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Article

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MANAGEMENT | RESEARCH ARTICLE

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A mathematical framework for managing interactive communication distortions in exascale organizations

Saeidi Ramyani Saleh¹, Ehsan Mousavi Khaneghah^{2*}, Nosratollah Shadnoush¹ and Araz R Aliev³

Abstract: Increased complexity of functions makes the need for interactions and communications with other organizations important, and complexity of the environment of twenty-first-century organizations gives prominence to the need for conceptual redefining in these organizations and creating the concept of twenty-first-century ecosystems to perform activities. The nature of these events is such that they will be created during the life of the system, and in the absence of a framework to deal with them, they will cause organizations' activities failure. This paper introduces a framework for dealing with and managing interactive distortions at the level of twenty-first century ecosystems in a way that it would be able to re-establish the organization's communications with other organizations based on the proposed mathematical framework and identify the nature of interactive distortion and its impacts on the elements, organizations, and ecosystem without having to fail at ecosystem level, through redefining the ecosystem member organization based on a non-Euclidean space.

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PUBLIC INTEREST STATEMENT

The functional nature and the activities run by the organizations designed for the twenty-first century are such that these organizations need to use complex and decentralized structures. The nature of the complex activities being run in these types of organizations is such that inter-organizational collaborations and interactions are required to implement the operations and activities. The functional nature of the activities being run by these organizations, as well as the complex and decentralized structure, cause dynamic and interactive events in these organizations. Due to the dynamic and interactive nature in inter-organizational communications and interactions, organizations will face situations that are not taken into account in the initial design because of lack of knowledge and information on the dynamic and interactive nature.

The framework, introduced in this paper, can be used by organizations which have geographical and managerial spread and also have a large number of constituent units.

Subjects: Environment & Business; Environment & Society; Environment & Theory; Environment & Economics; Decision Analysis; Environmental Economics; Business, Management and Accounting

Keywords: exascale organization; dynamic and interactive communication; disorder; eco systems

1. Introduction

By entering the twenty-first century, we are witnessing the formation of various dynamic, interactive, economic, cultural, and social interactions in different sectors of science and industry. The nature of twenty-first-century events is such that the need to create dynamic systems at the level of organizational structures, and also the need to empower organizational structures to deal with dynamic interactions have emerged as an essential and inevitable issue. These events necessitate the need for the creation of organizational structures that can be re-configured at runtime to redefine communications and run-time interactions in organizations that have inter-organizational communication and interactions (Khaneghah & Sharifi, 2014). Defining the above concepts based on the traditional definitions of organizational structures and behaviors is complex (Amit & Schoemaker, 2012, Pritchard & Pmp, 2014, Sadgrove, 2015), in a way that the use of traditional theories in this area cannot provide the organizations with the ability to survive in the twenty-first century. The nature of twenty-first-century distortion is not of classical risk and events defined for organizational structures and behaviors (Coker, 2014, Goetsch & Davis, 2014).

At the inter-system level (not intra-system level), the nature and the main cause of twenty-first-century distortions is the creation of complex and decentralized structures (Ribes et al., 2013, Weick, 2012). By entering the twenty-first century, we are witnessing the creation of ecosystems where, unlike traditional systems, because of using centralized structures to carry out system activities, we are moving towards decentralized and distributed systems to implement activities (Aswani et al., 2012, Coker, 2014, Hahn, 2011, Ribes et al., 2013, Weick, 2012).

The change in the context and process of implementing the system activities in twenty-first century makes redefining the following concepts necessary (Aswani et al., 2012): the nature of communications between systems (whether at the level of subsystems of a system or at inter-system level) or openness, systems expandability in various dimensions (geographical, managerial and numerical), the nature of keeping users away from the underlying complexities due to increased complexity (whether from the approach of increased complexity of problems that twenty-first century systems are solving or in terms of changing the process of implementing system activities) as well as defining new concepts such as a global activity for understanding such systems.

The formation of such concepts at the level of organizational systems leads to the formation of a concept called events with distorted nature in this system; distorted nature is a two-dimensional concept and can be defined and described in a space called distortion space (Aswani et al., 2012, Coker, 2014, Hoffmann, 2012, Kermisch, 2012).

According to the system theory, it can be argued that the occurrence of a distortion at the level of a system means that a set of events (or one event) will be formed in the system under discussion and will cause the elements, communications, interactions, behaviors, and patterns governing systems to exit predictable patterns at the time of the occurrence of a distortion, and in many cases, the nature of these events is such that the system cannot continue its activities.

System management requires mechanisms, methods, procedures, and frameworks to be able to solve the distortion caused by a distorted event occurring at the system level at runtime (Aswani et al., 2012, Coker, 2014, Daft, Murphy, & Willmott, 2010, Khaneghah & Sharifi, 2014, Okeson, 2014). The occurrence of events leading to distortion in systems causes nature and function (design and implementation) of

system management frameworks to be led from designing time to system runtime (Hildebrandt, Mukkamala, & Slaats, 2011, Jones, 2013). Although the distorted nature is proposed as one of the consequences of changing the course of implementing activities in the system and organizational structures of twenty-first century, but in its most general sense, it is a concept that arises from the change in the functional nature of the system and structures of twenty-first century against systems and structures of twentieth century.

The functional nature of systems and structures of the twentieth century was based on the use of rules governing extracted organizational events and their use in a certain area (Hatch & Cunliffe, 2012); however, the functional nature of systems and structures of the twenty-first century is based on the extraction of rules governing organizational events. In systems and structures of twentieth century, a set of rules and principles governing the structure and behavior of the organization that was created in the field of academia or any other field of knowledge generation was used for a specific instance (such as the automotive company), and the organizational system was operating in accordance with the rules and principles governing the extracted organizational structures and behaviors (Daft et al., 2010, Feldman & Orlikowski, 2011, Hatch & Cunliffe, 2012). This would make it possible to design the structure and behavior and define the mechanisms that violate principles and rules governing all aspects of the organization at the time of designing the organization and structure. This will allow the organization to achieve the organization's goal based on mechanisms, methods, patterns, and frameworks defined at the time of designing organizational system structure (Aswani et al., 2012, Rice, 2013). Conventionally, for whatever that violates the rules and principles governing the organizational system (exceptions), a strategy, mechanism, and a regulatory pattern are defined and explained (Hofmann-Wellenhof, Lichtenegger, & Collins, 2012, Rice, 2013).

This is while in the twenty-first century, organizations use traditional and classical concepts (rules and principles governing the organizational system) not as general principles governing the system and organization, but as basic rules, and overtime, in accordance with its functional nature and in case of occurring events that lead to distortion (whether dynamic or interactive), they extract rules and principles governing the organizational system (Burke, 2013).

The need to support the four concepts of communicating with other organizations, expandability, keeping users away from the complexity of the activity, and the concept of global activities among the organizations causes the occurrence of events that are not exceptions to basic and general rules and will lead to the creation of new rules and principles governing the organizational system (Burke, 2013, Saaty, 1985). Therefore, in organizations formed in accordance with the requirements of twenty-first century, we need to define patterns, mechanisms, methods, and frameworks in the organization that provide organizations with the ability to use distorted events not as a factor for the organization's failure but as a factor for extracting the principles and rules governing the organization's structure and behavior when facing a distorted event (Aswani et al., 2012, Pinedo, 2012).

The nature of distorted events is such that in the absence of mechanisms, methods, patterns, and frameworks appropriate to deal with them during the lifetime and implementation of the organization, they cause problems in continuing the organization's activities and result in its failure due to inability of basic and fundamental rules (Castells, 2014, Pinedo, 2012, Riempp, 2012).

The nature of the distortion caused by the occurrence of specific events in organizational systems and structures can be analyzed in two dimensions (Aswani et al., 2012, Castells, 2014, Coker, 2014, Khaneghah & Sharifi, 2014). The first dimension of the distorted nature is the dynamic dimension that affects the organizational system in two aspects of organizational structure and behavior.

Dynamic distorted nature changes the organizational system's structure and behavior. The second dimension of distortion is in the interactive field and concept; interactive distortions cause changes in the relationships between elements, systems, and ecosystems during the life of the organizational system. Interactive distortions make the organizational structures require new relationships and interactions between elements, organizations, and systems during the lifetime of the organization (Aswani et al., 2012, Castells, 2014, Khaneghah & Sharifi, 2014, Saaty, 1985). When an event occurs in an organization, if it cannot be analyzed during the life of the organization until its effects are identified (its effects on and the influences of fundamental elements of the system) and after its occurrence changes in communications and interactions between systemic elements (or systems) can be observed, an interactive distortion has been created in the organization. The nature of the interactive distortion is such that it derives from the concept of global activity (Aswani et al., 2012, Castells, 2014, Khaneghah & Sharifi, 2014, Sharifi, Mirtaheri, & Khaneghah, 2010, Weick, 2012). This especially shows its existential nature in a more tangible way in the twenty-first-century organizations where organizations use decentralized structures to implement organizational activities and the interactive distortion nature should be dealt with at the runtime (Haeckel, 1999, 1999, Hempel, Zhang, & Han, 2012, Sadgrove, 2015, Scheer, 2012, Sharifi et al., 2010, Young & Tippins, 2000).

In traditional methods of risk recognition, to extract the nature of definable risks in a system or organization, the initial assumption is that the event creating the risk necessarily occurs in a space where the system analyst has enough knowledge of fundamental elements and relationships between fundamental elements of that space (Sadgrove, 2015, Lépinette, & Tahar, 2013). In other words, the system analyst has a relative understanding of the system in which the risk is defined and it assumes that at the time of risk occurrence, first, the nature of the system will not change (any of the risk system factors will have a change in their nature).

Second, new communications and interactions at the system level or at the space and the system level will not be created in such a way that they can change the nature of the risk (Emerson, Nabatchi, & Balogh, 2012, Hempel et al., 2012, Pflug & Römisich, 2007, Lépinette, & Tahar, 2013), and based on this mental structure, the system analyst decides on the risk nature and risk classification (known and controllable risks, known and uncontrollable risks, and unknown risks) (Pflug & Römisich, 2007, Zsidisin, Panelli, & Upton, 2000).

This is while the nature of twenty-first-century events is such that the system analyst has an implicit perception and can have a general view of the event nature (not its effects) based on it. This general understanding makes the system analyst able to analyze the functional and existential nature of the event. The system in which the event is defined is itself a dynamic and interactive system, the fundamental elements of the system, the communications, and interactions between them as well as the interactions between the environment and the system are changing. This is especially of great importance in external system interactions (due to the source of risk in organizational structures). An event takes place in a system with strong interactions with other systems in the ecosystem. This makes the event and its impact on the system, that the designer and the analyst are investigating it, so complex that decisions cannot be made on its impacts and how it is influenced at the system level by the time it occurs.

The main problem of this paper is, first, what mathematical model can identify the nature of the interactive distortion that affects the communications and interactions of organizations in a twenty-first-century ecosystem, and decisions can be made on why the interactive distortion leading to a reconfiguration of interactions and communications is created. And second, based on what frameworks communications and interactions in the ecosystem can be reconfigured without interfering the process of the organizational activity.

This paper mainly aims at presenting a mathematical framework for managing the impacts of dynamic and interactive events and the resulting distortions on inter-organizational communications

and interactions in twenty-first century's organizations. In addition to analyzing the dynamic and interactive nature and its impacts on the function and role of time in inter-organizational communications and interactions, the framework should also be able to reconfigure these interactions without causing any disturbances in the process of the organization's operations. To this end, using the Reduction Thinking model, this paper has analyzed the concepts of Exascale organizations, global activity, relative advantages of beneficiary organizations in implementing global activities, as well as the concept of configuring beneficiary Exascale organizations to run the global activity. In the following, based on a systematic approach, the meaning of the dynamic and interactive nature in Exascale organizations' functionality is investigated. In this regard, the organization's generating space has been analyzed, and then, it is investigated that if a dynamic and interactive nature occurs and creates a distortion in the functionality of the twenty-first century organization, what distortion will mean in each of the organization's generating spaces. This makes it possible to provide a mathematical definition for distortions influencing inter-organizational communications and interactions. Due to this mathematical definition, the concept of the dynamic and interactive nature and its distortions on inter-organizational interactions can be analyzed. Considering this analysis and defining the vectors describing the Exascale organization's state, and based on the Reductionism model, RRresponse framework is introduced.

2. Basic concepts

This section introduces the basic concepts needed to design a mathematical framework to reconfigure interactions and communications in the ecosystem at the time of interactive distortion between the environment and the system, without interfering the process of the organizational activity. To this end, we need to define organizational structures that, first, a logical relationship exists between several organizational structures in the form of an ecosystem (a set of systems) so that the concept of global activity can be defined in it.

Second, the nature of the activities between systems making the ecosystem must be of the twenty-first-century activities to witness the occurrence of an event that leads to inter-system interactive distortion, and a mathematical model can be defined based on this event to deal with and manage it. In this paper, a new concept called "Exascale Organizational structures" is proposed, which has two common and specific concepts and will be considered in this section.

To extract the framework, we need to define four concepts and four assumptions about twenty-first-century organization. The first assumption is the concept of configuration communications and interactions in twenty-first-century organizations. The second one is the concept of Exascale organizations and their governing rules and conditions. The third is that the concept and definition of global activity in Exascale organizations as powerful organizations in implementing twenty-first-century tasks. The last assumption is the concept of heterogeneity as one of the advantages of Exascale organizations in executing their activities.

2.1. Nature of twenty-first-century ecosystems in comparison with twentieth-century ecosystems

The nature of twentieth-century organizational systems and structures, even when the system used a decentralized or distributed structure, was such that the ecosystem nature was designed in a static manner at the time of ecosystem designing (or a chain of systems) (Brown & Katz, 2011, Burton-Jones & Straub, 2006, Petter, DeLone, & Ephraim, 2008).

This situation would make it impossible to increase or decrease the number of elements or even the systems in the ecosystem if the ecosystem was unable to solve a problem that the distributed or decentralized organizational structure was created to solve it (Bullmore & Sporns, 2012, Gregory et al., 2013, Hempel et al., 2012, Robbins, Chatterjee, & Canda, 2011, Schlicht, 2011).

Systems' stability (either operationally and numerically) in this type of ecosystem caused many of the major challenges in managing existing activities, such as the way of distributing patterns of

activities (Robbins et al., 2011) and the way of operating activities in the system and the mechanisms used to exchange information, to be predetermined (O'leary, Mortensen, & Woolley, 2011, Payne, 2014, Wei et al., 2011). These ecosystems are suitable for solving static problems. These problems are considered to have a non-changeable nature at runtime (Garvin, 1998, Payne, 2014) and at the time of designing system (Gulati, Puranam, & Tushman, 2012) either in terms of the way of solving the problem or the required data to solve the problem.

Failure to consider the dynamic nature of activities (the nature of dynamic and interactive distortion) and its related requirements in designing ecosystems is considered as the main challenge of using traditional ecosystem designing model to achieve twenty-first-century ecosystems (Puranam, Raveendran, & Knudsen, 2012, Smith & Lewis, 2011). The most tangible feature of the models used to create twenty-first-century organizational ecosystems is known as "sub-problem problems."

The most important feature of traditional organizational systems and structures is that given the awareness of the system creator to make a system for a specific function, which is the ultimate goal of the system, the basic elements of the system are configured when it is designed to increase efficiency, improve the efficiency, determine the real function of each element, and identify the nature of monitoring and control of each element. Traditional systems use a model called the "initial configuration of the system" or "adapting the problem solver to the problem" to achieve their goals (Garvin, 1998, Puranam et al., 2012). A stable set of system stakeholders and the problem requirement (the ultimate goal of the system) enables system specialists to extract a model of adapting stakeholders to problem requirements when designing the system, and accordingly, configure the stakeholders' group to achieve system goals (Gharajedaghi, 2011, Leveson, 2011, Molchanov & Ralchenko, 2015, Nguyen, Hai, & Mohamed, 2011, Puranam et al., 2012, Rice, 2013, Smith & Lewis, 2011, Cascio, 2006, Wang, Slavakis, & Lerman, 2015).

2.2. Exascale systems

An organizational system is called Exascale if and only if:

- (A) To carry out its activities, the organizational system requires discovering the rules and principles governing the system event where the system functions and activities are defined.
- (B) To continue its activities, the organizational system requires frameworks for reconfiguration, reaction, expandability, reinteractions, and communications, and keeping the users away from complexity.
- (C) An organizational system has a distributed structure that is based on the distributed nature of its main activity. (In some cases, the semi-centralized structure).
- (D) The concept of global activity has been defined the organizational system, thus, the system requires needs to create an ecosystem to perform the global activity.

Therefore, if all the four conditions exist in the organizational structure, it will be considered Exascale ecosystem and vice versa.

The environment of traditional organizations was an environment with a small amount of dynamism, especially at the time of interacting and communicating with other organizations.

The concept of low dynamism refers to the fact that in the organization and environment governing the traditional organization, the way the organization communicates and interacts with the environment was clearly identified and predefined, and the environment had the slightest change from the organization's point of view, and if the environment had made significant and

severe changes, then the organization would have changed its functional nature as well and a new organization might have been created (Barrow, 1995, Shaikh, 2011).

The pattern of traditional organizations' communications and interactions with the environment is defined based on the observation window, and when the traditional organization's environment has changes that change the organization's view towards the environment, the organization creates a new organization, based on one of the patterns of integration, disintegration, or creation of a new organization, which has a clear vision of the organization's environment so that it can define communications and interactions between the traditional organization and the environment based on the environment's new vision. By entering the twenty-first century and due to high environmental changes, we are witnessing a collapse of the traditional pattern of interactions and communications between the organization and the environment (Barrow, 1995, Castells, 2014, Paterson, 2007, Puranam et al., 2012).

In Exascale ecosystems, the environment of the organization is itself highly dynamic due to the occurrence of dynamic and interactive distortions. This decreases the clear vision of the organization towards the environment, and subsequently, the definition of interactions and communications between the organization and the environment. Therefore, either traditional pattern should be used to deal with environmental changes (Castells, 2014, Hanna, Rohm, & Crittenden, 2011, Puranam et al., 2012, Smith & Lewis, 2011, Stark, 2011) or communications and interactions between the organization and the environment should be re-examined in a new way during the lifetime and running the organization's activities [50, 61, 62, 63]. Therefore, defining communication patterns of the organization and the environment must be transferred from when the organization is designed to the lifetime and performing the organization's activities, which means redefining the communications and interactions of the environment and organization (Gharajedaghi, 2011).

2.3. The concept of global activity in exascale ecosystem

One of the most important features of Exascale systems, in comparison with twentieth century's systems, is the nature of the global activity defined at inter-system level. In twentieth century's systems, the logical structure of the organization conventionally followed a centralized pattern. In centralized systems, even if the system is geographically widespread, there is necessarily a central element in the system that manages and controls all the activities and events at the system level (Cascio, 2006). This element, called central element, is the starting element of all global activities defined at the ecosystem level, and because it is the starter of the global activity at the system level, it causes:

- (A) Due to having complete information about the nature of the activity and the nature of the systems (and even the nature of the constituent elements of each system), the central element creates a structure accountable to its activities, that can operate this activity only in one system of the ecosystem or any part of it in a system of the ecosystem. Regardless of the activity caused by the central starter element is performed in what systems and elements of each system, a corresponding non-Euclidean space can be defined for the ecosystem environment (Molchanov & Ralchenko, 2015, Wang et al., 2015), and the concept of line in non-Euclidean space and the definition of affine plane can be used for the process of performing the activity at the ecosystem level. The non-Euclidean line and its resulting affine plane indicate a global activity at the ecosystem level.
- (B) Each element in each system (or even the information of each of the ecosystem's constituent systems) to make decisions on how to carry out the activity given the status information (capabilities, strengths, weaknesses, and extent of involvement in local and global activities. (Nguyen et al., 2011, Rice, 2013).
- (C) From the central element perspective, the ecosystem is a three-dimensional space (Time, State, and Attribute Activity). The central element starting the global activity provides detailed information on any of the activity (or activities) features that are carried out at

the ecosystem level, how time passes and affects the activity (or activities), and elements and systems. It also contains detailed information on the status of each element and system, its capabilities, and weaknesses.

- (D) For each global activity, a global accountability structure is created at the ecosystem level by the starter element of the global activity. Corresponding to any global accountability structure, a global control structure is also created by the starter element of the global activity.

Hence, based on what has been proposed in systems and structures of twentieth century, the concept of global activity can be defined as a set of sub-activities where an element in a system (or a number of elements in some systems) is accountable to each of these sub-activities based on the capabilities and the concept of relative advantage of each element, so that they will eventually lead to performing the global activity and achieving the goal of performing the global activity in the ecosystem (or system).

In systems and structures of the twenty-first century, because of the distributed nature of the organizational structure, the concept of central management and control element cannot be used. As a result, none of the elements in the ecosystem has a full view and awareness of system's basic elements, time, features of basic elements, and global activities defined in the system (Baldwin, 2011, Merabti, Kennedy, & Hurst, 2011, Mirtaheiri et al., 2013). Therefore, each element of constituent systems of the ecosystem should have a framework that can make decisions on the following issues based on it: a) obtain information on its capabilities from the other perspective of elements in the system with the least amount of information received from other systems (and even the other elements in a system); b) obtain information on special features of other elements that make it possible to transfer global activity to them; c) obtain information on system time and constraints governing time; d) make decisions on the nature of global activity (Mirtaheiri et al., 2013).

Although centralized structures have many advantages in terms of control management and execution processes of the activities, they cannot be highly efficient when the number and frequency of events that change the nature of the global activity are increased. On the other hand, centralized organizational structures need to have accurate information on the elements and systems in an ecosystem. However, the nature of events at the level of twenty-first-century organizations is such that they create new infrastructures (or new elements and, at worst, new systems) so that the required time to recognize the system by the central controller element cannot be neglected in comparison with the time of running the global activity (Castells, 2014, Merabti et al., 2011, Mirtaheiri et al., 2013, Scott, 2013).

2.4. The concept of heterogeneity in exascale ecosystem

If the organizational ecosystem is of Exascale ecosystem type which includes n independent organizational structures, then, based on the following items, it cannot be stated that all n organizational structures of the ecosystem have the same nature (Barrow, 1995, Mirtaheiri et al., 2013):

- (I) Not all organizational structures may have the same underlying platforms (in other words, the underlying platform and hardware structures in the organizational structures may not be the same). In this paper, it is referred to as platform heterogeneity (PH). In the context of PH, the focus is that the platform in which the organization is created may differ even in two similar organizations.
- (II) Not all organizational structures may have the same management patterns and models. In other words, each organizational structure of the eco-system may use a specific management model. The organizational structure management model directly affects global activity function of the organization and is influenced by the organization's nature. Any organizational structure management model can cause strengths or weaknesses in a structure. In this paper, it is referred to as management heterogeneity (MH).

- (III) All organizational structures may not have the same set of utilities. Each system provides a set of utilities for organization’s basic elements and elements that use the organization (elements that affect the organization or are affected by it). The existence of a wide range of utilities defined in each of the ecosystem member structures can create heterogeneity among the ecosystem structures. In this paper, it is referred to as utility heterogeneity (UH).
- (IV) All organizational structures may not have the same functional model. Some systems in an ecosystem may have a more important role in running a global activity that is defined in the ecosystem and some may have a less important role in the same global activity. In other words, the functional model of systems in the ecosystem has differences in terms of global activity (part of this capability is due to the extent to which the system is capable of responding to local activities to provide global activities with its resources). In this paper, it is referred to as functional heterogeneity (FH).

The four factors of systems’ heterogeneity (PH, MH, UH, and FH) can be considered as factors influencing the set of elements of the ecosystem, and make it possible to define an ecosystem. If these four factors do not exist in an ecosystem and all organizational structures forming the ecosystem are homogeneous, the formation of the ecosystem concept will be violated. The first three factors are also defined in twentieth-century ecosystem structures, but the fourth factor or FH heterogeneity is only tangibly defined in Exascale ecosystems. If these four factors cannot be defined in an ecosystem, the notion that each ecosystem-forming system has the capabilities that enable it to run the whole (or part of) global activity will be violated. Each of these four factors can cause changes in ecosystem’s accountability to global activities. Given this approach, the space generating the ecosystem can be considered as a four-dimensional space in the form of < FH, UH, MH, PH> .

The most important factor in differences between ecosystems in implementing global activity is the concept of functional model in ecosystem member systems (Kuja et al., 2013, Lehar, 2005, Sadgrove, 2015, Scherer, Palazzo, & Seidl, 2013, Skogdalen & Jan, 2011, Stamatelatos et al., 2011).

The concept of the functional model is very complicated. This paper only emphasizes a specific part, called functional behavior, in using existing resources in organizational structures to implement global activities. Different functional models cause the basic elements of organizational structures to have different behaviors in using their existing resources in implementing different global activities defined in the ecosystem.

3. The framework for managing and controlling interactive communicative events in exascale ecosystems

If we want to describe the events leading to interactive distortions at the level of today’s structures more precisely and discuss their interactive nature, we have to consider the two concepts of the run-time nature and ecosystem activity as well as interactions and communications between ecosystems as two affecting factors at the organizational level. On the other hand, we have to distinguish between these three structures: the organization we are examining, the system where distortion occurs, and the set of systems that are related to the system where distortion is defined. The organizational structure of each ecosystem member organization is meeting a certain goal. Its goal is in the form of a mathematical function in function 1.

$$f(\text{Traget}_{\text{System}}) \propto \left[\int_{t=0}^{\text{End}_{\text{Lifecycle}}} \left[\begin{array}{c} (\text{Buyer} - \text{Seller}_{\text{Space}}) \\ (\text{Social}_{\text{Space}}) (\text{Demand} - \text{Supply}_{\text{Space}}) \\ (\text{location Binding \& Limitation}_{\text{Space}}) \\ \text{Economic}_{\text{Space}} \end{array} \right] \right] \sum (\text{Creator}_{\text{Space}})_{\text{Disorder}} * \overrightarrow{\text{Wigth}} \tag{1}$$

Equation 1 implies that the ultimate goal of a specific organization in the ecosystem is a set of the resultant (with an unknown operator, where determining the operator depends on the organization that should be discussed) of hexed generating spaces affecting the ultimate goal space. Each of these generating spaces has a set of effective factors, some are in line with the ultimate goal of the specified organization in the ecosystem, and others have a total or partial standard deviation from the final goal space of the specific organization in the ecosystem.

Without entering into the details of generating spaces of the ultimate goal of the specific organization in the ecosystem (due to the fact that each generating space activates and deactivates some of its elements in a particular organization), the ultimate space of the specific organization in the ecosystem can be defined using a mapping function, like the one used in Equation 2.

$$f(t \rightarrow \text{Stable and Location} \rightarrow \text{Stable Eq.1}) \text{ then } f(\text{Traget}_{\text{system}}) \propto \frac{\text{Disorder}_{\text{Space}}}{\left\{ \text{Elman}_{\text{Bspace}} \right\} \left\{ \text{Elman}_{\text{Sspace}} \right\} \left\{ \text{Elman}_{\text{DSspace}} \right\} \left\{ \text{Elamns}_{\text{Lspace}} \right\} \left\{ \text{Elmans}_{\text{ESapce}} \right\}} \quad (2)$$

Equation 2 indicates that regardless of the organization's time and space nature, and only by focusing on a stable state and a state where the particular organization in the ecosystem is in its normal function, the generating set of such an organization includes the elements that affect the five-dimensional space of < Seller-Buyer, Social, Demand-Supply, Location, Economic> or are affected by them, in such a way that all of them are influenced by the discrete generating space of the distortion. Distortion space is a mapping and generating space. It means creating the distortion space is in the form of Equation 3.

$$f(\text{disorder}) \approx \left[\left[\frac{\text{Real Disorder}}{\lim_{t \rightarrow \text{unstableEvent}} \text{disorder}(\text{Technology}(t), \text{Human}(t), \text{Equipment}(t), \exists! \cup \text{unkonwn})} \right] \text{and} \left[\begin{array}{l} \left(\text{Disorder}(\text{BS}_{\text{Space}}) \pm \text{Elman}_{\text{Real disorder}}^{\text{important factor}(t,l)} \right) \text{and} \\ \text{TimeVector} \\ \left(\text{Disorder}(\text{S}_{\text{Space}}) \pm \text{Elman}_{\text{Real disorder}}^{\text{important factor}(t,l)} \right) \\ \int_{t=0, l=\text{first}}^{t=\infty, l=\pm \text{Life}} \text{and} \left(\text{Disorder}(\text{DS}_{\text{Space}}) \pm \text{Elman}_{\text{Real disorder}}^{\text{important factor}(t,l)} \right) \text{and} \\ \left(\text{Disorder}(\text{LS}_{\text{Space}}) \pm \text{Elman}_{\text{Real disorder}}^{\text{important factor}(t,l)} \right) \\ \text{and} \left(\text{Disorder}(\text{E}_{\text{Space}}) \pm \text{Elman}_{\text{Real disorder}}^{\text{important factor}(t,l)} \right) \end{array} \right] \right] \quad (3)$$

Equation 3 shows the state of the distortion generating space in its most general state. The distortion generating space includes a generating subspace, called real distortion, and five mapping subspaces resulting from factors affecting the distortion (or factors influenced by distortion) in each space of < Seller-Buyer, Social, Demand-Supply, Location, and Economic> . Real distortion space results from four-time elements, technology, human, and equipment distortions, and unknown distortions. As a generating space, it creates distortion in conditions when an event occurs in the organization or the organization environment in such a way that it changes organization's state from the stable into unstable.

The five subspaces are of a continuous type and a factor (or factors) may cause distortion in the mentioned organization in each of them; a factor (or some factors) has been observed in real distortion and are not influenced by similar factors in real distortion space. Therefore, they must be

deducted from the continuous distortion space for each of the five continuous spaces. But first, there may be a factor (or factors) in the real distortion space so that they provide a new definition when they are defined in each of the five generating spaces when mapped to the real distortion space. Second, the factor (or factors) may not be mapped to real distortion, but the corresponding factor (or factors) in the real distortion space may create a new concept in the distortion space of each of the five generating spaces. In this case, the factor (or factors) should be added to the continuous distortion caused by each of the five generating spaces.

On the other hand, the result of this continuous space must be raised to the power of the importance of this space at the level of the society where the organization is defined. The value of numerical importance coefficient is between zero and one hundred. This is due to the nature of distortion space and its dimension. The distortion space is a vector space which makes the spaces generating the final and ultimate goal of the system distance from the goal or come close to it.

The value of numerical importance coefficient between 0 and 100 means having no influences on generating spaces, which causes the distortion mapping subspace to be considered as one of the main bases of distortion space and transformed from a mapping subspace into a distortion space-generating subspace. The value of importance coefficient is itself a function of time and space, i.e. its value changes over the system's lifetime and the spatial state that the generating space of the importance coefficient is measured. Therefore, the change in importance coefficient value always occurs when the system is transferred from one temporal state (stable time, unstable time) to a new temporal state or from one spatial state (geographic space, management, and the number of subspaces that are considered as the whole system) to a new spatial state.

In traditional systems, what is known as a risk is, in fact, the real part of the space that generates distortion space (Lehar, 2005, Sadgrove, 2015, Skogdalen & Jan, 2011, Stamatelatos et al., 2011)? This element will never follow the time, but it will follow the system status. Therefore, the risk-generating element in traditional systems follows Equation 4.

$$\text{if Risk Occure, } \exists \text{Elaman} \in \text{Real Disroder Elman change } f(\text{target}) \text{ in } \text{time and location} \quad (4)$$

In Equation 4, the occurrence of a system-level risk implies that an element has been activated in a space generating real distortion in such a way that it influences the system's target at a specific time interval (*time*) and a specified location (*location*). However, distorted events in twenty-first century are events that are time-and-location-related and do not merely originate from real distortion generating space, also, their formation is based on both the distortion space and the interactions between distortion spaces. Interactive distortions defined in Exascale ecosystems follow a function such as Equation 5.

$$\begin{pmatrix} \text{Disroder}(t) \\ \text{Disorder}(l) \\ \text{Disorder}(S) \end{pmatrix} = \begin{bmatrix} \text{Real Disorder} & \text{Disorder}(BS_{Space}) & \text{Disorder}(S_{Space}) \\ \text{Disorder}(DS_{Space}) & \text{Disorder}(LS_{Space}) & \text{Disorder}(E_{Space}) \\ \text{Important Factor}_{Space} & \text{Operator}_{Space} & \text{Time and Location}_{Space} \end{bmatrix} \cdot \begin{bmatrix} \text{Interactive}(t) \\ \text{interactive}(l) \\ \text{Interactive}(s) \end{bmatrix} \quad (5)$$

In Equation 5, the generating space of distortion nature, from its interactive approach, is itself a three-dimensional space with three generating elements consisting of two discrete elements (Location, System State) and a continuous element (time). On the other hand, to calculate the generating space of interactive distortion nature of communications and interactions in an Exascale ecosystem, we need to calculate a 3 * 3 matrix whose elements are the generating spaces of the distortion mentioned in Equation 3. The most important difference between Equation

5 and Equation 3 in how to create an interactive distortion generating space is the nature of the effect of elements on each other. As seen in Equation 5, the distortion space:

- (i) Is a three-dimensional space with the elements of time, location, and organization state in the Exascale ecosystem (system)?
- (ii) Interactive distortion generating space is caused by the internal multiplication of the matrix traditional distortion generating spaces by the matrix of the generating space of specific organization's interactions in an Exascale ecosystem.
- (iii) The matrix of the state of traditional distortion generating spaces is a 3×3 matrix whose elements in the first and second rows are always traditional distortion generating spaces and the third row is the operators effective in traditional distortion generating spaces. In its most general case, the matrix of traditional distortion space state can be defined in the form of a $3 \times N$ matrix. In this case, the first and second rows of the matrix are always traditional distortion generating spaces and the third row is the operators that can be defined on traditional distortion generating spaces. Element (1,1) must always be the real distortion, element (1,3) must be importance coefficient, and element (3 * N) must be two spatial and temporal generating elements of distortion space, and operators and elements that create generating spaces at the third level must be defined between these two concepts.
- (iv) The matrix of the state of organization's interaction generating space is a matrix of 3×1 , which corresponds to the interactive distortion generating space matrix in the domain of system interactions.

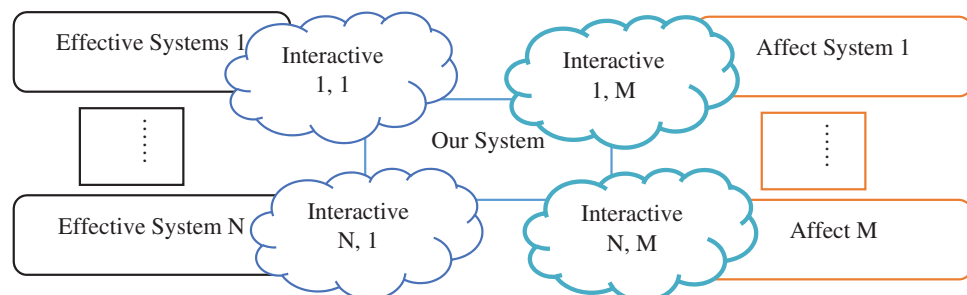
The most important feature of Equation 5 is the possibility of defining linear transformations for the matrix of the state of traditional distortion generating space to consider interactions and relationships between traditional generating spaces and interactive distortions. This makes it possible to extract characteristic function related to the matrix of traditional distortion space state using linear transformations and creates a mapping of traditional distortion generating space into interactive distortion generating space in each dimension of time, location, and organization status by taking into account the interactions and connections between traditional distortion generating spaces.

3.1. The concept of interactive distortions in the exascale ecosystem

Equation 5 provides organization designers with the possibility to have an overview of the nature of interactive distortion in the organization. Figure 1 shows an abstract state of an organization of Exascale constituent set from an interactive approach (regardless of interactive distortion nature).

As shown in Figure 1, an ecosystem, in its most general case, can be described based on an $N \times M$ matrix including a set of organizations that are affecting a particular organization (our system) or are affected by them. Each interactive and communicative space in the form of (i, j) has a distortion generating space in the form of Equation 5. In each interactive and communicative space, one (or several) interactive distortions may occur based on Equation 5. Interactive

Figure 1. The status of an abstract ecosystem from an interactive approach.



distortions cause an event to occur at the level of the entire organization affecting a particular organization so that the influence of this event at runtime can create a new communication and interaction (or removal) among the influential organizations and the organization under study. Therefore, the definition of communications between the organization and other organizations should be reviewed and recomunications for a specific organization are required. In its most general case, this event must necessarily occur in a global activity. According to the definition of global activity, an organization is necessarily proposed as the starting point of activity, and a part (or some parts of it) must necessarily be implemented in other organizations so that it can be claimed that the global activity at the level of the Exascale ecosystem has been completed. This paper examines global activities that start at our system point and a part (parts) of it must be implemented at the level of each (i, j) organization to complete the activity in our system. On the other hand, this paper only examines the interactive distortion events that create a new connection. Considering the concept of global activity, Equation 6 can be used to describe interactive distortion at the level of Figure 1.

$$\exists! \text{Diorder} \in \text{Disorder} - \text{Eq5 } (i,j) \text{ define ineteractive}_{(i,j)} = \sum_k (\beta | \alpha_k) \alpha_k \text{ Eq.6} \quad (6)$$

Equation 6 states that if in Figure 1 a global activity is defined on the basis of our system, then if a distortion event occurs in any of the organizations (i, j), this distortion will define new communications and interactions so that β represents the vector or matrix of distortion status of our system organization, and α_k is the distortion status vector of each k organization that participates in the global activity where the distortion has occurred.

For a better understanding, it can be assumed that W is a subspace of inner multiplication of Equation 5 that has a direct role in global activity (W can be any subspace of Equation 5 that has a direct impact on global activity d in some ways and d is a global activity created by our system). In this case, after calculating $\sum (\beta | \alpha_k) \alpha_k$, the value of (i, (j)) represents the exact interactions and connections created by interactive distortion among organizations k because it represents the best approximation for the value of the vector or matrix of our system organization distortion in Figure 1 for all possible vectors for w (Each possible vector for w is a distortion subspace of Equation 5 for each (i, j) organization of k that directly affects global activity d).

Formula 6 also shows a re-interaction model for the ecosystem shown in Figure 1.

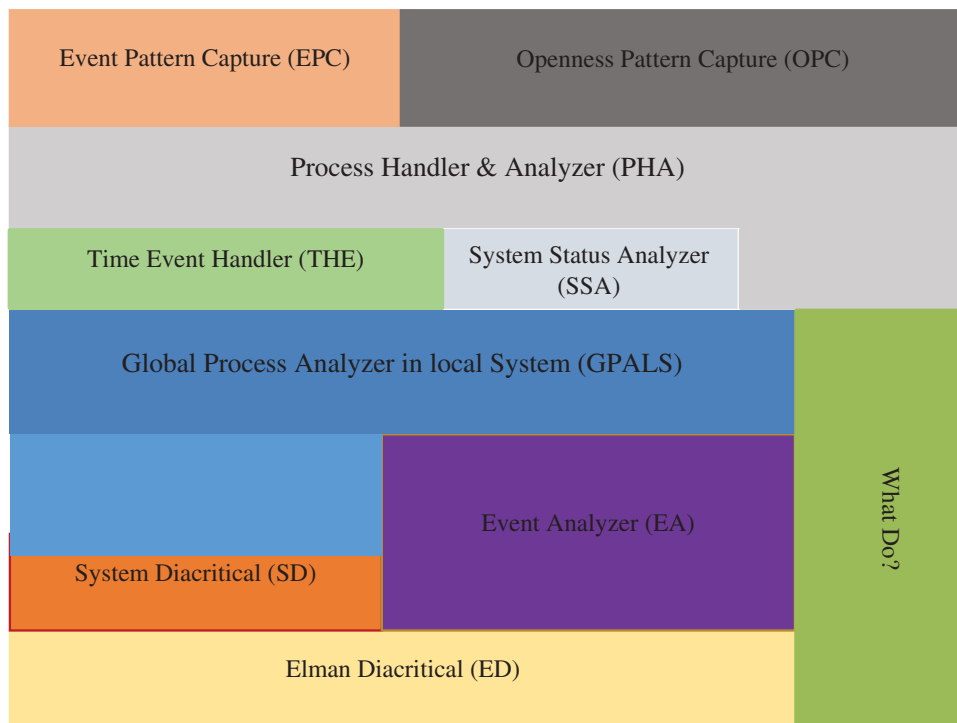
It can be comprehensively pointed out that the nature of the interactive distortion event is an event occurring at the level of organizations influencing or are influenced by the reference organization and its occurrence can be discussed in the best conditions by examining the status of distortion generating spaces governing each organization that influences or is influenced by the organization. But what is proposed as the effects of this event at the organization (or organizations) level cannot be discussed until an interactive distortion event occurs. Therefore, mechanisms, structures, models, methods, and general frameworks cannot be defined and identified to deal with it.

4. RRresponse framework

There are two methods to deal with distortion events that change communications and interactions between the organization and other organizations in such a way that until the occurrence of this interactive distortion, decisions on the nature of its impact on communications and interactions between the organization and other organizations constituting the Exascale ecosystem cannot be made. One method is observing the distortion and system, and the other is discovering the cause of distortion nature (Drack & Apfalter, 2007, Flood, 2010, Steffensen, 2013).

The second approach is based on atomism. In this paper, the second method is used to solve the re-interaction problem and the relationship of the organization with other organizations in the ecosystem. Based on the second method in this paper, Reductionism Reopenness or RRresponse

Figure 2. Schematic framework of RRresponse unit in each member system of Figure 1.



framework is introduced. The RR method for any distortion interactions occurring in the organization exists in our system's single RRresponse system, which uses the framework shown in Figure 2. In RR method, for each interactive distortion occurring in the organization, a unit called RRresponse exists in the framework shown in Figure 2. Figure 2 shows the schematic and systematic framework of RRresponse unit.

As seen in Figure 2, RRresponse unit is a unit of event analysis, and the operation implementation is based on the results of the analysis. The two elements of Event Pattern Capture and Openness pattern capture in this framework are first responsible for exploring the pattern governing the event caused a distortion in inter-organizational interactions. Second, they are responsible for examining the status of our system in terms of communications and interactions with other organizations in Figure 1 before and after the occurrence of interactive distortion events, creating a differential scheme from this investigation, and presenting it to other organizations that contribute to the distortion resulting in global activities. As shown in Figure 1, other organizations have communications and interactions with our system with an effective or influential status at each $t = t_e$. Thus, when an interactive distortion event occurs at the ecosystem level, the two EPC and OPC units have to determine the tasks (effective and influential) causing the distortion of global activity in our system. Two EPC and OPC units use two population difference methods (Samuels, Witmer, & Schaffner, 2012) to extract and describe the state resulting from interactive distortion.

The PHA unit task is to, first, examine the status of activities in the organization and determine what activities at the organization level are due to the specific function of the organization under study and what activities are the result of the organization role in implementing global activity (or activities). Second, by solving the difference of organization's status equation based on the activities and communication between them (intra-organizational interactions), it should determine which model has emerged at the organizational level that needs re-interaction in the organization. Extracting this pattern in a PHA unit can be presented to OPC and EPC units as a new pattern.

The GPLAS unit determines the changes caused by the distortion event resulting from the global activity on local activities of the organization. This unit determines the pattern of distortion detected in the PHA unit. More precisely, in the framework presented in Figure 2, in addition to recognizing the nature of the interactive distortion created by the ecosystem member organization, PHA unit also provides a solution to deal with the nature of the interactive distortion event and the ReOpenness of the organization under study in the ecosystem based on identifying the impact of distortion in global activity (as a factor of creating interactions and communications among ecosystem member organizations) by GPLAS unit. To extract the pattern to deal with the interactive distortion identified in PHA unit by GPLAS unit, we need to know:

- (i) How does distortion affect the activities of the system that arise from taking part in a global activity? (System-Global Space)
- (ii) How does distortion affect the local activities in the system? (Local-Disorder Space)
- (iii) What elements of the system need to be reviewed due to the distortion? (LElement-Redefine space)
- (iv) What are intra-system communications redefined because of the distortion? (LRelation-Redefine)
- (v) What events are caused by the distortion at the system level? (LActivity-System space)
- (vi) Is there a need to create or remove a system-level element to solve distortion? (System-EAddRemove space)
- (vii) Does system structure need to be changed? (Disorder—Restructure)
- (viii) Does the distortion change the role of the system in the ecosystem? (Disorder-Behavior Space)
- (ix) How does the distortion affect the role of key elements in the system? (Disorder Space—EBehavior)

The PHA unit creates a Latin square in the form shown in Figure 3 to provide a model for dealing with interactive distortion nature.

Figure 3. Schematic Latin Square.

Activity	System-Global	Local-Disorder	Lelement-Redefine	Lrelation-Redefine	Lactivity-System	System-EaddRemove	Disorder-Behavior	Disorder Restructure	Disorder Ebehavior
Disorder									
Real Disorder	A ₁₁								
Disorder(BS _{Space})									
Disorder(S _{Space})									
Disorder(DS _{Space})						
Disorder(LS _{Space})									
Disorder(ES _{Space})									
Important Factor _{Space}									
Operator _{Space}									
Time and Location _{Space}									A ₉₉

Square rows are the main factors of real distortion generating spaces and its columns are the effects of interactive distortion at the level of the organization under review based on PHA unit's data. Now, a corresponding matrix and, consequently, a vector in the non-Euclidean space can be defined for the Latin square shown in Figure 3. This vector is called v ; vector v is a vector in non-Euclidean space and is created based on the generating field shown in Equation 7.

$$F(Eq.5, PHA_{Elman}, \omega, \mu) \tag{7}$$

The generating field expressed in Equation 7 is, in fact, the generating field of vector v and, consequently, the generating field of Latin square is shown in Figure 3. In this generating field, the main elements are in the form of two-dimensional pairs of <Equation 5, PHAEleman>, and the two ω, μ operators create a Latin square or vector v .

Operator ω is a vector operator that extracts a characteristic vector of the effects of traditional distortion generating space on the organization's description space by PHA unit. Operator ω is actually an operator that transfers the two mentioned spaces into the space of distortion effects on the organization using the dimension reduction by the Latin square. Vector v , which is the corresponding vector of Latin square matrix shown in Figure 3, is in the form of Equation 8.

Interactive distortion does not appear at the level of an organization under study unless the interactive activities in the organization face challenges in external communication and interactions due to the distortion, and since the organization's interactions with other organizations are defined according to the two categories of local and global activities, thus, some part of the need for re-interaction arises from interactive distortion of local activities (shown by symbol μ) and some others result from interactive distortion of global activities (shown by symbol ρ).

$$\omega_{operator} : \left[\begin{array}{c} A_{11} \\ A_{12} \\ \vdots \\ A_{99} \end{array} \right] \&[If w = Disorder_1 \text{ vector}]$$

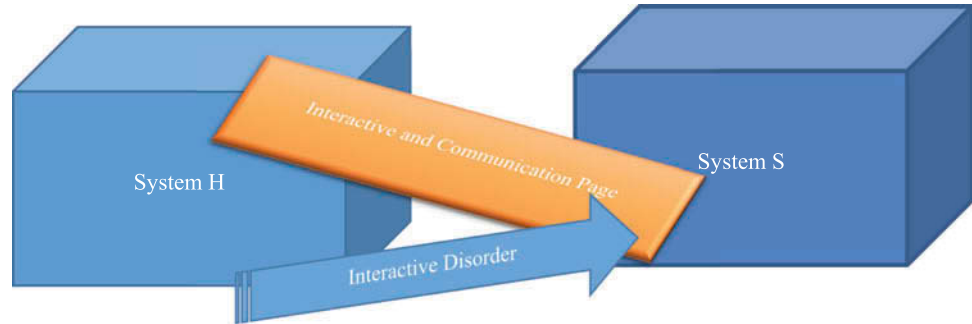
$\therefore [i \in \{Real\ Disorder, \dots, Time\ and\ Location_{Space}\}] \text{ herefore we have } W_{Space}$

$$\therefore \left[W_{Space} = \sum_{Vector_{Add}} W_i \right]$$

if c is one variable from v_{vector} && e_i is one variable from (w_i) vector then $\sum(c, e_i)$

$$= \left[\begin{array}{c} \left(\begin{array}{ccc} E((c_1, -u_1) - (c_1 - u_1)) & \cdots & E((c_1, -u_1) - (c_n - u_n)) \\ \vdots & \ddots & \vdots \\ E((c_n, -u_n) - (c_1 - u_1)) & \cdots & ((c_n, -u_n) - (c_n - u_n)) \end{array} \right) \\ \left(\begin{array}{ccc} E((c_1, -u_1) - (e_{11} - u_1)) & \cdots & E((c_1, -u_1) - (e_{n1} - u_n)) \\ \vdots & \ddots & \vdots \\ E((c_n, -u_n) - (e_{11} - u_1)) & \cdots & ((c_n, -u_n) - (e_{nn} - u_n)) \end{array} \right)^T \\ \left(\begin{array}{ccc} E((c_1, -u_1) - (e_{11} - u_1)) & \cdots & E((c_1, -u_1) - (e_{n1} - u_n)) \\ \vdots & \ddots & \vdots \\ E((c_n, -u_n) - (e_{11} - u_1)) & \cdots & ((c_n, -u_n) - (e_{nn} - u_n)) \end{array} \right) \\ \left(\begin{array}{ccc} E((e_{i1}, -u_1) - (e_{i1} - u_1)) & \cdots & E((e_{i1}, -u_1) - (e_{in} - u_n)) \\ \vdots & \ddots & \vdots \\ E((e_{in}, -u_n) - (e_{in} - u_1)) & \cdots & ((e_{in}, -u_n) - (e_{in} - u_n)) \end{array} \right) \end{array} \right]$$

Figure 4. PHA's systematic vision of a distortion occurring between communications between organizations H and S.



$$\text{therefore : } \left[A_{i,j} = \begin{bmatrix} \sum e_i e_j - (\sum e_i c * \sum c c^{-1} * \sum c e_j) \\ \mu_{e_i} + \sum e_i c * \sum c c^{-1} - c - \mu_c \\ \rho_{e_i} + \sum e_i c * \sum c c^{-1} - c - \rho_c \end{bmatrix} \right] \quad (8)$$

Equation 8 is a pattern used by PHA unit to extract and complete Latin square matrix based on corresponding non-Euclidean vector V. (Feller, 2008).

As seen in Equation 8, PHA unit uses the operator $\omega_{operator}$ to create a mapping space between traditional distortion generating space on each of the elements of defining organization status by PHA unit, and considering the fact that the created distortion has affected both the global and the local activities of the organization, it creates a Latin square matrix that describes the interactive distortion created in the organization. The most important feature of the Latin square created in the organization is creating a Latin square in a non-Euclidean space to reduce the nine space to a two-dimensional space defined by the vector v.

From PHA unit perspective, the organizations in Figure 1 are in a non-Euclidean space, and each organization uses a page called the Interactive Disorder Page for communications and interactions with other organizations. Therefore, the occurrence of any interactive distortion in the organization means that a distortion has occurred on its interactive page with one (or more) other organization in the ecosystem. To understand the function of operator μ , assume that in the global activity defined between organization H and organization S, an interactive distortion event has occurred in a way that the communication and interaction page between two organizations is distorted. In this unit, PHA defines μ operator according to Figure 4 in the form of Equation 9.

As shown in Figure 4, if we assume that the direction of global activity is from organization H to organization S, the occurrence of a distortion event in communications and interactions in organizations H and S creates a K vector in the space between the two organizations (vector K can be created in the space between the two organizations or within each of the two organizations). Operator μ uses Equation 9 to calculate the communication and interaction page after the occurrence of the event causing distortion.

$$\mu_{operator} : (\forall l \in \text{Interactive \& Communication page}) \& P \in$$

$$\text{Set Communication Between}_{H,S} \text{ with } P \ni l \text{ then } \exists ! \acute{l} \in l \text{ that } P \in \acute{l} \text{ and } l \cap \acute{l} = \emptyset \quad (9)$$

As shown in Equation 8, it is a logical proposition, and in case it is proved, distortion is created on the interaction and communication page between the two organizations and \acute{l} page or the Interactive & Communication page is no longer the communication and interaction page between the two systems. There is a point such as P, which is the point of communication and interaction

between S and H organizations, and is itself due to the distortion occurred between the two systems. Point P creates a new page called $\hat{1}$.

The rules governing $\hat{1}$ are the same as the rules that govern vector V created by operator ω and the new interactive P point is necessarily on the page $\hat{1}$, and vector v is the generating vector of page $\hat{1}$. There are no common points between l and 1. Operator μ is the operator of creating an interactive and communication page between S and H organizations.

In other words, PHA unit proposes that the solution to deal with the discovered distortion nature is recognizing the exact nature of interactive distortion and creating a non-Euclidean space to understand the nature of global activity (by GPLAS unit), the nature of interactions between organizations, and on the other hand, the solution of re-interaction and communication is creating a new interactive page based on operators ω and μ .

PHA unit accurately examines the nature of interactive distortion and sends the solution of creating the communication and interactive $\hat{1}$ page to What Do unit. But the cost of implementing such an operation, both in terms of time and cost, in an organization that has many interactions with other organizations, is very complex and expensive. It can intuitively be stated that the cost of non-Euclidean space created in the ecosystem, is a function of the number of its organizations and the maximum limit of i and j, and has an exponential relationship of NPRIN number type with the number of organizations and existing communication and interactions caused by organizations' participation in a global activity.

PHA unit output is sent to three units of What Do?, THE, and SSA. THE unit task is to determine the maximum time-out for global activity to calculate the new communication and interactive $\hat{1}$ page based on the Latin square matrix created in the organization. Looking back at Equations 8 and 9, we will find out that the calculation of vector v occurs only when p is present.

In this case, THE unit makes decisions on the time based on the number of P points caused by interactive distortion. In THE unit, if the creation time of the page is from the acceptable time for a global operation, the order to stop running global activities in the organization is issued, Otherwise, What Do? The unit creates a new interactive and communication structure based on vector v through GPALS unit and based on PHA information. The SSA unit also redefines the organization's role in global operations. It is important to note that page $\hat{1}$ will not necessarily be a page between two organizations H and S, although it necessarily interrupts the space between H and S, it may include other space (or spaces). This requires the organization under study to redefine its status among the organizations shown in the non-Euclidean space in Figure 1.

PHA unit information on vector v creating page $\hat{1}$ and what other organization (or other organizations) this page needs to redefine the communications and interactions between organizations H and S, is analyzed by SSA unit, and new communication and interactions between the new organizations and organization H and the extraction of the pattern of changes in the nature of global activity process is analyzed and provided to GPLAS and What Do? units.

Based on the extracted information as well as PHA unit information, GPLAS unit redefines the local organization based on the new constraints defined by SSA and What Do? units. This system redefinition can be primarily considered as a change in the role of the organization's fundamental elements which is carried out in ED unit based on SD and What Do? units information. Second, it can be considered as defining new elements for responding to new events at the ecosystem level, which is carried out in EA unit and based on the information of SD, What Do?, and GPALS units.

What Do? Unit is the operational unit of RRresponse framework operates based on the created information in PHA, GPALS, EA, and ED units whether at global activity level to resolve the distortion

based on the pattern obtained in GPALS and PHA units, or at the local level to redefine the organization and the elements of the organization based on the information of EA and ED units.

5. Conclusion

The RRresponse framework is defined in any organization that is implementing part (or entire) of the global activity. The functional nature of the RRresponse framework is decentralized. This causes many of the mechanisms and patterns defined in the RRresponse framework to be based on the organization's local information and in some of the mechanisms and patterns defined in the RRresponse framework, we need to update the status of information, based on the status of the organization initiating the global activity. On the other hand, the highest level of interactions between organizations within RRresponse framework is among the organizations that are reasonably considered to be the neighbors when implementing a global activity at the ecosystem level.

After observing an event that has caused an interactive distortion between the organization under investigation and other organizations in the ecosystem, RRresponse framework attempts to extract the nature and the cause of the distortion in the organization, and most importantly the exact impacts of interactive distortion on the function of the individual elements in the organization and ecosystem and its impact on the organization's interactions and communications with the ecosystem. Although the information extraction of interactive distortion nature and function makes it possible to obtain very accurate information on the effect of this distortion on both concepts of < Elman, Communication> and even define the elements, events, and interactions whether within the organization or in the communication and interactive space between organizations, but the high cost of calculations in PHA unit, also the high cost of analyzing and redefining inter-organizational communications in the ecosystem (in SSA, EA, SD, and ED units), makes it possible to use RRresponse framework in the real world in ecosystems that:

- (a) Performing local activities (activities defined at the level of an organization) within the organization under study should not violate or disturb the process of global activities. At each moment of the ecosystem lifetime in RRresponse framework, it should be possible to identify the status of the organization in SSA and GPALS units in relation to global activities.
- (b) Distortion nature is such that at any moment of distortion one and only one Event occurs at the ecosystem level. When an interactive distortion occurs, no system should be involved in more than one distortion. If the nature of the interactive distortion is such that it results in more than one event, then the EPC, OPC, and PHA units will not be capable of analyzing and distinguishing interactive distortions.
- (c) There is one and only one vector at any time of the ecosystem life (the criterion for any moment of ecosystem life is the average time when THE unit is being calculated and a global activity, that has caused the interactive distortion in the organization, is running at the level of the organization under study). Only and only one global activity has distortion.

Ecosystems that are in conditions (a) to (f) basically have a permanent procedure running as a global activity with preserving the above-mentioned conditions. (Alternatively, a global activity is running for a long time at the level of non-Euclidean space equivalent to the ecosystem). In these types of ecosystems, due to the high frequency of global activity running per time unit (global activity has a high repeatability in a given time unit) and high repeatability of the global activity, OPC and EPC units are likely to discover interactive distortion events in a shorter time based on previous patterns extracted by GPALS and PHA units. The existence of similar patterns in GPALS and PHA units within RRresponse framework reduces accountability time.

On the other hand, in ecosystems where global activity has a high runtime at the ecosystem level than the time of running the activity related to ecosystem re-interaction to eliminate the impact of interactive communication distortion within RRresponse framework, if the conditions (a)

to (f) are met, it is also possible to use RRresponse framework for re-interaction of the organization under investigation at the time of interactive distortion.

On the other hand, RRresponse framework can also be used as a basic framework that has development and Tailor capability for a unique ecosystem for ecosystems where one of the main objectives of the ecosystem is to find principles and rules governing inter-organizational communication in the twenty-first century (providing patterns, methods, mechanisms, and developing frameworks governing an ecosystem) for a particular ecosystem.

This is due to the specific pattern of RRresponse in discovering the nature of distortion and its careful examination of its impact on elements, communications, and organizations in the non-Euclidean space. The existence of a semantic relationship in EPC and OPC functions with PHA and GPLAS units in recognizing interactive communication distortion increases the accuracy of the framework in dealing with interactive distortions existing at the level of ecosystems that use a scheme similar to scheme Figure 1. On the other hand, it creates an accurate framework to discover, understand, analyze, and define the patterns, mechanisms, and approaches tailored to the interactive distortion nature of each organization (of the total ecosystem organization) that has an interactive distortion nature.

Due to the high complexity of PHA unit in creating a space for describing ecosystem communications based on Latin square, this approach is a very costly and time-consuming solution. It must be noted that RRresponse structure is intrinsically and functionally a semi-centralized structure and is best suited for decentralized ecosystems.

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