FROM CRISIS OF CIVILIZATIONS TO THE CIVILIZATION OF CRISIS: LONG-TERM PATTERNS IN/OF CIVILIZATIONAL LIFE-CYCLES

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Abstract: Organismic approaches to civilizations disseminate the common sense perspective that "civilizations born, live, and die", but generally do not provide a systemic and analytical explanation for this process other than referring to biological analogies. In order to have a more comprehensive understanding on the life-cycles of the civilizations, they should be conceptualized as dissipative structures which are created and sustained through continuous re-generation of their peculiar orders reflecting their sets of social values by utilizing both the material and non-material environmental flows.

In this study life-cycles of civilizations will be studied as broad societal orders dependent on environmental flows by using an analytical model based on complexity theory and the generalization and normalization crisis in contemporary global order will tried to be explained according to this model. In explaining life-cycles of civilizations, insights from non-linear thermodynamics will be used and threshold behaviors in complex systems as well as importance of human agency will also be taken into consideration.

Keywords: Civilizational Life Cycles, Crisis, Order, Thermodynamics, Complexity/Chaos.

MEDENİYETLERİN KRİZİNDEN KRİZ MEDENİYETİNE: MEDENİYETSEL YAŞAM DÖNGÜLERİNDEKİ UZUN DÖNEMLİ ÖRÜNTÜLER

Öz: Medeniyetlere dair organik açıklamalar "medeniyetlerin doğduğu, geliştiği ve öldüğü"ne dair genel kabulü yaymakta fakat bu süreci açıklamak için biyolojik benzetmelerin ötesinde sistemsel ve analitik bir açıklama sunmamaktadır. Medeniyetlerin yaşam döngülerine dair daha kapsamlı/kapsayıcı bir açıklama sunabilmek için medeniyetlerin, maddi ve maddi-olmayan çevresel akışları kullanarak kendilerine has toplumsal değer kümelerini yansıtan özgün düzenlerini sürekli yeniden üreterek kuran ve muhafaza eden birer çözülgen yapı olarak kavramsallaştırılması gereklidir.

Bu çalışmada, medeniyetlerin yaşam döngüleri karmaşıklık kuramına dayanan bir analitik model çerçevesinde çevresel akışlara bağımlı genel toplumsal düzenler olarak ele alınacak ve günümüzde küresel düzende kriz durumunun yaygınlaşması ve normalleşmesi bu model çerçevesinde açıklanmaya çalışılacaktır. Medeniyetlerin yaşam döngüleri açıklanırken doğrusal olmayan termodinamiğin içgörüleri kullanılacak ve karmaşık sistemlerde eşik aşan davranışlar ile insanın toplumsal evrimdeki rolü de dikkate alınacaktır.

Anahtar Kelimeler: Medeniyetlerin Yaşam Döngüsü, Kriz, Düzen, Termodinamik, Karmaşıklık/Kaos.

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Geliş Tarihi: 01 Aralık 2017
Date of Received: *01 December 2017*
Kabul Tarihi: 18 Ocak 2018
Date of Accepted: *18 January 2018*

I. Introduction

The civilizational life-cycles shape/influence the fates and the evolution of human societies. As part of cyclical theories/understanding of history, they have always been an issue of substantial scholarly interest since the early philosophers of antiquity to modern social scientists who are studying the factors affecting social change and crisis. These scholars, who have been intrigued by the question of collapse of human societies, have tried to explain or understand the conditions under which civilizations prosper, regress or die. Organismic approaches to society have disseminated the common sense perspective that "civilizations born, live and die" as all the other living organisms do; although they have rarely provided a systemic and analytical explanation for the existence and functioning of life-cycles other than referring to biological analogies. In order to develop a comprehensive understanding on the life-cycles of the civilizations, they should be (re)conceptualized as dissipative structures which are created and sustained through continuous re-generation of their peculiar orders[i] reflecting their sets of social values by utilizing the environmental flows.

A crisis of civilization occurs and endangers a society's survival when and if the society failed to re-create its order patterns effectively and efficiently enough because of the mounting external and internal pressures or an internal decay in order creating mechanisms which hamper systemic efforts to protect or maintain the civilization's vitality. As a rule the fragility of a social system grows with its increasing complexity or the complexification of the environment in which it has been constructed; and the increasing fragility multiply the probability of occurrence of a crisis because of increasing difficulty in continuous re-creation of order patterns.

In this paper civilizations will be re-constructed as broad societal orders dependent on environmental flows by using an analytical model based on complexity theory; life-cycles of civilizations will be explained by using insights from non-linear thermodynamics and threshold behaviors in complex systems; and then the generalization/normalization of crisis in contemporary global civilization will be assessed according to analytical framework developed.

II. Life-Cycles of Civilizations

Civilizational life cycles are cycles of birth, growth and decline that govern the dynamics of establishment, rise and fall of human societies with all the concomitant social and institutional changes. The civilizational life-cycles, as part of cyclical theories/understanding of history, have always been an issue of substantial scholarly interest since the early philosophers of antiquity to modern historians who wanted to understand the fall of Rome/Western Civilization and social scientists who are studying the factors affecting social change and/or crisis that are characteristics of all societies either historical or contemporary. Ancient Greeks' notion of civilizations as organisms with their respective cycles of birth, growth and death was one of the earlier intellectual attempts to explain the life cycles of civilizations. (Yoffee, 1988, p. 2) From Ibn-i Khaldun and Edward Gibbon to Paul Kennedy, Joseph Tainter, and Jared Diamond numerous students of history, anthropology, sociology, politics, and

international relations have tried to understand the conditions under which civilizations/states prosper, regress or die, and to explain their long term trajectory for historical change.

Their common argument is that civilizations born and prosper when and if their leaders/elites make the correct decisions and implement sound policies; or they collapse and die when and if they make mistakes and/or cannot adjust to changes in their external environment due to their inability to solve the emerging or persistent environmental, socio-economic, political or military problems. Incapable leaders/elites making inappropriate/faulty decisions and insisting on implementing same policies even after they proved to be inadequate or wrong—partly because of the existence of socio-political structures that isolate them from the consequences of their decisions—particularly during times of environmental, socio-economic, political or military distress have been considered as the main causes of their demise.

According to Ibn Khaldun, the decline of great civilizations is a result of loss asabiyyah (social cohesion or group solidarity)—a socio-psychological attribute that arises spontaneously in small kinship groups such as tribes and can be strengthened by a religious belief system. When and if a group/tribe of warriors get accustomed to sedentary city life with all its fine attractions and assimilated into its cultural practices; its asabiyyah weakens and it is replaced by a new nomadic group with a stronger asabiyyah. (1990, pp. 302-391).

Edward Gibbon has followed a similar socio-psychological line of reasoning in his explanations on the collapse of Roman Empire and claimed that it was the gradual loss of civic virtue among the citizens of the Roman Empire that led to its decline and eventual fall. He has claimed that as the Roman citizens gradually had lost their martial spirit and their willingness to make sacrifices for Rome, the burden for defending the Empire was shouldered by barbarian mercenaries whose numbers had increased with the growing external threats. (Gibbon, The Decline and The Fall of the Roman Empire, 1998) According to him, Christianity had contributed to that increasing unwillingness by weakening traditional Roman martial spirit with its doctrines of passion and pusillanimity as well as its emphasis on the afterlife. (Gibbon, 1966, pp. 10-12)

Jared Diamond, using an anthropological approach, has explained the rise and fall or the relative strengths of human societies either by referring to differences in geographical factors (such as diversity of wild plant and animal species suitable for domestication in their environment or the convenience of the major axis of their continent for the spread new techniques and new domesticated species) (Diamond, Tüfek, Mikrop ve Çelik: İnsan Topluluklarının Yazgıları, 2002) or by using a framework consisting of 5 set of factors including the magnitude of environmental damage; the extent of changes in the climate; existence of aggressive neighbors; loss of support from the friendly neighbors; and the societies' reactions—which are shaped by cultural factors—to their problems. (Diamond, 2006)

Paul Kennedy, a historian of international relations, economic power and grand strategy, has claimed that the rise of nations is a result of their increasing economic efficiency and productivity which provides more resources and economic capacities that enhance their military prowess. The nations' power decline when, due to their expanding strategic commitments as a

hegemon, their military expenditures increases and this imperial overstretch leads to their long-term decline by the economic burden it has created on their economies. (Kennedy, 1996)

These examples can be further enriched by adding a long list of different researchers studying civilizational life-cycles or the factor(s) that contribute(s) to civilizational collapse from different perspectives. Lowe, in his book on the collapse of Mayan civilization, classified them according to their perspectives for explanations; and he differentiated between simple causal models—using environment, ideology, techno-economic factors or socio-political forces within their explanatory frameworks—and systemic models of collapse. (Lowe, 1985, s. 43-112). Tainter also has provided a comprehensive evaluation of the substantial literature explaining the disintegration of states or the collapse of (complex) societies by classifying and critically assessing them according to major themes used in their explanations: *depletion or cessation of a vital resource; establishment of a new resource base; occurrence of some insurmountable catastrophe; insufficient response to circumstances; other complex societies; intruders; class conflict, societal contradictions, elite mismanagement or misbehavior; social dysfunction; mystical factors; chance concatenation of events; and economic factors. (Tainter, 1988, s. 44-89)*

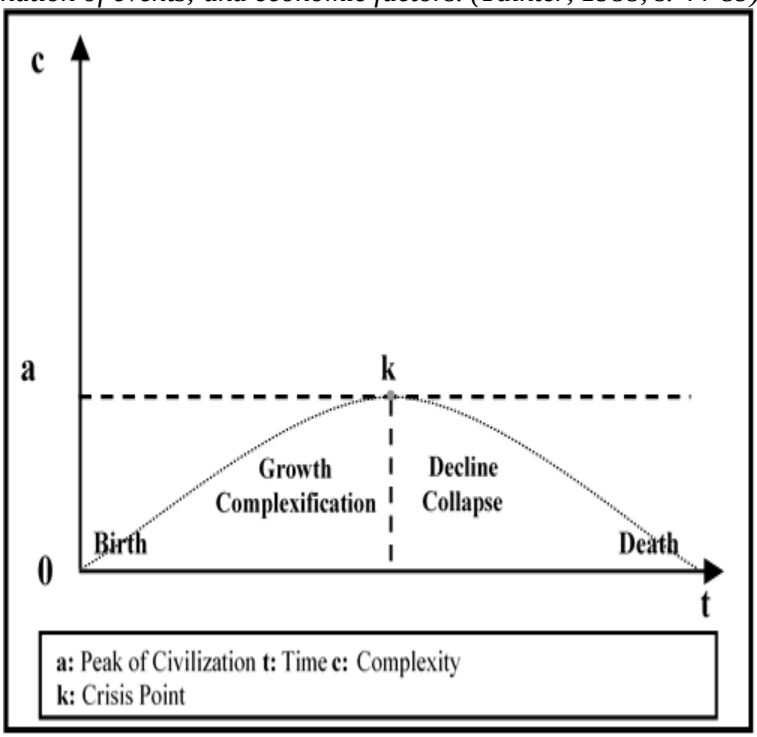

Figure 1: Rise/Complexification of Civilizations

III. Thermo-dynamics, Entropy and Life Cycles

However, these conceptualizations or models for explaining the long term trajectory of civilizations are inadequate although they are not incorrect or totally misleading. Their inadequacy is a result of their ontological premises that consider the existence of an(y) order—including human civilizations—and its

development as a universal law and an inevitable process. They presume that order emerges out of chaos spontaneously through self-generation and endures as long as there is no external or internal (f)actor detrimental to its survival or unless the societies make errors in their decisions or policies. This perspective constitutes the basis for the well-known dictum that "civilizations born, rise, decline and eventually die" as if they are biological organisms. This dictum is generally presented in the form of a curve showing first the increasing complexity of order and then its decline (See Figure 1) Due to these ontological premises, they presume the existence of an(y) order as something "normal", and in their explanations on civilizational life-cycles they tend to concentrate on the (f)actors that may lead to emergence or growth of crisis in human societies.

This conceptualization about the existence is not compatible with the general orientation of the universe manifested by the second law of thermodynamics. According to the second law, the entropy[ii] level of any isolated system increases in time as amount of available the energy decreases and its quality degraded. (Skyttner, 2005, p. 20) As the entropy level of a system increases, the system irreversibly loses its useful energy and so its ability for spontaneous change. (Slesser, 1988, p. 96) (Corning & Kline, 1998, p. 276) When the second law interpreted from a cosmological perspective, it indicates that the universe is ineluctably moving towards aging and death (Guillen, 1999, p. 177) as more and more potential energy converted into heat in the universe. The second law makes it clear that the general orientation in the universe is to dissolution and growing disorder. Everything that exists or created decays in due course and eventually dissolves after its inevitable collapse.

Thus any study on civilizational cycles should start with the premise that the dissolution of orders of any kind and the existence of crisis within the system is the norm that governs the universal existence. On the other hand, emergence or continuation of orders is a spatio-temporal exception and a temporary deviation from the general orientation. They are either products of singularities created by temporary and local disequilibriums in the system or they are established and maintained by conscious intervention of sentient beings through manipulation of the flow of energy-matter in the universe. (Rifkin & Howard, 2003, pp. 37-50)

A brief exploration of the numerous examples of the collapse in the history of human civilizations (Diamond, 2000) exposes that the elemental question when studying civilizational life cycles should not be "how and why (societal) orders/civilizations have failed". It should be "how an island of order could/can emerge/created within the ocean of disorder" and "how it can maintain itself within a universe heading towards dissolution on the macro scale". From a thermo-dynamical perspective as life is just a temporary respite for the eventual and inevitable death for all living things; order is a just a delayed or suppressed crisis condition in human civilizations: life continues as long as death is delayed by constant re-creation of organism; order continues as long as the universal tendency for dissolution is suppressed and crisis is delayed.

Creation of an(y) order or its complexification is materialized by intentionally decreasing the initial entropy level of the system. Orders can be

maintained as long as they are capable of re-creating themselves by suppressing/externalizing entropy through importing and utilizing the available energy in their physical environment. As a rule growth and increasing complexity of an(y) order necessitates the suppression of more entropy by diverting increasing amounts of energy flow from their environment and using it for re-creating their order on a higher level of organization. (See Figure 2)

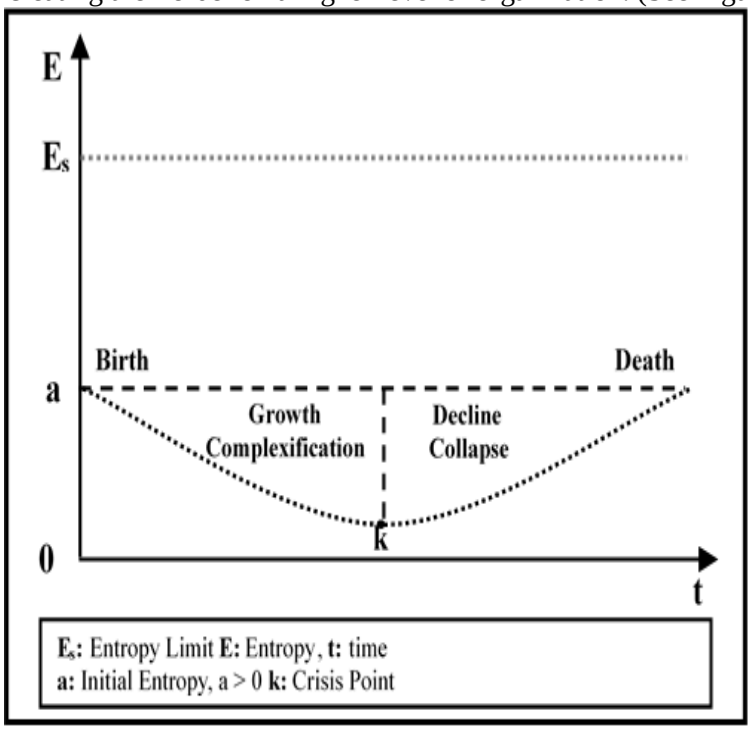

Figure 2: Rise/Complexification of Civilizations-Entropy View

For this reason, there exists a direct thermo-dynamical relation between the vitality and complexity of a system and the amount of available energy in its environment. The level of entropy indicates the quantity and quality of the useable/available energy for a given system within a pre-defined energy environment. In isolated systems the entropy level continuously increases until it reaches a systemic maximum that denotes maximum dispersion, homogeneity and thus macroscopic/system wide disorder. The evolutionary trajectory of an isolated system in phase space represented with a logistical curve. (Yazğan, 2010, pp. 96-97) However, most of the other systems in the universe including human societies are open systems that have an energy and/or material traffic with their environment—a function that is restricted by their connectivity with their physical environment and other human societies. Although in the long run they are bound by the ultimate fate of the universe (thermal death), their evolutions cannot be represented as a point attractor. Their trajectories in the short run depend on their ability to produce negentropy (negative entropy) by harnessing energy from their environment and thus stopping or decreasing ever-rising entropy levels at the expense of an increasing entropy in their environments. (Katz & Kahn, 1969, s. 94-95)

As in all open systems, the entropy reduction process in human societies consists of two broad categories of systemic activities: exporting the accumulating waste material that endanger their vitality and order; and importing energy in required quantity and quality at the required time to be used in the recreation of order. Both of these activities are carried out by certain order creating mechanisms (OCMs) which are responsible for the preservation of their vitality and order through constant restructuring. There exists a direct relation between the capacity of OCMs and the magnitude of societal order. If and when there is adequate energy to import into the system, more capable OCMs create a more complex order with a wider functional and geographical scope by further suppressing or decreasing the level of systemic entropy. The growth or complexification period of any human civilization is a process of constant re-creation in which the normal entropy production within the system can be temporarily suppressed and even reversed due to availability of environmental resources (energy forms) and the efficiency of OCMs. Differences in the capability for suppressing the entropy and thus creating order in human civilizations created the different entropy curves that represent the different levels of organizational complexity and energy utilization. (See Figure 3)

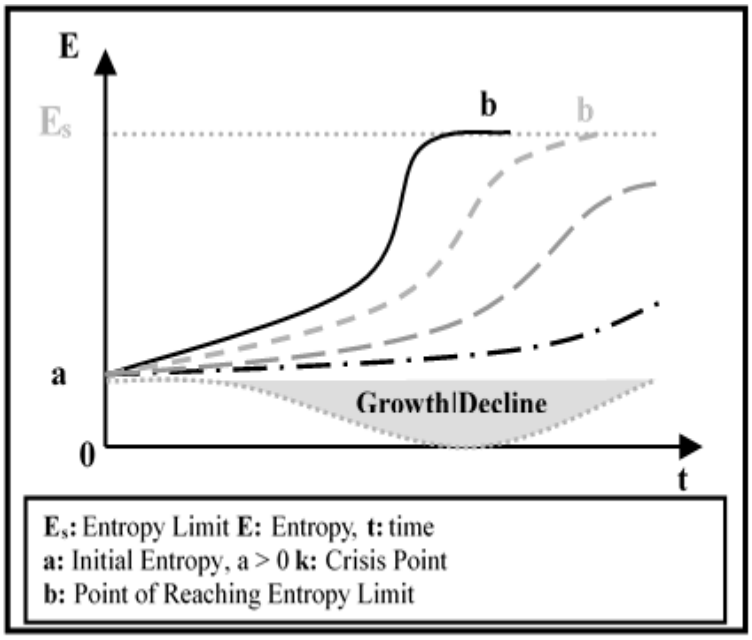

Figure 3: Alternative Entropy Growth Curves of An Open System

When and if this constant re-creation process cannot be actualized because of inadequate energy flow, inefficiency and ineffectiveness of OCMs or extensive changes in the environmental conditions; the general orientation will take over and the order will revert to its natural condition: disorder. That means the decline or collapse of human civilizations does not necessitate errors in judgment, decision, action or policy by the elites or the society as a whole. When and if they cannot do what they have to do in order to suppress the ever-increasing level of entropy by importing energy or exporting waste effectively

and efficiently enough; decline and dissolution will occur automatically as a result of inevitable increase of entropy within the system. This is when the crisis and its effects will become more visible and decisive on the evolutionary trajectory of the order.

IV. Dynamics of Order and Crisis in Life Cycles

The thermo-dynamical context of order and civilizational life-cycles makes it an imperative to consider human civilizations as dissipative structures in order to have a better and thorough understanding on the dynamics governing them and on the increasing proneness of contemporary human civilization to recurrent crisis. The notion and the concept of dissipative structures have been developed by Ilya Prigogine to describe systems functioning within the framework of non-equilibrium thermodynamics. They are defined as disequilibrium structures formed and sustained by the environmental energy flows, and which are prone to destabilization and dissolution if and when these flows creating order cease or interrupted. In this sense they are opposite of equilibrium structures which tend to protect their stable conditions in the short or medium terms. (Prigogine & Stengers, 1998, pp. 178-184)

As dissipative structures, civilizations are created and sustained through continuous re-generation of their peculiar order patterns reflecting their sets of social values by using both the material and non-material environmental flows. In practice this is actualized through localization of the evolutionary trajectory of systemic probabilities to a particular area in phase space by utilizing the energy flows available to the system. In order to create the order on the micro level the probability of occurrence of singular systemic states and on the macro level contingencies that may occur during systemic evolution are restricted through re-arrangement of the level of energy and its flow within the system.[iii] The aim of localization/restriction of systemic possibilities is to create a clustering of energy and systemic probabilities and thus to increase systemic heterogeneity that represent a higher and complex level of organization.

In human civilizations restriction of systemic possibilities is materialized with reference to a predefined set of social values (SoSVs) which reflects the elites' or society's social, economic, political, cultural, and ideational preferences in the universe as well as their value judgments. A SoSVs is shaped by a society's convictions on what constitutes a good society/good life and it provides the individuals and the society with a normative framework for assessing their place in the universe and for giving a meaning to their existence. A SoSVs consists of both material and immaterial values including physical as well as spiritual survival, economic welfare, ideology, identity, etc. (Said, Lerche Jr., & Lerche III, 1995, pp. 20-30)

In order to be implemented the SoSVs of any order is operationalized by converting them into a probability restriction set (PRS) that depicts the preferred systemic possibilities of the individuals or the society in a phase space which represents all possibilities. Certain preferred systemic possibilities tried to be promoted or protected by preventing undesired systemic possibilities through manipulation or control of energy flows within the system, because not all possible systemic values are favorable for the continuous re-creation of individual and societal order. Visual presentation of these preferred systemic

possibilities in a phase space creates order patterns that provide an instrument both for assessing the evolution of the complexity of specific human societies in time, and for comparing them with others. The actual shape of an order pattern and its position in phase space changes according to PRSs of different orders while their complexity vary from each other according to their spatially and temporally differing levels of technology and socio-political organization. (See Figure 4a) These differences in complexity and shape are ultimately created by differences in the flow of energy in their environment and within their systems. When and if more systemic probabilities are externalized or restricted by importing and using an increasing amount of energy, a more complex order pattern representing a higher level of organization is created. (See Figure 4b and 4c) In its most complicated form the architecture of order patterns may take the shape of a two dimensional sierpienski carpet or a three dimensional menger sponge (a lattice with infinite surface and zero volume) (Sprott, 2006, pp. 284-288) (Gleick, 2000, p. 116) which are geometrical shapes with fractal dimensions—geometrical forms of infinite complexity that repeat their geometrical patterns independent of scale. (Gleick, 2000, pp. 108-115) (See Figure 4d)

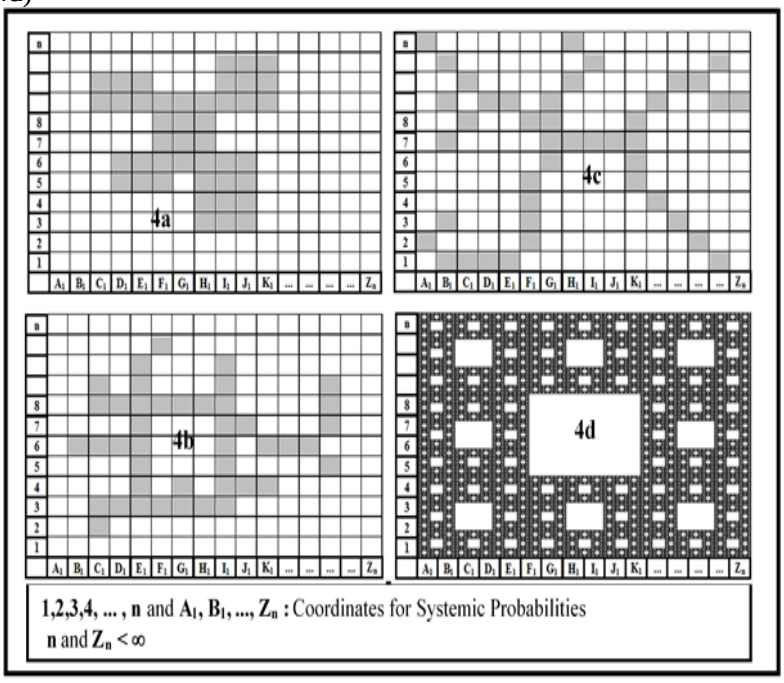

Figure 4: Restriction of Systemic Probabilities in Phase Space

However, these PRS/OPs should not be considered as static or fixed. They ineluctably evolves/transforms as the SoSVs of an order changes as a consequence of the changing preferences of individuals or the society in time. Inevitable spatial-temporal fluctuations in the efficiency and effectiveness of order creating mechanisms and the fluctuations in the environmental energy flow also create vibrations in the PRS/OPs. These vibrations in PRS/OPs increase with the complexification of the order patterns because of the unavoidable increasing demand for energy in absolute and relative terms.

The PRS/OPs provide an indicator for the level of complexification of societal orders. As the OPs become more complex, more systemic possibilities occupying a smaller area of the phase-space are restricted among its more disconnected and distant parts. Complexification of PRS/OPs is a consequence of both the qualitative (functional intensification) and the quantitative (geographical expansion and increasing number of variables) enlargement of the societal orders. As the systemic possibilities that are geographically and/or functionally related with each other occupy adjacent positions within the phase space, concomitant PRS/OPs are affected from the geographical and functional distribution of probabilities to be restricted. The more apart the probabilities are the more distributed and complex the PRS/OPs will be.

These dynamics of creation of order as a dissipative structure suggest that human civilizations, similar to all other living systems, can only exist and survive as long as they can effectively and efficiently re-create their order patterns by decreasing the systemic entropy level through exporting waste and/or importing energy. That process inevitably includes a continuous struggle against both the nature and the other societal orders in search of adequate resources to be utilized to control nature, to suppress other orders and to re-create themselves. During this re-creation, they try to re-arrange the environmental energy-resource flows in a way that will support and maintain their societal orders.

When considered within this perspective, it can be argued that crisis of a(ny) civilization is essentially a crisis of re-generation. When and if OCMs of a(ny) civilization failed to re-create its order patterns effectively and efficiently enough because of external/internal pressures or an internal decay in OCMs and thus failed to protect/maintain its vitality, a crisis may emerge and endanger its survival. That means civilizations do not have to make obvious mistakes for the emergence of a collapse; just being incapable of responding to external or internal pressures through making the right decisions and implementing the right policies at the level of effectiveness and efficiency necessitated by the situation will intensify the crisis and lead to the eventual fall of civilizations.

However, every inconvenience encountered during the re-creation of order cannot be identified as a full-fledged "crisis" because thermo-dynamically order is a suppressed disorder and disorder intrinsically exists in every system. As Wallerstein argues, the concept of crisis should be used to refer "not conjectural difficulties within a system but a structural strain so great that the only possible outcome is the disappearance of the system as such, either by a process of gradual disintegration…or by a process of relatively controlled transformation". (Wallerstein, 1983, s. 21) The concept denotes to the situations where the functioning of the system deteriorates as a whole or in part; sudden and unexpected changes occurs in fundamental systemic variables; critical systemic values cannot be constrained within certain limits; and systemic instability increases.

The crisis can be considered as a continuous (dis)equilibrium condition that emerged out of adverse changes in functional and structural systemic processes. It occurs when the large fluctuations in system structures and processes—that are created by the inability to constrain systemic probabilities—hamper the continuous re-creation of order patterns. The factors producing these

fluctuations may include systemic transformations that complicated the order by increasing the number of possibilities; disruptions and shifts in the systemic PRS/OPs created by sudden and large scale changes in the environmental conditions; and other changes that may obstruct reduction of entropy within the system.

The crisis in human civilizations may take two different forms according to their pace of development, their immediate destructive potential on the systemic order, their evolutionary dynamics and their possible impact on systemic sustainability: slow, long-term and chronic ordinary crisis that describes the dissolution of all clustering and the homogenization of all created heterogeneities as a result of the long term effects of inevitable entropy growth in the universe leading to heat death; sudden, short-term and acute extra-ordinary crisis created by the severance of the links keeping order intact by external or internal (f)actors. Ordinary and extra-ordinary crisis can be differentiated from one another according to their impacts on the curve in phase space representing the trajectory of the entropic evolution for civilizational orders.

The overall impact of ordinary crisis on orders is similar to ageing in biological systems. During an ordinary crisis, as the OCMs lose their effectiveness and efficiency, civilizations face more problems in the re-creation of their orders and ultimately dissolve by surrendering themselves to the entropic orientation of the universe. The reasons for that loss of effectiveness and efficiency can be created by conjectural problems in the energy flow, inability of the existing energy structure to provide adequate energy necessary for the survival of order at the existing level of complexity, or exhaustion in OCMs due to their structural incapacitation. Under these conditions suppression of the entropy growth cannot be achieved and the growth or complexification of the civilization first slows down and then stops. As a result the graphical curve indicating systemic entropy level returns to its natural course and goes upwards. This change of direction signalizes the beginning of the ordinary crisis. (See Figure 5a) However, re-established entropy growth as a part of the ordinary crisis does not have to be irreversible. If OCMs can be revitalized through re-organization (structural reform) or new energy sources that are adequate for satisfying the needs of the order can be discovered (enlargement or deepening of the energy base), it is possible to rein over the process and decrease the increasing entropy again.

The impact of extra-ordinary crisis is similar to a sudden and acute illness or a sudden external attack disintegrating the order or incapacitating its OCMs. Extra-ordinary crisis factors lead to a sudden increase in entropy and an immediate loss in the level of complexity if and when their aggregated overall impacts exceed the carrying capacity of the civilizations or their OCMs. Thus, during an extra-ordinary crisis a sudden collapse and dissolution of civilizations may occur due to the concomitant immediate and overwhelming entropy growth. The more complexified the civilizational orders are, the more prone they will be to a sudden collapse, because the creation and maintenance of orders necessitate more capable OCMs and more energy import from the environment as civilizations and their PRS/OPs become more complicated. When the required energy cannot be guaranteed at an adequate level or OCMs

cannot function as effectively and efficiently as required, the orders become more vulnerable. If an external or internal attack occurs under these conditions, civilizations cannot protect their vitality and thus dissolve into their constituent units/parts. During an extra-ordinary crisis, it takes less time to reach maximum entropy and so crisis period is shorter but more intense. (See Figure 5b)

V. Complexity and Civilizational Crisis

The pace and level of crisis and collapse in civilizations is linked to their systemic complexity level. As a rule increasing complexity of a civilization and/or the environment in which it has been constructed, increases the probability of occurrence of crisis by increasing the fragility of the system and making it more difficult to continuously re-create order patterns. The link between increasing complexity and increasing fragility is established by the thermo-dynamical context of social orders; dynamics of order creation, and the chaotic interactions that may lead to threshold behaviors in complex systems.

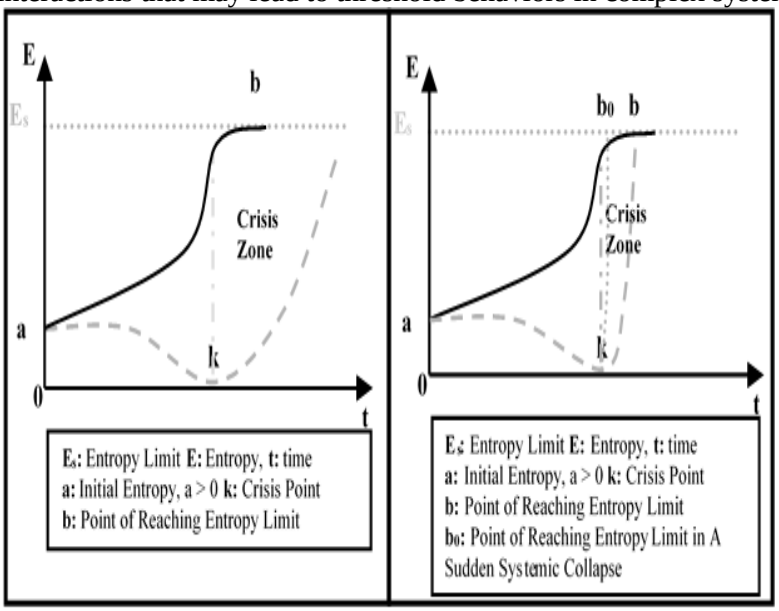

Figure 5a: Ordinary Crisis

Figure 5b: Extra-ordinary Crisis

Thermo-dynamical context of order creation, described in the previous pages, has shown that there exists a direct relation between the complexity of a civilization and amount of energy it needs. As energy needs of a civilization increases in line with its complexity, its vulnerability to the fluctuations in energy flow intensifies. Contemporary human civilizations are structurally and functionally more complex than any of their predecessors and so their energy needs are both qualitatively more varied and quantitatively greater. So, they are more vulnerable to virtually unavoidable fluctuations in the energy supply which is provided by a complex network of energy transportation lines stretching out in all corners of the world. This increasing vulnerability to energy supply makes them more prone to emergence of crisis and intensifies its negative consequences.

Increasing complexity also necessitates more effective and efficient control systems due to increasing number of systemic probabilities and

increasing speed of systemic processes. They are necessary to protect the functionality of the system, to keep the flow of energy under control, and to prevent the potentially destructive contingent threshold behaviors. The existence of more effective and efficient control systems required more complex and comprehensive feed-back loops for control and the processing of more information in shorter periods. However, the functioning of any control system is conditioned or constrained by the informational entropy—used as a measure of loss of information during the transmission of command and control messages among the control systems. (Luenberger, 2006, pp. 10-11) (Skyttner, 2005, pp. 238-246) As a rule, the more complex an order is the more informational entropy it will produce, and the probability of anthropogenic or systemic errors in the transmission of control messages increases with the increasing entropy. This means lesser control over the systemic processes of order re-creation and thus increasing potential for crisis as the systems complexify.

Complexification of orders may also lead to an increase in the threshold behaviors and creates non-linear dynamics within the system. Emergence of non-linear dynamics creates bifurcations and unpredictable evolutionary trajectories for the evolution of civilizations and decreases their reliability against the internal and external detrimental effects. (Munasinghe, The Economics of Power System Reliability and Planning: Theory and Case Study, 1979, pp. 10-11) Increasing unpredictability of systemic processes constrains the ability of OCMs to re-crate an order according to a pre-defined PRS and makes the orders more prone to crisis. Tainter, explained this increasing uncontrollability by referring to diminishing returns of investment in social complexity because of the decreasing marginal productivity of changes (innovation/novelty) in socio-political organization. (Tainter, 1988, s. 91-118)

Interaction of all these three factors has transformed contemporary globalized human civilization into a "civilization of crisis", because the increasing integration of human civilization(s) into a more complex and unified monolithic societal order inevitably increases the probability of emergence of crisis. The complex web of functional relations created throughout the globalization process provides the links through which crisis that emerge in one part of the system can be generalized by spreading every corner of the world. Increasing frequency of crisis in different functional areas of social life and system wide generalization of conditions of emergency, have normalized crisis as one of the characteristics of contemporary human civilization(s). This condition has been further aggravated by the emergence of a crisis matrix—consisting of a set of crisis factors that overlaps and interacts with each other to strengthen and intensify their negative impacts on the re-generation/re-creation processes of the human civilizations—which has become the real threat to the survival of the globalized human civilization.

VI. Conclusion

In order to have a better and through understanding on the civilizational life-cycles, they should be considered as dissipative structures within a thermo-dynamical context. The relation between energy flow and order creation materialized according to a pre-defined PRS shapes the dynamics governing the

rise and decline of human civilizations. Complexification of orders makes them more vulnerable to internal and external factors—including flow of energy—that are detrimental to the survival of civilizations. Emergence of a globalized human civilization as a form of complex and unified monolithic order, has increased the probability of emergence of crisis and has normalized the crisis conditions by increasing the frequency of system-wide emergency situations.

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[i] Order as a concept can be defined as "spatio-temporal continuities within functional and structural arrangements".According to Chalidze, it refers to restrictions imposed on the dispersion probabilities of constituent units in the system. These restrictions can be both physical limitations created by laws of physics and social limitations imposed by taboos, traditions, practices, conventions and laws of society. (Chalidze, 2000, pp. 41-43)

[ii] Entropy is a concept used as a measure of the amount of energy within a system that cannot be transformed into work because of irreversibility of energy-heat conversion processes. (Guillen, 1999, pp. 212-213)

[iii] The link between energy and restriction of probabilities can be explained according to quantum mechanics. As any system whose energy level has been constrained by having it caged in a box in the phase space can only has a finite number of systemic possibilities; at a given energy level the area occupied by the system in the phase space and so the number of possibilities it can materialize are restricted. (Ruelle, 1999, p. 98)