposed HI. This study also discloses a new dimension of Japanese management by describing the HI paradigm’s application to American management.

Some readers may assiduously note that there exist not only differences, but also similarities between Japanese and American management practices. As discussed by Simon [34], management may be considered as a set of decision-making processes. Intuitively, both Japanese and American administrators exhibit the same primary decision-making characteristics. Therefore, it can be easily imagined that there are many similarities in the business practices of the two countries. Accordingly, the HI paradigm, the
The essence of Japanese management, ubiquitously plays within an international arena, one inclusive of private, public and not-for-profit sectors and, thus, may become the essence of American management.

The structure of this article is organized as follows: Section 2 describes Matsuda’s OI and its incorporated OI intellectual processes. Section 3 describes various capabilities for functioning the OI system. Section 4 presents organizational principles and strategies of HI, all of which are characterized from Japanese management infrastructure and business practices. The new framework originating from a brain is carefully incorporated into the OI system, so that the combination of OI and the functions of a human brain may serve as an underlying basis for describing HI. The conclusion and future extensions are presented in Section 5.

2. Organizational Intelligence (OI)

Matsuda [12] has defined OI as “the total problem-handling capability of an organization.” It is easily thought that the OI concept is an extended and more sophisticated form of individual intelligence; i.e., the function of a brain. As found in a series of Simon's studies[32,33,34], each person utilizes the function of individual intelligence to solve various decisional issues. The intelligence function of a brain may be characterized by various concepts derived from cognitive psychology, including "bounded rationality," "limited information processing capability," and "satisficing criterion" [34].

Today, the function of a brain serves as a basis for identifying the function of artificial intelligence in modern computer systems. Of course, neither the computer-assisted nor computer-based intelligence can reproduce all the functional elements of human intelligence. However, modern technology has an enormous capacity for supporting or assisting shortcomings of individual thought and creativity. For instance, a computer system incorporating an effectively designed database can provide each individual with information sufficient to facilitate his/her individual thinking process. By supporting each other, artificial intelligence and human intelligence together, may yield a successful problem-solving capability.

A theoretical shortcoming related to Simon's perspective on decision-making, in combination with artificial intelligence, is that his paradigm does not sufficiently provide a theoretical basis for understanding "activities for organizational creativity." Such activities are essential for improving and innovating various decision-making processes in Japanese management.

To incorporate such a new perspective of organizational thinking and creativity into understanding Japanese management and business practices,
this research proposes a use of OI, admirably delineating the multiple functions of OI. Such a combined use will be extended into our proposed HI. [See Murakami et al. for a description on Japanese strategy for organizational creation.] This study recognizes that the most arduous, yet most valuable, functioning of OI is to occur when organizations are provided a method for "inducing, accomplishing and stabilizing" innovation [12]. Innovation entails activities least likely to be scheduled, planned or controlled; hence, innovative results occur only sporadically in most organizations. In an implied extension of his important work, Matsuda [12] called for "an established mechanism" by means of which any organization could "institutionalize" a process for innovation.

Gradual Improvement and Innovation

Hereafter, this study specifies definitions of Japanese gradual improvement and innovation, both of which are the final results of HI efforts.

Figure 1  Gradual Improvement and Innovation
Table 1  Gradual Improvement and Innovation

<table>
<thead>
<tr>
<th></th>
<th>Gradual Improvement</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Effect</td>
<td>Long-term and lasting but undramatic</td>
<td>Short-term but dramatic</td>
</tr>
<tr>
<td>2. Pace</td>
<td>Small steps</td>
<td>Big steps</td>
</tr>
<tr>
<td>3. Timeframe</td>
<td>Continuous and incremental</td>
<td>Intermittent and non-incremental</td>
</tr>
<tr>
<td>4. Change</td>
<td>Gradual and consistent</td>
<td>Abrupt and volatile</td>
</tr>
<tr>
<td>5. Involvement</td>
<td>Everybody</td>
<td>Select few &quot;champions&quot;</td>
</tr>
<tr>
<td>6. Approach</td>
<td>Collectivism, group efforts, systems approach</td>
<td>Individual ideas and efforts, rugged individualism</td>
</tr>
<tr>
<td>7. Mode</td>
<td>Maintenance and improvement</td>
<td>Scrap and rebuild</td>
</tr>
<tr>
<td>8. Spark</td>
<td>Conventional know-how and state-of-the-art</td>
<td>Technological break-throughs, new inventions, new theories</td>
</tr>
<tr>
<td>9. Practical requirements</td>
<td>Little investment but great effort to maintain it</td>
<td>Large investment but little effort to maintain it</td>
</tr>
<tr>
<td>10. Effort orientation</td>
<td>People</td>
<td>Technology</td>
</tr>
<tr>
<td>11. Evaluation criteria</td>
<td>Process and efforts for better results</td>
<td>Results for profits</td>
</tr>
<tr>
<td>12. Advantage</td>
<td>Effective in slow-growth economy</td>
<td>Effective in fast-growth economy</td>
</tr>
</tbody>
</table>

source: Imai (1986,p24)

Figure 1 visually describes the difference between gradual improvement and innovation. Table 1 also summarizes the differences between the two approaches. As depicted in Figure 1, innovation is a major change occurring in an organization, the result of a breakthrough in production, manufacturing and management. Innovation is usually a single-shot event, whose impact upon management is so dramatic that it demands real attention. The introduction of a Computer-Aided Manufacturing (CAM) system into a factory is an example of such innovation activities. Conversely, gradual improvement is frequently executed in the form of small, incremental impacts upon management. The use of fishboning charts to modify existing production processes illustrates the incremental nature of gradual improvement; tomorrow’s procedures are refinements of today’s attempts. Further, the results of the group’s gradual improvement may only unconsciously affect organizational members in the short run. For instance, Total Quality Management (TQM) is a good example of Japanese gradual improvement. TQM typically requires total corporate efforts for the long run. The TQM implementation does not immediately lead to quality improvement.
Innovation is embodied in the American business culture. When American management looks for immediate results, a comprehensive change is easily executed by means of top-down management infrastructures. Meanwhile, Japanese business prefers gradual improvement because its management is oriented towards a long-term vision. Furthermore, the middle-up/down management style has often a difficulty in executing a sudden change due to innovation. Japanese management focuses upon human resource process and therefore, management is unusually attentive to their opinions of employees and group recommendations. Here, any immediate and visible change may invite some kind of resentment among group members. However, it is important to note that in a critical situation, as an exceptional case, where innovation is needed for survival, even Japanese management depends upon a top-down approach to deal with critical decisional issues. [Clark and Fujimoto [1] provided a detailed description regarding managerial shortcomings and strengths of Japanese firms.]

Figure 1 depicts a time trend of gradual improvement and innovation impact on management. The innovation often yields organizational resentment among members because people have a tendency to stay in conventional management, method and practices. While perhaps only a single individual may generate an innovation, the group is required for implementation. People need time to adjust to dramatic organizational change. To accomplish what Senge [30] describes as “a shift of mind,” management must allow members to engage in dialogue, to ponder, to question, and to exhibit “reflective openness” for the assimilation of potential or pending change [30]. The “big steps” required for innovation, as represented in Figure 1, volatile fluctuations following upon the heels of the abrupt verticality of innovation. The volatile fluctuations are organizational resentment to the innovation, the resulting cognitive dissonance, and the required shifting of a collective organizational mind. Yet, when effectively managed, the organization responds to the innovation much like a human brain to the catalytic ingestion of pure sucrose (or caffeine); once the nervous system survives the initial shock, the mind functions with an enhanced vigor.

The gradual improvement impacts management, as well. The volatile fluctuations which precede gradual improvement provide a spark of potentiality. An incremental rise by gradual improvement is the release of both the innovation’s, and the group’s, kinetic energy. Management must nurture gradual improvement if the organization’s new standards, processes and know-how are to yield the fullest long term benefits to the group. As with the brain, an organization’s acquisition of new knowledge means little in the absence of assiduous application. For example, the recognition of danger does not prevent the human from error and calamity; appropriate
behavioral adaptations must follow. In the long run, while most organizations will eventually gain access to all but the most recent technology, it is by the implementation of processes that entities may establish a survival of the fittest. The gradual improvement is the collective action, the movement, that builds organizational production and prosperity.

Still, the most fit organizations will be ready, even eager, to embrace innovation. As Figure 1 depicts, an energy boost of the innovation elevates a plain upon which gradual improvement performs. Certainly the gradual improvement, by its very nature, could continue uninterrupted. Yet, the innovation saves organizational time, and group energy, by hastening the group’s arrival at a higher level of performance. Here, when the gradual improvement yields to innovation, the former is less interrupted than supercharged. Management empowers all at their fullest value only when it engenders innovation.

Thus, there exists a critical interdependency between gradual improvement and innovation. Each exists only by the strength of the other. Management must foster a cycle, a phasic movement to and through each state. It is the synergism of gradual improvement and innovation, so dependent upon a cyclical activation of both, that HI must generate. Here, this study suggests the use of OI.

**Subsystems of Organizational Intelligence**

Because OI indicates the intellectual capability incorporated within an organization to handle various types of decisional issues, one may conceive of OI categories, cycles, or phases through which a decision-making entity passes, in route, to organizational gradual improvement and innovation. This study recognizes that organizational change most frequently occurs as the direct result of a need, as when a problem exists, acting as a catalyst for change. The problem-solving etiology of innovation is of value; it recommends distinct, but progressive subprocesses. Furthermore, the problem-solving orientation meshes with the OI theory, advocating that organizations enhance the circulation of information, by channeling, expediting the flow of communication. Here, the general reference to "information" is made problem-specific and operative. Thus, this study discerns the problem-solving content of a structural OI process that is further broken down into the following three subprocesses: (1) Deinstitutionalization Process (DP), (2) Innovation Expansion Process (IEP) and (3) Institutionalization Process (IP).
Since Matsuda's OI can be found in his article [12], this study avoids the duplication of his paradigm. Rather, this study focuses upon the description of OI from the perspective of Japanese management methods for gradual improvement and innovation. This study establishes structural, functional OI, delineating the alternating "activities" (rectangular borders) and "outputs"
(oval borders) within the three OI subprocesses of Figure 2. As described visually in Figure 2, the process activities and outputs warrant some discussion and highlighting. It is important to note that Figure 2 is originally presented in Matsuda [13]. This study modifies the figure, focusing upon the consensus building process, so that this study can describe the Japanese decision-making process more clearly from the perspective of a self-innovative organization. All the credit for OI belongs to Matsuda's outstanding works [11,12,13]. [See Sueyoshi [35] for a detailed description of how to use the OI concept for implementing a management science technique referred to "data envelopment analysis."]

**Deinstitutionalization Process (DP)**

The OI function is initiated in DP, as presented in Figure 2. The DP function usually occurs with a limited number of members (an individual or at most a few members) in an organization who recognize an immediate need and respond with gradual improvement and innovation. The DP function starts with sensing various pressures, either from an external environment, or frustrations (potential crises) in an internal environment. The environmental stimuli include governmental regulation, political pressure, fluctuating customer needs, demographic change, strategic change of other competing firms, and many other factors stimulating organizational change. Thus, an initial function of DP, the "pressure sensing capability," needs to be incorporated in DP. The other possible stimulus may come from the failure to achieve current strategic goals. For instance, as a consequence of such failure, members of the organization are frustrated by the low performance. The sensing of "frustration" is an initial source of internal pressure for organizational gradual improvement. Management needs to learn, as does a brain, by each mistake. Either external pressure, or internal frustration, is expressed by "felt crisis" that is a result of the crisis sensing function of DP. The felt crisis may be described as a mental pressure occurring in critical situations, such as facing an imminent business bankruptcy or governmental budgetary cutbacks. A member (or a limited number of members) feels very strongly that something has to be done to improve its current performance. Otherwise, his/her organization may fall into a very serious crisis. Such strong fear is the felt crisis. The crisis recognition of DP directs the member(s) towards the identification of an opportunity for gradual improvement and innovation. This stage preliminary searches available resources and means within the organization, assessing the appropriateness of each strategy for gradual improvement and innovation. The "opportunity search" may require that members execute a shift of minds, addressing new organizational innovation or improvement possibilities. For example, some
members are likely not aware that they are occupied with dogmatic views, methods and management. The conventional perspective frequently produces a limitation on free thinking needed for innovation. The felt crisis in combination with "opportunity information" is transformed into a locally conscious problem. Here, the term "local" indicates a limited number of members are motivated towards gradual improvement and innovation. Hence, the need for the innovative change is not yet supported by other members and the issue is not yet one addressed by the whole organization.

**Innovation Expansion Process (IEP)**

The second subprocess of OI is IEP. It functions to extend the local problem identified in DP into a global organization-wide context, where all the members in an organization are acknowledged to be impacted. Here, the alerted members explain to other members (including colleagues, subordinates and superiors) the generalized nature of the local problem, presenting advocated management methods, available resources and means for responding to the need. Here, the previously localized problem evolves into a generalized organizational issue. In an effort to extend the local problem to a global organizational issue, the alerted group needs to achieve "consensus" among all the members, or at least establish a "coalition" supported by influential individuals, such as corporate executives and public agency directors.

Japanese call the consensus building process "nemawashi". The process, listed as "organizational involvement" in Figure 2, is extremely important, but very time consuming, in Japanese organizations. For example, many Japanese firms use a so-called "ringi" process in which all individuals at all managerial levels are involved in a collective decision-making process. It is usually observed that information for consensus-based approval flows in a bottom-up manner and its range depends upon the importance of a decisional context. In the Japanese consensus-based approval process, decision-makers pass a paper from a manager to another manager for formal approval. The formal approval is accomplished by the action of marking the paper with one's own stamp. The stamp both symbolizes and documents each member's approval of the decision, and a commitment to support the proposal's implementation. If a member disagrees with what is being proposed, the individual may ask for an amendment of the proposed idea. The consensus-based approval process circulates the paper. An informal negotiation process is simultaneously initiated between the proposing and opposing member(s). If any serious opposition is anticipated for a pending consensus-based approval process, a senior member usually becomes an informal negotiator so that the member obtains an informal approval from an opposing member(s). As a
result of this informal negotiation, the Japanese consensus-based approval process seems to be smoothly executed. [American managers looking for immediate results may have difficulties understanding this process-oriented Japanese approach.] Thus, the decision-making process explores a "decision domain" until a proposal satisfies all the related members. This process is extremely time-consuming because many members are involved. Yet, this is Senge's "reflective openness" in action. After obtaining formal and informal supports from other members through the consensus-based approval process, the alerted members can identify a problem domain from the organizational context at the end of its final process. [It is clear that the purpose of the group approval process is to coordinate interests among members, not to discuss whether a decision is good or not. See Yamada [40] in which the consensus-based approval process is described from the perspective of Japanese management.]

This process may often provide new information related to gradual improvement and innovation in the forms of "value premises" and "factual premises." In this stage, "organizational climate" inside the organization influences the process for yielding a "global organizational problem." The internal climate includes formal and informal power structures, organizational politics, organizational history, and other factors influencing the whole process of an organization-wide problem generation. At the end of IEP, the global organization problem is "defined, structured and modeled" to obtain qualitative, and/or quantitative, (strategic) solutions within a generalized, organizational context and applications.

Institutionalization Process (IP)

The final major subprocess of OI is Institutionalization Process (IP). Here, the implementation of the proposed strategy is designed, operationalized, executed and evaluated. Significantly, the IP provides for a "structural and operational design" linked to the prevailing organizational climate. Here, again, the internal linkage serves to ensure feasibility of content (function) and process. Along the strategic outline determined in IEP, the IP function starts with the design of a whole "structural system" in which each member's commitment is clearly specified in the form of a hierarchical structure. The resulting "commitment structure" serves as an underlying basis for designing an "operational plan." The operation plan provides a "detailed implementation strategy;" if necessary, amending a whole contract among members so that the organization can avoid any kind of expected difficulty in actual implementation. Following the detailed implementation strategy, the "role" of each member is carefully specified for the actual implementation. Finally, the proposed process for gradual
improvement and innovation is executed and its "performance outcome" is evaluated by comparing its goal and achievement. If the achievement is significantly lower than its goal, then a strong feeling, or frustration, emerges from the failure. The frustration initiates the DP function and the OI processes are repeated until management achieves successful gradual improvement and innovation.

Figure 3  Organizational information processing
Source: Matsuda (1990)
Finally, Figure 3 provides a total information processing system incorporated within the OI paradigm. Since this picture visually conveys many implications, this article omits a detailed description on Figure 3, except noting that the center for processing information usually belongs to the middle level management in Japanese firms. That is, important decision-making in Japanese management is handled in the form of the middle-centered, up-and-down approach. As mentioned before, Japanese management builds consensus among all members. The middle-centered up-and-down decision-making is the most efficient management infrastructure for obtaining consensus. [This concept (i.e., the middle-center up-and-down) is first proposed by Nonaka [21]. This research is also aware of the fact that there are other types of decision making processes[25].]

3. Composite Capabilities for OI Functioning

The processes and corresponding mechanisms comprising the formal procedure for OI must be supported by the development of organizational capabilities that are tools for generating innovative strategies. In fact, this study views capabilities as prerequisites for the effective activation of functional OI.

In order to maximize the effectiveness of its OI activities, to enhance its flexibility, resiliency and inventiveness, and to complement OI’s efficiency, an organization must develop and refine selected skills and abilities. Based upon an interview study (from 1995 to 2000) with Japanese corporate executives, this study identifies the following twenty-five interdependent, composite capabilities for OI functioning:

**Composite Capabilities for Functioning Organizational Intelligence**

1. Adaptability
2. Collection Capability
3. Communicative Effectiveness Capability
4. Consensus Building Capability
5. Creativity Capability
6. Decision-Making/Problem-Handling Capability
7. Design Capability
8. Information Processing Capability
9. Internal Reliability
10. Knowledge Accumulation Capability
11. Learning Capability
12. Motivating/Goal Directing Capability
13. Pedagogical Capability
14. Performance Enhancement Capability
(8) Elimination Capability (21) Planning/Strategizing Capability
(9) Evaluation Capability (22) Rational/Cognitive Capability
(10) Flexibility (23) Risk Taking/Entrepreneurial Enhancement Capability
(11) Forecasting/Prediction Capability (24) Sensing Capability
(12) Implementation Capability (25) Structuring Capability
(13) Information Channeling Capability

(For operational definitions of the composite capabilities, reference Appendix A.)

The composite capabilities activate the formal procedure for OI. As the critical skills and abilities utilized to create OI activities, they generate OI outputs. Therefore, this study connects each capability to its corresponding DP, IEP and/or IP subsystems. Furthermore, this study delineates the specific OI output generated by each capability, referencing "Capabilities Linked to OI Outputs," as a descriptive example.

**TABLE 2  CAPABILITIES LINKED to OI OUTPUTS**

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>Deinstitutionalization</th>
<th>Innovation</th>
<th>Institutionalization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DP</td>
<td>IEP</td>
<td>IP</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Framework Limitations</td>
<td>Contingent Information</td>
<td>Structural Redundancy Role System System Maintenance Procedures</td>
</tr>
<tr>
<td>Collection</td>
<td>Opportunity Information</td>
<td>Value Premises Factual Premises Contingent Information</td>
<td>Structural Redundancy Operational Implications Implemented Outcomes</td>
</tr>
<tr>
<td>Communicative</td>
<td>Local Problem</td>
<td>Proposed Solution Employee's Opinion Executive's Opinion</td>
<td>Contact Amending Mechanism Proposed Implementable Systems Role System System Maintenance Procedures</td>
</tr>
<tr>
<td>Effectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consensus Building</td>
<td>Framework Limitations</td>
<td>Consensus/ Coalition</td>
<td>Contact Amending Mechanism Proposed Implementable Systems Role System System Maintenance Procedures</td>
</tr>
<tr>
<td>Creativity</td>
<td>Opportunity Information</td>
<td>All</td>
<td>Structural Redundancy Operational Implications Commitment Structure All</td>
</tr>
<tr>
<td>Decision Making/</td>
<td>Local Problem</td>
<td>All</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Capabilities</th>
<th>Deinstitutionalization</th>
<th>Innovation</th>
<th>Institutionalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Handling</td>
<td>DP</td>
<td>IEP</td>
<td>IP</td>
</tr>
<tr>
<td>Design</td>
<td>Framework</td>
<td>Model</td>
<td>Structural Redundancy</td>
</tr>
<tr>
<td></td>
<td>Limitations</td>
<td></td>
<td>Operational Implications</td>
</tr>
<tr>
<td>Elimination</td>
<td></td>
<td></td>
<td>Commitment Structure</td>
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<tr>
<td>Evaluation</td>
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<td>Implemented Outcomes</td>
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<td>Flexibility</td>
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<td>Proposed Implementable</td>
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<tr>
<td></td>
<td>Limitations</td>
<td>Employee's Opinion</td>
<td>Systems</td>
</tr>
<tr>
<td>Forecasting/Prediction</td>
<td>Framework</td>
<td>Organizational Problem</td>
<td>Proposed Implementable</td>
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<tr>
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<td>Limitations</td>
<td>Executive's Opinion</td>
<td>Systems Contact</td>
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<td>Implementation</td>
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<td>Limitations</td>
<td>Proposed Implementable</td>
<td>Role System</td>
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<td>Information Channeling</td>
<td>Framework</td>
<td>Value Premises Factual</td>
<td>Proposed Implementable</td>
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<td>Premises Organizational</td>
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<td>Problem</td>
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<tr>
<td>Internal Reliability Knowledge</td>
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<td>Learning</td>
<td>Opportunity Information</td>
<td>Model Contingent</td>
<td>Systems Maintenance</td>
</tr>
<tr>
<td></td>
<td>Local Problem</td>
<td>Information</td>
<td>Procedures</td>
</tr>
<tr>
<td>Motivating/Goal Directing</td>
<td>Felt Crisis</td>
<td>Organizational Problem</td>
<td>Role System</td>
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<td></td>
<td></td>
<td>Model</td>
<td>System Maintenance</td>
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<tr>
<td>Pedagogical Performance Enhancement</td>
<td>Framework</td>
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<td></td>
<td>Model Proposed Solution</td>
<td>Operational Implications</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Proposed Implementable</td>
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Table 2: Capabilities Linked to OI Outputs

<table>
<thead>
<tr>
<th>Capabilities</th>
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<th>Innovation</th>
<th>Institutionalization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DP</td>
<td>IEP</td>
<td>IP</td>
</tr>
<tr>
<td>Risk Taking/Entrepreneurial</td>
<td>Opportunity Information</td>
<td>Contingent Information</td>
<td>Structural Redundancy</td>
</tr>
<tr>
<td>Sensing</td>
<td>Frustration Felt</td>
<td>Felt Crisis</td>
<td></td>
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<td>Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structuring</td>
<td>Framework Limitations</td>
<td>Organizational Problem Model</td>
<td>Structural Redundancy Role System</td>
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</tbody>
</table>

An analysis of the capabilities linked to OI outputs produces a recognition of the most complex outputs, those requiring the greatest number of composite capabilities, within each OI subsystem. For example, the first row of Table 2 presents that "adaptability," indicating the capacity of an organization to modify [itself] or its parts making it more fit for existence under the conditions of its environment. The capability is fully utilized in "framework limitations" in DP and "contingency information" in IEP as well as "structural redundancy", "role system", "system maintenance procedure" in IP. Similarly, other capabilities listed in Table 2 can be linked to the three OI subsystems. Now, turning our attention from row to column of Table 2, this article describes a feature in Table 2. That is, the DP's "framework limitations" requires nine capabilities for successful activation, as identified in the second column of Table 2. The IEP's "contingent information" requires ten capabilities, as identified in the third column. The IP's "structural redundancy" requires fully twelve capabilities, as in the last column. Accordingly, this study suggests that all OI outputs are not equally easy to activate.

Further analysis of the capabilities linked to OI outputs produces a recognition of the most frequently required OI capabilities. "Creativity" and “decision-making/problem-handling” capabilities are utilized in the generation of all outputs in the IEP. Additionally, "decision-making/problem-handling" is utilized in the creation of all outputs in the IP. Accordingly, this study suggests the intrinsic importance of creativity and decision-making/problem-handling in the activation of functional OI.

In summary, the composite capabilities, and their linkage to OI outputs, comprise the second piece in understanding the outline of Japanese management. While the formal procedure of OI, by making OI functional, enhances the efficiency of organizational decision-making, the capabilities
activate functional OI. Here, it is understood that composite capabilities must be developed and refined, and that certain capabilities are more crucial than others, if only because of greater frequency of use within OI. Lastly, it is suspected that certain capabilities are unusually difficult to create.

Therefore, the activation of functional OI, the maximization of an organization's capacity to be as flexible, resilient and inventive as a human brain, requires a final component. The activation of functional OI requires a context, an organizational environment, most conducive to the development and refinement of the composite capabilities, with emphasis upon creativity and decision-making. As the final component, in the generation of organizational gradual improvement/innovation, this study proposes principles and strategies of HI.

4. Holographic Intelligence (HI)

As discussed previously, the central issue of this study is to present the essence of Japanese management, in particular gradual improvement and innovation by metaphorically describing the brain-like functioning of self-innovative management. To achieve the research objective, this study uses a holographic property for the metaphor of the brain's function. The central property of a hologram exists within the following brain function: even if a holographic system is broken into several parts, any single piece may be used to reconstruct its original, entire image. The function of a whole system is, thus, enfolded within its subsystems and the function of the subsystem is the same as the whole [17]. Using the holographic property, this study identifies HI as a paradigm, generating the context for Japanese-styled self-organization and its related organizational gradual improvement and innovation. This study recognizes HI to be comprised of inter-related design principles and strategies for enhancing gradual improvement and innovation. Here, HI concurrently supports the use of activated, functional OI and enhances the development and refinement of the OI composite capabilities. Thus, the principles and strategies explored in this section will be immediately extended into the activated, functional OI.

It is important to note that, of course, this study is aware of the existence of several research works on holographic management. [See Mackenzie [10], Morgan[17] and Nonaka [21] for discussions of brain functioning duplicated, and applied, to understand the innovation of self-organization.] This study does not replicate a description of self-organization from the conventional studies. Rather, this study is geared towards a discussion of holographic functions for self-innovative organization from the perspective of Japanese principles and strategies in the framework of the holographic
perspective and OI.

**Principles of Holographic Design**

This study recognizes the following four holographic principles for describing, in the context of Japanese management, a self-innovative organization:

1. Functional redundancy
2. Required task variety
3. Maximized freedom
4. Multiple loop learning

The functional redundancy exists when extra functions are added to each of the operating parts, so that each part is able to engage in a range of functions rather than just perform a single specialized activity. The result of the functional redundancy is that "at any one time, each member possesses skills that are redundant in the sense that they are not being used for the job at hand" [17]. This perspective is referred to in the Japanese management context as functional redundancy. For instance, each career-oriented (elite) Japanese manager periodically transfers from one department to another, obtaining new experience, training and management knowledge in changed surroundings. Usually, departmental transfers occur with promotions [7]. A job training system seeking developmental experience and promotion is called "On-the-Job Training (OJT)." This Japanese strategy of functional redundancy expands the range and number of tasks performed within all members at the management level. As a result of OJT, formal and informal communication channels are established among departments. Each manager can understand various managerial difficulties related to jobs and tasks in other departments. Thus, the OJT of Japanese organizations is aimed for effectively promoting the consensus-building process in the IEP of OI. Furthermore, the functional redundancy enhances an organization's range of strategic alternatives, since multiple work groups perform the most demanded (generalized) activities. Thus, each Japanese manager is educated to simultaneously be a specialist and generalist. The redundant management function also provides a "real capacity to reflect on and question how [an organization] is operating," allowing an organization "to change its mode of functioning in constructive and holistic ways...to adjust actions..." [17].

The required task variety exists when a work group, in response to external (often problematic) change forces, modifies and adapts existing functions. The hybrid functions are wholly new, distinct (specialized/generalized) activities for dealing with external information. Furthermore, significant organizational implications are associated with the business strategy. That is, when it exists, the organization can be developed in
a cellular manner around self-organizing, multi-disciplined groups that have the requisite skills and abilities to deal with external environment in a holistic and integrated way. An important example of the required task variety can be found in designing a Computer-Aided Manufacturing (CAM) system. The task for developing the CAM requires multi-dimensional design views from managers and engineers related to product, process, tooling, marketing and other individuals involved in the design process [37]. As a self-innovative autonomy, a task team needs to diversify its capabilities to meet various requirements for developing a CAM system. The required task variety optimizes the decision-making resiliency in OI as functions in a brain. Within activated, functional OI, the task variety fosters a self-innovation capability that creates a decision-making autonomy in an organization.

The maximized freedom exists when an organization specifies "no more than is absolutely necessary for a particular activity to occur."[17] A work group is granted the freedom to select procedural means and resources for creative works [20,24]. The work group analyzes, strategizes and organizes in the absence of system-imposed, procedural constraints. Maximised freedom occurs with the delegation of accountability and authority from superiors. To expedite free-thinking and free-view among members, OI needs to eliminate all conventional management practices that impede innovative imagination. Maximised freedom optimizes the inventiveness of OI. This strategy encourages work groups to invent new strategies for gradual improvement and innovation in the absence of prescriptions and restrictions [9,29]. Maximised freedom encourages local work groups to discover and invent. Still, a total absence of critical task specification, coupled with the perfect delegation of authority, could produce organizational chaos, endangering work group outputs. Therefore, especially in the presence of functional and task varieties, the work group's use of maximised freedom first requires the development of processes for adaptation to its dynamic external environment. Thus, maximised freedom requires organizational, experiential learning [8].

The multiple loop learning, exists when work groups adjust extant actions based upon immediate experiences[17]. The mid-course corrections generated by learning to learn are immediate, but conscious, strategic interventions. The multiple loop learning establishes an organization's capacity for coherent self-regulation and control. In the learning process, each work group guides itself with reference to a set of coherent values or norms, while questioning whether these norms provide an appropriate basis for guiding behavior and decision-making. Given the demands for functional and task varieties, in the presence of maximised freedom, direction and coherence must come from the group members themselves as they set and honor the
shared values and norms that evolve along with changing circumstances. Team learning occurs at the local level, enhancing both vertical and horizontal learning; more members develop deeper understanding [27]. Multiple loop learning optimizes flexibility, resiliency and inventiveness in OI. Within activated, functional OI, learning to learn fosters self-innovation in an organization; this principle is the enabling force behind organizational development and the refinement of OI capabilities.

The principles of holographic design exist as ends, as outcomes to be achieved, measuring or signaling the organization's success in implementing gradual improvement and innovation. When the four principles are upheld, the organization will function holographically like a human brain. Therefore, upholding the four principles, the implementation of OI, must be addressed. [See Matsuda [12] in which he presented the importance of intended organizational ambiguity to function organizational intelligence from the perspective of Japanese management. This research also believes that the intended ambiguity may be an important organizational feature to function the four holographic principles since the execution of such HI principles needs a high degree of free-thinking freedom among members.]

**Holographic Strategies**

This study presents planning objectives and strategies for the implementation of OI. This study proposes the following seven strategic objectives by which organizations expedite gradual improvement and innovation:

(1) Create functional linkage and redundancy
(2) Create system with subsystems
(3) Create specialized/generalized functioning
(4) Create long-term perspectives
(5) Create self-autonomy
(6) Create group responsibility
(7) Create group incentives

Creating functional linkage and redundancy occurs when two symbiotic objectives are attained. The functional linkage entails the construction and use of resource allocation, among work groups, for the purpose of collaboration; e.g. inter-departmental information management conduits. The creating redundancy entails the construction and use of replicated functions, among work groups. It is impossible to create a new idea on gradual improvement and innovation without some kind of redundancy or resource
slack. The two objectives are inter-dependent, they are mutually-supportive; redundancies allow for inter-group work exchange, while the inter-group trust, reliance and resource sharing uncover additional opportunities for collaboration, by means of valuable redundancies[36].

In maintaining linkage and redundancy, an organization may apply the principle of functional redundancy, securing the replication of critical functions within, and/or among, work groups. The functional redundancy acts to maintain connectivity; it provides an intra- and inter-work group commonality, a reason to build a communication system, to share information, to disclose OI activities and outputs, to collaborate, and to execute gradual improvement and innovation. Furthermore, as multiple loop learning and functional varieties produce synergistic innovation, the linkage increases self-innovation through connected work groups, generating their own ad hoc, varietal specifications.

Creating system with subsystems entails the creation of work groups capable of performing comprehensively. In designing the function of a system into its subsystems, an organization applies the principle of functional redundancy, securing the replication of critical functions within, and/or among, work groups. Functional redundancies act to replicate whole organizational features; they grant a self-sustaining, parental feature to an individual, secular work group. Furthermore, as the principles of multiple loop learning and functional varieties produce work group-specific gradual improvement and innovation and self-organization, connected work groups generate aggregate, whole learning of any new, ad hoc, varietal specifications.

Creating specialized and generalized functioning entails the creation of work groups capable of exhibiting precise, discrete, unique and varietal behaviors, while also performing whole, generic and redundant functions. In designing simultaneous specialization and generalization, an organization concurrently applies the principles of functional redundancy and requisite variety. An example of this holographic strategy may be found in the Japanese OJT system. As described previously, Japanese managers need to transfer from one department to another with their promotions, experiencing different managerial tasks, jobs and functions. Thus, the Japanese manager is educated to become a generalist, maintaining a special expert area(s). A disadvantage of the OJT system is that it is a time-consuming process, because each manager must experience specialized and generalized tasks. However, this holographic strategy may effectively establish creative consensus building functions within OI.

Creating long-term perspectives entails the creation of organizational perseverance. Any organization, like a brain, needs to follow a learning
process for adjusting itself to an innovative change. Gradual improvement activities, including TQM and the Japanese production control system, are process-oriented management changes and, therefore, these management influences are usually observed over the long run. Moreover, innovation needs a time period for digesting its innovative change, as explained in Figure 1. [The long-term perspective may be usually found in Japanese organizations. This is partly due to the fact that Japanese corporate executives are not evaluated by annual-based accounting performance.]

Creating self-autonomy entails the development of self-sustaining work groups able to internally provide all functional, and strategic, planning, management and control. Of considerable OI significance, self-organization demands resource availability to all work groups. In creating self-autonomy, an organization applies the principle of maximized freedom, removing system-imposed procedural obstacles to information flow and ad hoc, flexible decision-making. Furthermore, an organization applies the principle of multiple loop learning, allowing experience to feed forward into systems gradual improvement and innovation.

Creating group responsibility entails the development of self-sustaining work groups, each willing to hold itself accountable for collective, individual results. Of considerable OI significance, in exercising group responsibility, the work group anticipates resource needs, proficiently procuring and disseminating resources. In creating group responsibility, an organization applies the principle of functional redundancy, utilizing the-system-into-subsystems design to enhance work group self-sustenance. Further, an organization applies the principle of maximized freedom, allowing work group authority and autonomy. Lastly, an organization applies the principle of multiple loop learning, encouraging the feeding forward, or looping, of learning.

Creating group incentives entails rewarding creative collaboration among group members (rather than competition), by replacing all individual achievement recognitions with group performance acknowledgments and rewards; e.g. group plaudits, commendations, appraisals, reviews and compensation. In creating group incentives, Japanese organizations synergistically apply the principles of requisite variety and maximized freedom; rewarding each work group according to the impacts, the successes, generated by non-legislated, aggregate adaptations to its external environment. It can be easily thought that each member (even Japanese) works for an organization to satisfy individual needs, not group needs. Therefore, Japanese incentive systems carefully incorporate two conflicting (individual vs. group) perspectives so that each organization can maximize its whole performance. For example, compensation is determined by the seniority of each member,
indicating how long the member remains in an organization. The longer the tenure, the more seniority the individual may achieve in the Japanese seniority system. Individual capability and performance are not major factors in the calculation of an individual's compensation. [Of course, there might be slight (not major) differences within same-seniority groups at the beginning of their careers. The difference may be widen in their promotion.] The individual's contribution to an organization is recognized by group appraisals, bonuses, and most importantly, promotions. Thus, compensation is determined as a group incentive, while promotions are the result of individual competition. Japanese organizations accumulate OI wisdom through the seniority system; members must accrue tenure to receive more benefits. Shortcomings of the HI strategy can be found in organizational corruption and strong resentment to innovative change. Furthermore, individual performance is evaluated by not only each annual-based contribution, but also by other multi-faceted dimensions; e.g. willingness to cooperate with other members, good relationships with each superior, and educational background.

This concept supports the use of activated, functional OI. The objective creates the same context, as in the above-mentioned group responsibility. Consequently, creating group incentives enhances the development and refinement of the same multiple OI capabilities, as in the above-mentioned group responsibility.

In summary, HI concurrently (1) supports the use of activated, functional OI and (2) enhances the development and refinement of the critical capabilities. HI, employing inter-related design principles and the implementation of planning objectives, fosters the context, the organizational environment, synergizing the activated, functional OI. The activated, functional OI is the mechanism by which all management may engender both gradual improvement and innovation.

5. Conclusion and Future Extensions

This study has proposed a new organizational paradigm of HI, for the design of optimally innovative decision-making processes. This research has constructed HI from a new set of OI activities and functions along with the identification and delineation of its composite capabilities. Then, it has extended OI, constructing the HI paradigm: a set of OI activities for totally handling various innovation issues. This study designed OI to be as flexible, resilient and inventive as the function of a human brain. Lastly, this research has presented an application of the HI paradigm; it is the essence of organizational innovation, of Japanese management, and a means to simultaneously engender and synergize both gradual improvement and
innovation.

This study acknowledges the considerable, significant, further study to be conducted on HI. Certainly, the need exists to prescribe the means by which organizations may initiate HI in a certain industry. National or cultural differentiation must be identified in the further research. Here, others may isolate those internal characteristics and/or environmental externalities, constraining organizational attempts to employ HI. Case studies and empirical data are demanded.

As a future study, this article recommends an empirical study, contrasting the global, industrial strategies of Japan (represented by the MITI: Ministry of International Trade and Industry) and the USA. The extended study, following the HI concept, may investigate Japanese industrial policy, a subject of debate among American political scientists and economists concerning Japan. One faction (e.g., Dertouzos [2] et. al. and Dietrich[3]) asserts a strong role for MITI as an innovator of "rational" industrial policies. Another group (e.g., Richardson and Ueda [28]) see MITI's role as variable; industrial policy processes are usually politicized, so that multiple rationales are involved, and policy impact varies with the number of firms in industry and other factors. There are many examples of MITI's successes and failures, or at least departures from the "rational" model. Therefore, this future study may assess the accuracy of MITI's perceived role, its image; much evidence suggests that stimuli for MITI's industrial policies comes from business, and that much of the propelling energy comes from the Liberal Democratic Party. The extended HI study, based upon the business perspective, will examine whether or not MITI is the omnipotent innovator which everybody admires or fears.

Finally, it is hoped that this study makes a small contribution for understanding Japanese management. We await further HI developments along the lines addressed in this article.

Appendix

Composite Capabilities for Functioning Organizational Intelligence

Adaptability: the capacity of an organization to modify [itself] or its parts by making it more fit for existence under the conditions of its environment. [Note: adaptability is an ability issue.]

Collection Capability: the ability to gather or to bring together into one body or place.

Communicative Effectiveness Capability: the ability to effectively
exchange information through a common system of symbols, signs and behaviors. It may include the use of technology for the transmission of information (as by the printed word, the computer or telecommunications).

**Consensus Building Capability:** the ability to generate group solidarity in sentiment and belief directed towards the achievement of organizational goals and objectives, maximizing cooperation and minimizing competition.

**Creativity Capability:** the ability unique paradigms to apply existing information; generating transformations (metamorphoses).

**Decision-Making/Problem-Handling Capability:** the ability to find, and acknowledge, isolate, formulate and state, construct a solution model, and resolve undesired results.

**Design Capability:** the ability to plan and organize a project to generate coherence and cohesion.

**Elimination Capability:** the ability to intuit when and how to cease a plan of action.

**Evaluation Capability:** the ability to determine an entity's or event's significance by means of either careful appraisal/study (observation/monitoring) or intuition; yielding a valid comparison against objective, or subjective, standards or desired results.

**Flexibility:** the capacity to respond or conform to changing or new situations. [Note: flexibility is a willingness issue.]

**Forecasting/Prediction Capability:** the ability to accurately anticipate future contingencies.

**Implementation Capability:** the ability to execute a plan of action, to incorporate functions and activities.

**Information Channeling Capability:** the ability to move information from one discrete unit to another; creating interdependent linkages; coupling; balancing centralization with decentralization (though, it may not require centralization; in fact, bureaucratic accountability is antithetical and perfect information exchange may systematically occur within a holographic environment).

**Information Processing Capability:** the ability to manipulate data by means of a "series of actions or operations conducing to an end.

**Internal Reliability:** the dependability of any individual's contribution; the collective work orientation.
Knowledge Accumulation Capability: the ability to minimize losses of information to bounded rationality, maximizing data retention; ensuring functional redundancy.

Learning Capability: the ability to assimilate and apply new, organizational information and processes; to gain knowledge or understanding of or skill in by study, instruction, or experience.

Motivating/Goal Directing Capability: the ability to encourage, inspire and achieve individual involvement and participation in the accomplishment of work group, unit and organizational goals.

Pedagogical Capability: the ability to effectively teach; to inculcate.

Performance Enhancement Capability: the ability to generate increasingly more approximate and appropriate behaviors, those most meeting organizational objectives, from colleagues.

Planning/Strategizing Capability: the ability to generate a detailed formulation of a plan of action or a method for attaining an end.

Rational Capability: the ability to make decisions according to a pre-identified, or given, conceptual model or framework; logical flexibility; situational adaptability; cognitive reliability; the role of intuition.

Risk Taking/Entrepreneurial Enhancement Capability: the ability to empower colleagues, enhancing their willingness to: (1) display flexibility, (2) acquire new knowledge, (3) challenge existing norms and methodologies, (4) devise, recommend and implement new approaches. It is an operational basis for requisite variety.

Sensing Capability: the ability to proficiently and efficiently perceive by means of conscious awareness or rationality.

Structuring Capability: the ability to design and provide ad hoc modification of the internal functional structures (hierarchy) to accommodate needed change.

REFERENCES


