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Master of Business Administration

Interim Report in the module of:

DISSERTATION

with subject:

Using Complexity as a guide for acting in Healthcare

by
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Thessaloniki – 21 December 2012

LIST OF ABBREVIATIONS

CIA	Central Intelligence Agency of USA
CAS	Complex Adaptive System
EC	European Commission
ECB	European Central Bank
EEC	European Economic Community
EMU	European Monetary Union
EOPYY	The National Greek Public Insurance Health Organisation
EU	European Union
GDP	Gross Domestic Product
IMF	International Monetary Fund
OECD	Organization for Economic Cooperation & Development
Troika	European Commission, European Central Bank, International Monetary Fund
USA	United States of America

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Using Complexity as a guide for acting in Healthcare *(the interim report)*.

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Abstract: Complexity deals with living systems, and death is part of life cycle. Greece experiences a huge and prolonged recession which demonstrates characteristics of holistic depression. Being in the doorstep of social decay, jeopardising its sovereignty, the country is obliged to follow a set of pro-cyclical interventions aiming to recover. Late evaluations have revealed that the country is expected to rebound within a period of 10 to 20 years from now (2032).

Healthcare sector is the mostly affected in terms of reformation and impacts. The sector is pushed to bring results in alignment to the dominant economic policies of cost-cutting and internal devaluation. Since the country does not administer its own currency, it is impossible to apply customised monetary policies for hedging. Instead, Greece has to follow Eurozone's commands which reflect the group's prospects and demands. Therefore, in order to cope with deficits, the strategy is to diminish value of services, primarily addressing human labour costs. This takes place in a horizontal way, including every aspect of the country's labour market. As a result, the new paradoxical situation is the devaluation of euro in a country where most of products are still imported, while the locally produced are supply-chained by oligopolistic cartels. The market imports in euro and pays in devaluated euro.

This study was inspired by a series of literature which seem to be a cohesive evolution of prior settlements. Initial concerns start from the "Limits to Growth" and the report to the Club of Rome on 1970, then continues raising the issue of de-growth as the mediator between recession and growth and reaches the essence of geopolitics from the perspective of managing influences and power, on relationships and the environment. Further to that, the author addresses new economic geography (known also as geo-economy), as a product of international trade theory that cascades globalisation and the dynamics of regional growth. Finally, the end point in these concerns is the issue of governance. Governance being the generative source of politics is considered the definitive factor for creating a resilient and sustainable society. Governance, incorporates the set of principles towards social cohesion and collective action, and defines the social behaviour of a society. The society which will manage to succeed in keeping its health value, it is expected to acquire competitive advantage over others in the near future and here is where health governance interferes.

Healthcare systems demonstrate characteristics of complex adaptive systems. Moreover, they acquire attributes that could not be analysed through traditional managerial techniques, not even dealt with. Therefore, this study intends to bring forth complexity and complex adaptive systems (CASs) as an integral component of health governance, especially in times of crisis, and more concrete when countries are facing non-linear effects and are obliged to deal with emergence and self-organisation, as sources of novelty and surprise. Through complexity's lens, it is easiest to accommodate diversity and understand the special characteristics of health and healthcare. Moreover, by approaching healthcare systems as CASs, there is a different mindset to preview, where patterns of interaction are recognised as vital components, and players, are the agents of the system. Such systems are familiar to emergence, co-evolution and self-organisation as a resilient practice which mostly results from a robust response to external shocks. Giving the case of Greece, and the sector's specialties and distortions, this study suggests picturing the current situation in a more holistic view rather than reductive one. There is no chance to predict and control in a complex adaptive system. But, it is possible to put complexity into practice and let it work while in the same time apply tactics such as, minimising exposure, acquiring flexibility, doing observation, making sense of what happens, and developing mindfulness. New techniques such as improvisation and bricolaging, are tools of dealing with complexity. While globalisation incorporates unknowability, the study on complexity encompasses remembering and forgetting history, which is nothing more than the capacity to learn.

Keywords: health governance, healthcare, complex adaptive systems, complexity, Greece, crisis

1. Introduction

1.1 General Overview

Greece is experiencing a strong and violent set of pro-cyclical and counter-cyclical economic conditions which stem from the continuous recession. On the other hand, due to its specialties - oligopolistic market structure, small market size, and paternalistic mindset - the local economy demonstrates distortions such as an increased inflation in an aggravated downturn situation. Moreover, the bulk of loans that the country borrowed from external creditors, in combination with the policies for internal devaluation as imposed by them through memorandums, have created an explosive mix. The country, after almost three years of economic isolation has started to demonstrate signs of social decay. During the last two years, a number of global think tanks, researchers and politicians are posing the dilemma of monetary change as a mean for the country to return into sustainability and growth. Nevertheless, views and explanations of various experts differ and are contradicted.

The healthcare system of Greece could be perceived as a complex adaptive system which demonstrates analogous characteristics and is part of the country's complex adaptive system. It is independent and in the same time interdependent with other systems that co-exists. Nevertheless, it is an entity, belonging to a broader context, may be a player in a searching-for-equilibrium game. It is interesting what *Daskalakis et al (2005; 2006; 2009a; 2009b)* have concluded, in terms of complexity and equilibrium. Giving that a complex system could be a game, in such a game there is always equilibrium. May be the equilibrium is the complex system itself, and the challenge remains in exploring the rest of the game. Complex adaptive systems (CASs) are strongly experiencing change, emergence and co-evolution as phenomena which constantly push the system far from equilibrium. According to *Daskalakis et al (2009a; 2009b)*, this happens due to players' willingness to change or not to change their behaviour, based on their motives. In such a case, there is no optimal solution, but putting complexity to work while being alerted and ready for action. And action, results from the capacity to learn.

Dealing with complexity may be the other side of the same mindset, which preserves the mechanistic view of management. Planning and controlling are gradually replaced by patterning and adapting in continuous changing environments where prediction is impossible. Authority is not necessarily the source power rather than the emergent players who happen to find themselves in the centre of a whirl. However, self-organising is the ultimate subject of research for a system to sustain. This may include the scenario of destructing those parts that are considered obstacles for the self-preservation or vice versa in case of destructive innovation (the white-page strategy; *Klein, 2011*). Societies from time to time seem to get into a mechanistic operation, trying to stabilise their prosperity and to exploit what they have achieved so far. This agrees to what ancient Greek philosophers discussed regarding nihilism and infinity, as the imperfect space where complexity meets humanity *(Goudelis, 1993)*.

When new challenges are ahead, then behaviours are more compatible to complexity and follow more or less similar adaptive cycles. Trying to apply machine-metaphor thinking in the effort to cope with complexity brings consequences of frustration within the system. Healthcare ystems are not linear and additive. Therefore, their dynamic could not be obtained by summing up their parts. *McDaniel and Driebe (2001)* claimed that no one is smart enough to figure out where the healthcare system is going at any level. Both investors and practitioners are trying to predict the future of the healthcare, aiming to discover the component that will prosper. Besides, *Beautement and Broenner (2011)* have concluded that the evolution of the system is unknowable.

It seems that there is no concrete answer, so far, in the Greek experiment and how to deal with it, from complexity's perspective. Experience has proven that whenever there is a need for change, focus leaves the mechanistic-Newtonian approach, and tends to see people as inherently complex human beings. To be more precise, while trying to outline a holistic view of current situation, the imposition of internal devaluation, as a mean to rebound competitiveness, is a horizontal and deterministic measure which impacts the organisms (agents) of the country. Obviously, this is a modern repeating practice of the "one-size-fits-all" strategy; rather a clockwork approach omitting the essence of non-linear dynamics. Greece is a complex adaptive system itself being incorporated and in the same time being part of a broader CAS in the globalised complex adaptive system. Moreover, health and healthcare, as mentioned earlier is a smaller CAS, demonstrating high interdependence, which needs to co-evolve and find its new fitness landscape through a dynamic placement.

Continuous public deficits and increased expenses of central government have revealed enormous weaknesses and inability of the country to finance its basic needs. From the economic

perspective, the monetary change is a possible scenario, and often is presented from different think tanks, as the solution to rebound. Nevertheless, such decision, no matter the outcome will comprise a new shock for the local economy affecting in result all industries as well as the country's substance in global terrain. On the other hand, it is obvious that, within the turbulence of entropy, the country has a unique opportunity to change its structures rather than simply change roles among players, rejecting for the first time in its history the "us against them" mindset *(Papadopoulos, 2003)*. Therefore, the challenge is to identify and propose techniques on how healthcare could perform changes in such an explosive social environment. The purpose is not to provide any model or introduce certain ways of action. On the contrary, the approach is intended to be more practical, mostly inspired from putting complexity to work and evolving with the real phenomena.

1.2 Initial concerns and thinking roadmap

This section aims to discuss the backbone concerns and motives of the study. In addition, it is intended to demonstrate the rational pathway towards research objectives. In this case, the problem is the Greek healthcare sector and how this is expected to behave in response to the external shocks that affects it. Moreover, the aim is to bring forth and discuss possible practices to enable any proactive measures that could keep the sector viable and resilient.

The background of the study, as it is presented, demonstrates a sequence of thoughts which are considered relevant and interrelated. Starting from the issue of growth and ending to geopolitics, geo-economy and governance, there is an attempt to link these with healthcare and the current impacts in the country through the framework of crisis situations and how these are experienced within a society. One of the challenges for this research is to investigate whether such essences synthesize a path-dependence and create the common ground in the crisis' puzzle.

1.2.1 The limits to growth

What Greece experiences is possibly a small part of a wide change. This is how the country confronts, within its microcosm, to a bulk of consequences stemmed from the change of bigger strategies incorporating certain global aspects. Yet, is normal claiming that the motives are planetary wise, implying the ultimate humankind's sustainability.

Donella Meadows (1995) defined as sustainability the equilibrium of co-existence between humanity and the planet. Such target incorporates the essence of the "complete vision", as she claimed, which besides that, it necessitates the components of spirituality, of community, of decentralization, of a complete rethinking in the ways humankind is accustomed to do things. One could also say that there is a missing component in the above; this is solidarity, historically a common link especially in tough periods.

Meadows (1995) clarified what sustainability means, by providing the following explication:

1. Renewable resources shall not be used faster than they can regenerate.
2. Pollution and wastes shall not be put into the environment faster than the environment can recycle them or render them harmless.
3. Non-renewable resources shall not be used faster than renewable substitutes (used sustainably) can be developed.
4. The human population and the physical capital plant have to be kept at levels low enough to allow the first 3 conditions to be met.
5. The previous 4 conditions have to be met through processes that are democratic and equitable enough that people will stand for them.

Nevertheless, it is difficult to realise how democracy co-exist with control of human population. Years earlier, a scientific team delivered a report to the Club of Rome *(Meadows et al, 1972)* which briefly concluded that if humanity would maintain the same growth trends in a series of resultants, the limits to growth on this planet will be reached sometime within the next hundred years. This report was submitted on 1972 and it was the first time identified, that, infinite creativity has to confront with finite resources. This perception coincided years later, with the recently introduced green policies and the popular discussions on ecological footprints. There is a global challenge though that humanity follows an exponential growth in a finite and complex system. In these terms, *Meadows et al (1972)* were not restrained in identifications. They have recommended that if growth trends could be altered and stagnated in a state of global equilibrium, probably this could rebound sustainability.

As *Maskin (1983)* highlighted, according to the concept of Nash equilibrium, each player is expected to decide on his social choice rule taking into account the decisions of other players. This brings equilibrium in a game where all powers find their position. The rapid population growth, the industrialisation, the depletion of non-renewable resources and the deteriorating environment, constitute an explosive mix which obviously jeopardises human evolution and raises increasing entropy just like the ice-melting in a warm room. Entropy appears when an entity starts to lose its cohesive attributes towards elimination. Under such circumstances, de-growth, slowing down development and re-orientating could be an alternative strategy.

1.2.2 The essence of de-growth

De-growth, non-growth or even a-growthism are not newly introduced ideas. The bottom line of cultivating future expectations for a society may be to remind the local powers the meaning of their existence. It is true that most of the times fear, greed and wishful thinking were hidden behind the modern practice of grasping opportunities for the sake of growth. *Newman (2011)* presented his thoughts on the sarcastic question if finally "we live too many on this planet", implying that may have come the time to reconsider our population models. The issue of the population bombing and the link with the environment is not recent. *Ehrlich (1966)* introduced the IPAT Model in his effort to simplify the understanding of the humanity's impact to the planet. Much discussion is raised since then, even nowadays, about whether such approach is adequate and scientifically valuable. Nevertheless, it is well-admitted that he, at least, tried to establish a set of measures in the perception of impact *(Figure 1).*

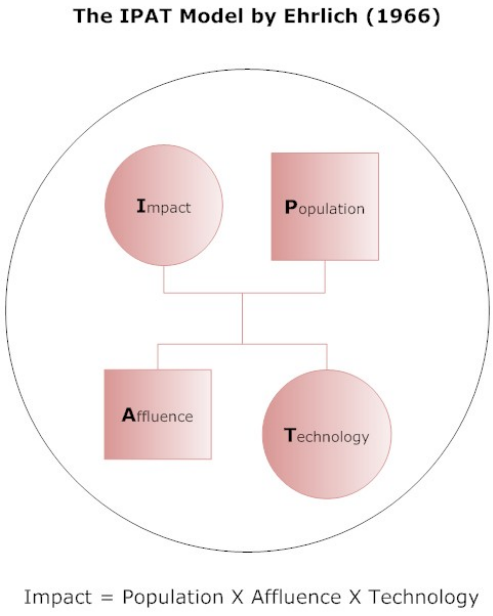

Figure 1. The IPAT Model

It is interesting that Ehrlich, well early had identified that the derivative of affluence and technology as means used by the population, had direct environmental impact in a measurable way.

Either following growth or de-growth models, it is imperative for any power to develop a set of relationships within these parameters, in order to promote its given policies. It is notable that the model was introduced in early '60s where technology had not yet achieved global penetration.

De-growth is not a policy rather than the mediatory situation between recession and growth. As *Georgescu-Roegen (1971)* claimed in his study on entropy law and economic process, de-growth is inescapable. Many years later, *Latouche (2004)* brought forth the issue again using the term contraction economics, to describe as de-growth the deconstruction of the matter of development. De-growth is not a practice rather than a guiding principle, which contradicts to growth being one of the doctrines of modern economics. It aims to present an alternative path which directs to self-sufficient and materially responsible societies. However, beyond de-growth, there are additional ways for a society to expand limits.

1.2.3 Geopolitics

According to *Ciprian (2009)* geopolitics is the analysis of geographical influences upon power relationships in international politics. Furthermore, geopolitics incorporates the components of geo-strategies and technologies for managing the environment (both physically and strategically). This practice has been proved a valuable asset for states that aimed to increase their wealth, their power and ultimately protect their citizens. As *Headey (2008)* claimed, a bilateral aid policy among a powerful and a weak state was a biased method hiding geopolitical motivations. For example the emergent concept of market environmentalism is used as a mean from more progressed states to create new geopolitical conditions, probably in the same way that green accumulation and ecological footprint were recently introduced as well *(McMichael, 2009)*. The environmental colonialism is hard to be left aside while on the contrary a strong philosophy could be built on it. In the same manner energy, water and accompanied physical resources may be geopolitical targets for acquisition.

Consequently, geopolitics implies political decisions stemmed mostly from the distribution of power. The control of resources, especially in a finite planet, brings power and guarantees sustainability for the acquiring group.

On the other hand, a socially and politically destabilised country with a seemingly diminished geopolitical role, demonstrates lots of vulnerabilities. In such case, it is more probable for the country-state to seek for external help and exchange its sovereign dependence. As *Strayer (1970)* highlighted, the state is a social group which acquires a certain territory and endures through time. Since time and space are two crucial factors, jeopardizing any of the two, may raise questions of existence creating a loose-jointed community. Therefore, exercising geopolitics could be a mean for manipulating globalisation powers. Thus, free move of capital, prepares penetration to markets contributing in a new geography of economies.

1.2.4 Geo-economy or the new economic geography

The transition of spatial thinking to international trade theory defines the framework of the new economic geography *(Ciegis, et al, 2011)*. Geo-economy incorporates the essences of globalization, the relationship between the environment and the economy, taking into consideration the dynamics of regional growth. In the same manner that, economies of scale are identified as effective managerial practice, the high concentration of people in regions-cities creates economic conditions for trade. In simple terms, geographical advantages affect a certain interaction among economical factors and cultivate a fertile ground for region-central places in the globe. Therefore, the geographical landscape meets in a sense the economic landscape and nations as unified enterprises are requested to cope with the business valuation financial technique.

According to *Storper (2011)* the new economic geography, deals with innovation-driven agglomeration and specialisation as well as the development of regions in emerging economies. In order to implement such plans, there is a need for strong and well prepared governance.

1.2.5 Governance

Governance is the set of values, the principles and the cooperative models which define the social framework where people decide to experience their lifecycle. Governance is not government and is not politics, although is strongly linked to both of them. *Rosenau (1992)* has defined governance as the group of functions that have to be performed in any viable human system in order to sustain. Such functions deal mostly with external challenges, internal conflicts as well as the procurement of resources. *Stoker (1998)* defined as governance the concern of creating the conditions for ordered rule and collective action. It is interesting though to mention that according to him, the essence of governance states on structured governing mechanisms which cannot be externally imposed but are the result of the interaction and influence among the societal members.

Among others, this can be applied in the healthcare concern of a society. The adopted healthcare model defines the wealth and the health capital of a region.

1.2.6 The relation with health and healthcare governance

Healthcare is considered one of the most valuable pillars for a society to sustain and progress in the global terrain. Since human capital and human intelligence is accommodated and protected through healthcare practices, any external or internal shocks that generate times of crisis reveal sector's vulnerabilities. From industrial age to knowledge era humanity have experienced various cohesion and survival shocks. According to *Naomi Klein (2011)* there are three ways for a society to change. These are: due to natural disasters, wars, and economic burdens.

Nevertheless, modern times revealed that societies still have not yet seriously confronted with the diminishing health value of their members but they will. Growth, de-growth, geopolitics, geo-economy enable a straight effect in health and healthcare. Further to knowledge era, the next challenge is expected to be the one of the welfare epoch. Regions that will keep the healthiness of their human capital in high levels, will acquire a unique advantage and opportunity for further progress. Therefore, health would be an asset to escalate competition and create new conditions. In a continuous changing global environment, health governance plays the role of trustee who undertakes the responsibility to protect the rules of progress.

Adopting *Walters (2001)*, there is a suggestion to embed the mindset of building blocks health innovation. The building blocks of health governance could aim to raise the powers of survival through certain practices such as:

- Implementing national welfare reforms
- Using information technology
- Pursuing process improvement
- Enlisting the help of both public and private sector
- Empowering communities (citizens)

Current research aims to accommodate further knowledge on this area given the case of Greece and the experiencing recession having impacted strongly the healthcare sector. Globalisation has brought strategies, which -either motivated from geopolitics or other stimuli- direct regions towards standardization and homogenization. Societies that will be unable to comply will experience a much more sharp alignment or isolation.

1.3 Problem statement (the study's rationale)

Greece was always a geopolitical target for many reasons *(Stratfor, 2010)*. The long-historical and cultural connection with East in contrast to its geographical placement in the Western civilisation was always a source of conflict. It was primarily a country-region that belonged to different empires through time, had accommodated different people, and had absorbed mixed affections from different cultures. Besides that, although it had faced various challenges the country -in its different forms- managed to survive through certain practices. One of them, possibly emerged due to circumstances, was that inhabitants tried to innovate in order to differentiate and keep track with any changes. As a result, the risen natives developed similar skills through time.

However, for once more the country experiences tough conditions and remains in the centre of interest as a unique experiment; the case of a country which faces the dilemma of exiting from a strong monetary consortium in the 21st century, probably ending to isolation and its consequences or remaining in Eurozone by devaluating its existence.

Although the economic crisis has global characteristics the country lives the consequences through its own specialties. A number of scientists have tried to discuss and present their findings on what crisis means and who is responsible for it. *Schneider and Kirchgassner (2009)* identified that global community is currently observing one of the most severe and deep world financial and economic crises in history. They both argued that the origin is USA. *Lang and Jagtiani (2010)*, as well as *Wallison (2010)* aligned in the same conclusion. On the other side, *Gross and Alcidi (2009)* highlighted that Europe had already internal weaknesses to cover and it was a matter of time for them to be revealed. In contrast, there were a number of scientists who argued that current crisis has antecedents in earlier crises, including the "Great Depression" of '30s *(Gaffney, 2009; Wheelock, 2010).* Nevertheless, a quick glance in the past demonstrates that humanity experienced economic crises even from the 12th century, when Europeans established their states.

Back to Greece, the global situation in combination with internal imbalances and distortions, directed the country in facing a multilevel economic recession, consisted of the following characteristics *(Provopoulos, Bank of Greece Annual Report, 2010):*

- A negative environment (both economic and social) due to: (a) the lasting structural weaknesses and distortions, (b) the macroeconomic imbalances, and (c) the non-sustainable development, as proved to be a-posterior, the growth during the years 1996-2007.
- The high risk for the country loosing the opportunity, to get advantage of the global recovery.

- The luck of confidence in country's prospects to overcome its problems and return to development and prosperity.
- The inability to get external financing due to the above characteristics.

The result was for the country to enter in 08 May 2010, officially under the economic supervision of the troika consisted of: (a) the International Monetary Fund (IMF), (b) the European Central Bank (ECB), and (c) the European Commission (EC). Practically this was done through a memorandum of recovery (Memorandum of Understanding of Specific Economic Policy and Conditionality) accompanied by a trilateral agreement (contract) which provided an enormous loan of 110 billion euro. It is interesting though, that Greece was represented separately in the agreement by: (a) the Greek government, and (b) the Bank of Greece.

Since the country could not secure external funds, it was unable to borrow through regular global financial channels of income. International funds were not willing to purchase Greek state bonds, requesting interest rates that were over 6% on that time. On the other side, Greece as a member of euro zone (European Monetary Union (EMU), searched for help through its euro partners who imposed economic custody in response. The memorandum signed, as the ultimate saving plan, introduced a series of structural reforms that the country was obliged to perform in a very short time, within three years (until 2013). The government *(Socialist Party with G. Papandreou, Prime Minister and G. Papaconstantinou, Minister of Economics)* under the pressure and the panic of the situation directed the country into an arrangement with no actual prior negotiation.

Therefore, after two years of implementation of the First Economic Adjustment Programme (Memorandum), the results were disappointing and almost catastrophic. The measures and reforms in the way that these applied or not applied had raised a series of negative consequences for the country instead of ensuring the opposite. Practice demonstrated that neither of the local political forces proved to be eligible to undertake the responsibility to perform the reformation plan not even to present equal alternatives. Instead, on 09 February 2012, the country, after a series of negative evaluations by troika, adopted the Second Economic Adjustment Programme, under a new, more strict and dangerous for its sovereignty contract. This had duration of three years (till 2015) and was accompanied with additional 130 billion euro. The money was agreed to be provided in small instalments depending on reviews related to the progress of the programme. It seemed that the government adopted and applied part of the programme and most important, did not proceed with structural reforms. Instead, it tried to balance the situation through single fatal practices of decreasing horizontally wages and pensions in public and private sectors. Both First and Second Adjustment Programmes included a specific mindset of restructuring status quo but, this found strong opposition in social partners.

During 2012, the negative situation turns even worse, especially in terms of experiencing a kind of death-spiral effects like, increasing unemployment (approx. 25%) with increasing taxation, devaluation of labour cost, inflation and zero investments. No prospects are given by any social partner, while in the same time, predictions for recession for 2013 range between 3,55 to 8% as published by different think tanks and organisations. Furthermore, current reformative implementations in combination with the imposed practice of internal economic devaluation which is the backbone of the whole change plan, creates an explosive social mix, with unexpected reactions. This reformation scheme has a direct impact primarily in devaluating cost of life while remaining in same currency, incorporating the cutting-cost among others in health and healthcare.

Greek healthcare sector, starting from 2011, experiences a deep restructure aiming: (a) to decrease the number of hospitals and clinic units in operation, until the end of 2012, (b) to decrease the working hours of medical staff, especially the ones appeared as overtimes and (c) to decrease the number of employees in the sector. Another measure is to cut-off budgets regarding the whole healthcare supply-chain. Such changes are addressed to the public sector which represents the bigger percentage of healthcare services in the country. Moreover, the imposed healthcare reforms include the radical decrease of pharmaceutical spending both for in-hospital and out-hospital cases. The ladder raises a series of perplexed consequences involving pharmaceutical industries, medical companies as well as any related company that the public system had cooperation with.

First consequences of cut-off policies, as expected, resulted in inadequate healthcare service provisioning with multiple social effects. During 2012, the sector faces an enormous instability and uncertainty since planned reforms do not bring the desired results. Nevertheless, this is mostly due to social partners' opposition. Social groups that had cultivated a certain status quo, for at least 40 years, demonstrate an increased sense of self-preservation. On the other side, government had

postponed payments for healthcare services and products to private suppliers and big industries in an effort to re-negotiate and settle down a new framework of cooperation. This was decided in an attempt to rationalise expenses and apply a paying scheme which will be affordable according to its financial abilities. This decision raised different behaviours in players of the sector. Some multinational companies left Greek market and withdrew their products. This created a sense of incredibility for the country. Pharmacists started a series of strikes trying to push the system. Doctors are currently in a transitional stage since some of them do strikes while others continue to offer their services under the new regime. Medical staff mainly of public sector works in a shrinking environment. The sector experiences chaos. Possibly this is the first time that social partners have to decide, what kind of healthcare they want to provide in the country; a purely privatised sector, controlled by the markets' rules, where the health capital could be the object of trading negotiations; or a balanced sector, following certain governance rules under the respect of health as a national asset of a country based primarily on reciprocity and solidarity.

No matter whether the country remains or leaves Eurozone, sector's restructuring has to be performed, and radical, to-the-bone changes should take effect rather immediately.

In this environment, this study adopting the complexity perspective, tries to approach the sector as a complex adaptive system and intends to reveal what should be done in practice in order for the country to assimilate new data and achieve the reform. This is a matter of successful combination between health governance and complexity.

1.4 Overview of the study (the structure)

In Section 2, there are presented clearly the overall aim as well as research objectives and research questions of the study. In this section actually, is defined the framework of current research upon which literature review (Section 3) and methodology (Section 4) are unfold and based on. Literature review analyses and discusses the issues of:

- Greek economy
- Characteristics of complexity (in general)
- Complexity and healthcare
- Healthcare's complex characteristics
- The nature of complexity in practice and how complexity could be exploited

Literature review starts from the case of Greece and follows a path where there is a strong combination among the essence of complexity and the existence of its characteristics in healthcare. In Section 4, are presented the details of suggested methodology to follow in order to perform a qualitative analysis. Next, Section 5, emphasises in the concern of ethics, which coupling with Implications of the study (Section 7) are both considered of high sensitivity for this study. In Section 6, there are given some expected outcomes prior to the implementation of the survey. Section 8, gives a new revised timetable of the study *(being in the phase of interim report)*. Finally, a number of temporary conclusions, as discussed in the end of this report, are mostly reflect what have been discussed so far.

2. Aims and Objectives

2.1 The overall aim

The overall aim of the research is to identify and explore the **emergence** and **self organisation** as the major transitional components that stand between death and renewal in complexity. In practice, this is represented through certain **managerial practicalities** which, in this case, could be applied in healthcare sector, in terms of **putting complexity to work**. Being in the centre of turbulence, healthcare should sustain while preserve social principles but adopt a modernised mindset. The aim is definitely not to model any complexity's manipulation scheme. On the contrary, the intention is to investigate and analyse the significance of acting based on limited knowledge and ambiguity.

2.2 The research objectives

Self-organisation is a characteristic of complex adaptive systems which could be considered as the end-result in a series of changes in behaviour in combination with the emergence of dynamics which establish new forms and structures. Moreover, this comes as a result of the system's decision to acquire a new status and stabilise its components after renewal.

In order to realise the overall aim, it is more effective to divide it, into three parts identifying them as measurable supplementary objectives *(Figure 2).* These objectives are related to characteristics of complexity, and more specific to those that demonstrate healthcare's specialties based on literature. This helps current study to apply a more concrete approach to healthcare and conclude on results more accurate and valuable in relation to the overall aim.

Figure 2. The Research Objectives of the study

2.3 The research questions

Following the aim and objectives, the study poses a number of questions. The target is to discuss and suggest managerial practicalities in terms of complexity especially in current situation, where both healthcare sector and the country experience a shock effect. The research is going to follow a qualitative analysis since the subject demonstrates increased specialties. Therefore, in the next *Figure 3*, is given the concrete questions' framework to be used as a guide in survey.

Research Questions' Framework

Information asymmetry: does this exist among the agents of the healthcare sector and especially among the providers of the services, the receivers of the services and the payers of the services? (agent-based nature)

Interdependencies: is information asymmetry a source of high interdependence among agents? Are there any weak links created through interdependencies? (connectedness)

Heterogeneity: is there considerable professional and technological heterogeneity within healthcare organizations? Does this create difficulties in understanding the organization and the sector in extent? (emergent dynamics)

Attractor patterns: how the system reacts and responds to certain issues of change? Is there any paradox regarding absorption of changes within the system? Does the system respond as a whole or diversified? (emergent dynamics)

Generative relationships: is this a special complexity characteristic of healthcare sector? Who defines such relationships? Does this affect the behavior of agents? Does this affect the healthcare service itself? Do the specific relationships create contexts? (connectedness)

Collective reflexivity: how this works within the sector? Is this a derivative of complexity thinking? Can this be further exploited? (emergent dynamics)

Figure 3. The Research Questions' Framework of the study

The above six components, are forming the research framework according to research objectives of the study.

3. Literature Review

3.1 The structure of Literature Review

Literature review follows a four-pronged approach, which is extended in: (a) to identify and discuss the characteristics of Greek recession, including historical economic data, (b) to present and discuss the characteristics of complexity and complexity thinking, and (c) to bring forth and reveal the relation of complexity and healthcare, and (d) to discuss practicalities that could help the sector to define its complexity space and apply complexity thinking in terms of emergence and self-organising towards resilience and rebound.

This structure aims to reveal the path-dependence of healthcare governance in times of crisis, and how this is affected by the complexity metaphor.

3.2 The case of Greece

After ten-years of seemingly strong growth, Greece started to experience the effects of the global downturn in early 2009. The large fiscal deficit from the one side and the external imbalances on the other side, have revealed the chronic vulnerabilities of the national economy.

Greece is a country member of the European Monetary Union (EMU) – using Euro, officially adopted since 2001 - with approximately 11 million inhabitants but 5 million of labour force, till the end of 2010. This number is declining from 2011 onwards to less than 4 million, and so forth. According to calculations included in the recently issued Greece's Public Budget for 2013, the unemployment during 2012, has reached 23% while the forecasts for the next year exceed 25% *(Stournaras, 2012)*. A significant percentage of the labour force still is consisted of immigrants especially in sectors that are considered crucial for the country's economy (constructions, tourism, agriculture etc.), mostly in primary sector. Less than half of the registered population belongs to what-so-called economic active population. Regarding synthesis of country's domestic product and the labour force, in very general terms, 65% is occupied in services, 23% in industry and the rest 12% in agriculture.

3.2.1 Historical economic data

Although the country in early 50s had been characterised by the increasing development of agricultural and industrial sectors, the gradual incorporation in European Economic Community (EEC) towards 1981 (year of official entry) *(European Union, 2012)* was the main reason that switched the orientation primarily to services. This directed in experiencing a de-industrialisation and an emphasis in non-intensive agricultural products.

Moreover, the country experienced an enormous growth in the period of 1953-1973, hitting the upmost performance in the decade of 1951-1961 *(Bowles, 1966; Delipetrou, 2012)*. In *Appendix A* is given a comparative table registering the country's GDP growth rate on that period, placing the country in the second place in the post-war advanced economies. Maintaining a growth rate of 6.1%, Greece was, with Italy and Germany the drive-wheel of Europe's reconstruction. In *Appendix B* is given the distribution of the country's growth rates per sector. Energy, construction and mining were the driving forces of country's rebound.

During 1961, Greece reached the enormous 11.15% GDP growth rate. The following years until 1973, the growth rate was ranged from 5.5% to 10% annually *(Indexmundi, 2012)*. This positive tension sustained until 1980 (0.68%) with the exception of 1974 (-6.44) the year of state regime's change. It is strange though, that although the country had experienced a series of political instabilities during that period, the economy had demonstrated strong characteristics of resilience.

Nevertheless, starting from 1981 the country had been experiencing low growth rates (around 3%) and even negative ones until 1999. The year of 2000 was linked to the euro zone enter. The growth rates from 2000 to 2007 were positive, ranging approximately from 2% to 6% remaining very close to other European economies. Suddenly, since 2008, the growth rates were negative following a sharp decline reaching the surprising -7%, probably the highest de-growth rate in the Greek economic history for the last 60 years. Ever since, the country is facing a gradually deep recession.

In the same way, unemployment followed the GDP de-growth rates. In *Appendix C, Demekas and Kontolemis (1997)* present the unemployment rates in Greece which were considered the

lowest in OECD countries especially prior to 1970. The foreign direct investments during that period were kept in high percentages since the state had demonstrated a clear will to support the capital and distribute the agglomerated premium both to investors through returns and to the labour force through social policies. Therefore, investments brought capitals which cultivated in extent social relationships in the country and enabled an environment for future social concerns. Probably, one of the determinants which played a significant role in keeping foreign investments in the country was that these were protected under definitive strict laws.

The development had been based primarily in external economic help from USA and rich European countries (the Marshall Plan) in combination with an internal 4-pillar source of financing originated grom: (a) remittances, (b) maritime exchange, (c) tourism, and (d) export of agricultural products. These four sources created the basis for further evolvement of other sectors which contributed to the country's GDP.

Greek economic history has demonstrated that the country always based a significant part of its progress in external loans *(Romaios, 2012)*. In addition, there were always consortiums of local industries which supported development plans; this, in combination with the independent monetary policy and economic tools that the government exploited, they were used from time to time, either to absorb any fiscal pressures or to boost economy. Furthermore, the country had acquired strong placement in the global terrain, in a series of products and services. The country's product (GDP) consisted of a set of individual end-products which contributed to the final formation. In other words, there were multiple sectors to depend on, and make economic policy.

3.2.2 Recent economic situation

Further to the euro zone enter, and rather gradually, the country experienced a loss of competitiveness, as that was identified by its EU partners (*Memorandum of Understanding of Specific Economic Policy and Conditionality, 2010; Memorandum of Understanding of Specific Economic Policy and Conditionality, 2012)*. Thus, the real exchange rate was considered significantly overvalued relative to fundamentals. On the other side, local labour market was considered to be relatively weak. Also, the employment rate was low and the unemployment duration was among the highest among peers. Long-term unemployment turns to inactivity. Structural impediments hinder product market performance such as: limited liberalisation of utilities, insufficient internal competition due to high regulation, low ICT penetration, and high barriers to entry in the market, especially in services.

Further to the above, EU partners and other economic organisations identified that the country had one of the highest disparities between the number of public servants, as percentage of the workforce, and their compensation as percentage of total compensation. The compensation of civil servants in Greece was relatively high *(OECD, 2010)*.

In terms of budget for 2009 revenues were of 109 billion dollars and expenditures of 145 billion dollars. Exports were estimated in 21.3 billion dollars and imports around 64.2 billion dollars *(CIA, 2010)*. The fiscal deficit reached 13% of GDP in 2009 *(OECD, 2010)*. Public debt was about 100% of GDP in 2008 and 113.4% of GDP in 2009 ranking the country in the 8th place globally. Defence spending was estimated at 4.25% of the GDP in the mid-2000s.

The country was considered as less developed than any other euro zone country. At the same time, it registered higher rates of growth and inflation than other member countries. This was due to "a structural expensiveness" in the Greek market which mostly has an oligopolistic nature, with almost the unique exception of the telecommunications sector *(Pelagidis and Toay, 2007)*. The product market rigidities may be considered as the impact derived from excessive regulations, complicated hiring burdens and mediating costs that are keeping bended any free-will for investments. Moreover, there are serious obstacles in business activities due to bureaucratic issues. Such cases encourage money laundering and financial crimes.

Besides, there is a determinant between growth and development. Although these may be related and they co-evolve, this is not necessary to happen in a synchronous way, especially in the neo-liberalistic economic model. In the case of Greece, the country for more than a decade had demonstrated high indexes of growth but this was not penetrated in the real economy, which mirrors the level of development. Actually the country, during this time experienced an underdevelopment, which is a possible disease of modernisation. Economies in their attempt to update and align with modernised techniques may fall into underdevelopment. Underdevelopment is the phenomenon of economic increase without development *(Argyris, 1983)*. Obviously, this was confronted in the case of Greek economy due to its high dependence on distortions and restrictions, as well as other structural characteristics but most of all due to paternalistic mindset. Another factor was that the country lost its membership's economic orientation in Eurozone. What

exactly want the partners from Greece to produce? What is the expected role of the country in Eurogroup?

According to Global Corruption Report 2009 *(Transparency International, 2009),* Greece was placed in the 57th out of 180 countries for the year 2008. Furthermore, a national survey presented by the Transparency International Greek branch, for the year 2009, estimated that the size of the total corruption (both public and private sectors) was increased at approximately 787 million euro, comparing to 748 million euro for 2008 *(Transparency International-Greece, 2009)*. Levels of foreign investments remained low comparing to other OECD countries, as appeared in international reports *(Political Risk Services, 2009).* Openness to foreign investment could be considered rather restricted. Foreign and domestic investors face almost the same screening criteria. Foreign firms are not subject to discriminatory taxation. Although there were various efforts to create a positive environment for investments - such as the "Invest in Greece Agency" which operates as a one-stop shop for assisting investments in the country – this, by itself was no more than a single attempt. The lack of a stable law-taxation framework towards investments is the primary cause of investors' aversion.

Greece's economy had been subject to intense governmental regulation *(Political Risk Yearbook, 2009)*. Greek labour laws are restrictive in terms of working hours' limits, flexible employment (part-time, on demand etc) as well as hiring and dismissal of personnel *(Political Risk Services, 2009)*. The tax regime lacks stability, predictability and transparency. The government often used to make small adjustments to tax levels and imposed retroactive taxation. Besides that, it is still difficult to measure productivity especially in the public sector where there is no clear image of what is the value of produced goods and services, since there isn't an evaluation framework.

Nevertheless, it should be recognised that the country is currently making a strong effort to change the existed economic environment - November 2012 - through a series of new laws which aim to bring a radical restructure. The third memorandum of understanding, known as the Fiscal Strategy Framework 2013-2016, approved on November 2012 by the Greek Parliament, changes the structures in multiple levels trying to eliminate a series of distortions and cultivate a framework for real development.

Greece had more or less a fiscal deficit of fifteen percent (15%) during 2010, the year that finally entered in the first adjustment programme. The Greek government had to finance this deficit, in other words find ways to ensure that accounts will be paid and cash flow will not stop. By that time, growth had been financed by a private sector borrowing and a public sector borrowing and spending. A significant income channel came from the absorption of EU structural adjustment funds and the participation in a number of other EU programmes *(Political Risk Services, 2009)*.

3.2.3 Consequences

Over the last fifteen years the country has exhibited a remarkable record of growth and monetary convergence with the euro zone which finally could not manage to exploit. Economic expansion had been largely based in (a) the liberalisation of the financial sector (provide cheap credits to households), (b) the reduction of interest rates due to EMU, (c) the migration inflows, (d) the pervasion to the southeast European markets, (e) the growth in public investments, (f) the inflows from EU programmes and (g) the consumption.

However, this growth - as mentioned earlier - was neither balanced nor in relation to labour productivity, employment participation and technology adoption. This growth did not direct to rearrangement of wealth distribution towards sectors that could lead further. Instead, the financial sector's liberalization and lower interest rates after euro adoption caused a demand booming. Nevertheless, inflation and labour cost growth exceeded that of trading partners and eroded competitiveness *(IMF, Country Report, 2009)*. Imbalances persisted and in combination with the global financial crisis, that had weakened sentiment and had sent spreads soaring, causing financial scare. In addition, the lack of political consensus hampered any effort for effective policy making *(IMF, Country Report, 2009)*. Revenue shortfall and the rising expenditure widened the fiscal deficit. In addition, the country felt the downturn beyond its own causes, due to Euro area's problems. Euro zone is still experiencing a recession, in terms of more countries that are facing similar to Greece economic problems, although of different nature.

Greece is expected to further decouple. Main forces are lower investments and exports, destocking and a decline in private consumption as confidence and employment have dropped *(IMF, Country Report, 2009)*. Inflation remains high with unemployment rate reaching 24 percent within 2012. Uncertainty and high risks remain. It is questionable whether local social partners are willing to support the necessary changes. As *Monastiriotis (2009)* concluded, the recent economic turbulence had proved that Greek economy suffered of structural problems and weak

fundamentals. Public debt, lack of international competitiveness, unemployment, eroding public finances and a credibility gap, plus inaccurate and misreported statistics, are forming an explosive mix which direct to economic instability *(CIA, 2010)*. The falling state revenues and the increased government expenditures are two more ingredients of this unstable mix which moreover accommodates: tax evasion, inelastic government expenditures, an ageing population and an unsustainable pension system. Structural problems driving to low export penetration, unemployment and inactivity, low labour mobility and wage flexibility, low technological absorption, low educational performance *(Monastiriotis, 2009)*.

Above all there is an economic duality which creates a framework; a given status-quo consisted of (a) a large shadow economy and (b) a disproportionately protected public sector *(Monastiriotis, 2009)*, which still the country cannot administer effectively due to the political cost and the probable social explosion.

The fiscal position is further challenged from (a) the programmed reduction of European Union structural funds and (b) the cost pressures from rapid ageing. The consistent underperformance on applying the necessary structural reforms throughout the years will continue to lead in low productivity. The imbalances of the Greek public sector are driven by multiple structural factors. The dramatic rise of public expenditure and the inadequate control of government spending were the main cause of the widening fiscal deficit *(OECD, 2010)*.

The International Political Economy "think tank" had issued an article on the devaluation of the Greek euro, where it was clearly presented the country's exit scenario of the Euro zone, although temporarily (*Aliber, 2010)*. The Greek "product" is considered expensive, since costs are too high. As a result it cannot stand in the globalized markets; it is less competitive and provides no sustainable future. If there is no competitiveness there is no growth, according to the growth models of globalised markets.

On the other hand, high costs lead to a massive current account deficit and among others contribute to high levels of unemployment *(Aliber, 2010)*. Unemployment directs to low level of fiscal revenues. A bigger economy makes it easier to absorb aging costs and improves the standard of living for all Greeks. Revenues need to increase and expenditures need to be cut. Greece will face incremental difficulties in placing additional debt not because the past debt, which has already been absorbed by the market, but because of the pressures from implicit future debt under current policies *(IMF, Country Report, 2009)*. The longer the government waits to adjust the comprehensive net worth gap, the more difficult it gets, because the shortfall is projected to get deeper every year.

3.2.4 Healthcare

Under this evolvement, healthcare sector was the first impacted. Various reports from global organisations have concluded that Greek healthcare system demonstrated specialties and monopolistic patterns which resulted in raising burdens to the country's deficit *(Davaki & Mosialos, 2005; IMF, Country Report, 2009; Memorandum of Understanding of Specific Economic Policy and Conditionality, 2010; Memorandum of Understanding of Specific Economic Policy and Conditionality, 2012)*.

On March 2012, Greek government fully adopted the *Memorandum of Understanding on Specific Economic Policy and Conditionality (2012)* which was the framework including all necessary reforms for the healthcare sector, to be implemented until 2015. The efforts were directed mainly to the control of public pharmaceutical spending *(Appendix D)*. More precisely focus is given on (a) the reasonable pricing of medicines, (b) the monitoring of prescribing, and (c) the increasing use of generic drugs *(Appendices E,F,G)*. The target placed for the country was to increase the adoption of generic drugs from 32% to 60% by the end of 2013. This target challenged the existed system and was considered a direct intervention in how the medicines provision would be administered. Below, there is an attempt to illustrate how the old and new systems work. This is an eco-map of health operations in terms of pharmaceuticals provision to people *(Figure 4)*.

The old system provided an essential independence on pricing and prescribing to the primary system's players, which were: (a) the pharmaceutical companies, and (b) the doctors.
Government was actually isolated in identifying the health needs and approve the budgets originated from the Public Insurance Organization (EOPYY), who had a relative independence in administration and budgeting. The system was rather a flabby one, with lack of controls and absence of appraisals.

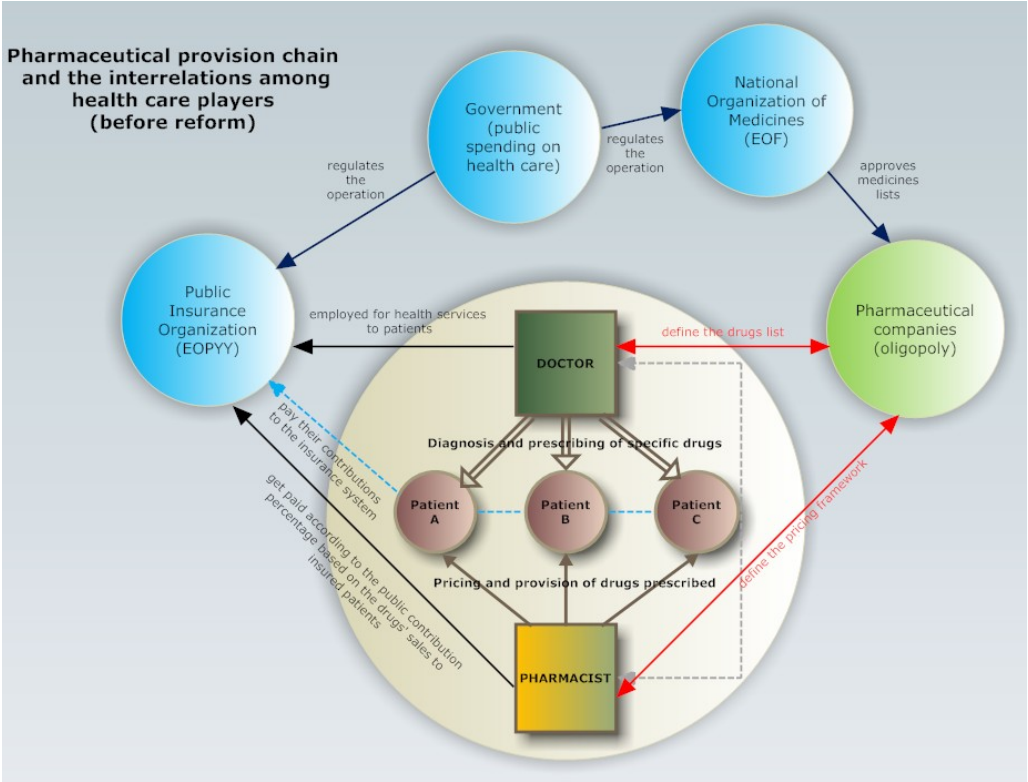

Figure 4. Eco-map of the pharmaceutical provision system – public spending (old system)

For example, doctors acted as decision making agents by defining which type of drug will be given to the patient. This practice though has global and old characteristics. Doctors' behaviour in terms of prescribing is based on information and incentives *(Hellerstein, 1998)*. Such behaviour incorporates the supplier induced demand. When decisions are originated from asymmetric information and agent problem this creates social and health costs. Thus, the decisions are not cost-effective. Nevertheless, in common practice, pharmacists often substitute branded drugs prescribed by doctors with generics that are considered equivalent *(Hellerstein, 1998)*.

In the new law there is an intervention to monitor the prescribing of medicines, and increase the use of generics in order to decrease healthcare spending *(Hellenic Republic, 2012).* In the next diagram *(Figure 5)*, it is clearly demonstrated the change of roles and controls, as placed by government. Nevertheless, such changes reveal weaknesses mostly originated from the inability of public services to support effectively the altered operations. This stems from luck of budgets which are necessary to protect the new legal framework.

The reformed system introduced a close monitored process where prescribing and pricing is under continuous scrutiny. At this stage, primary market system's players are: (a) the government, (b) the National Medicines Organization, (c) the doctors, (d) the pharmaceutical companies, and (e) the pharmacists. Pharmacists are the ones who will decide the generic in the new system following the government rules. As experienced in the case of Norway, pharmacists demonstrate heterogeneity in drugs decision which stems from their professional specialties *(Dalen et al, 2011)*.

The new health system started its operation during summer 2012, with many problems and a series of oppositions originated from the healthcare partners including doctors, paramedical staff, pharmacists and healthcare products companies *(Hellenic Republic, 2012; the new Healthcare Law 4052/2012)*. In simple terms the reform, introduced policies for:

1. Reducing and controlling expenditures in the pharmaceutical sector.
2. Instituting a single universal social health insurance organisation (E.O.P.Y.Y, the National Organisation for the Provision of Health Services).
3. Reforming the hospital sector.

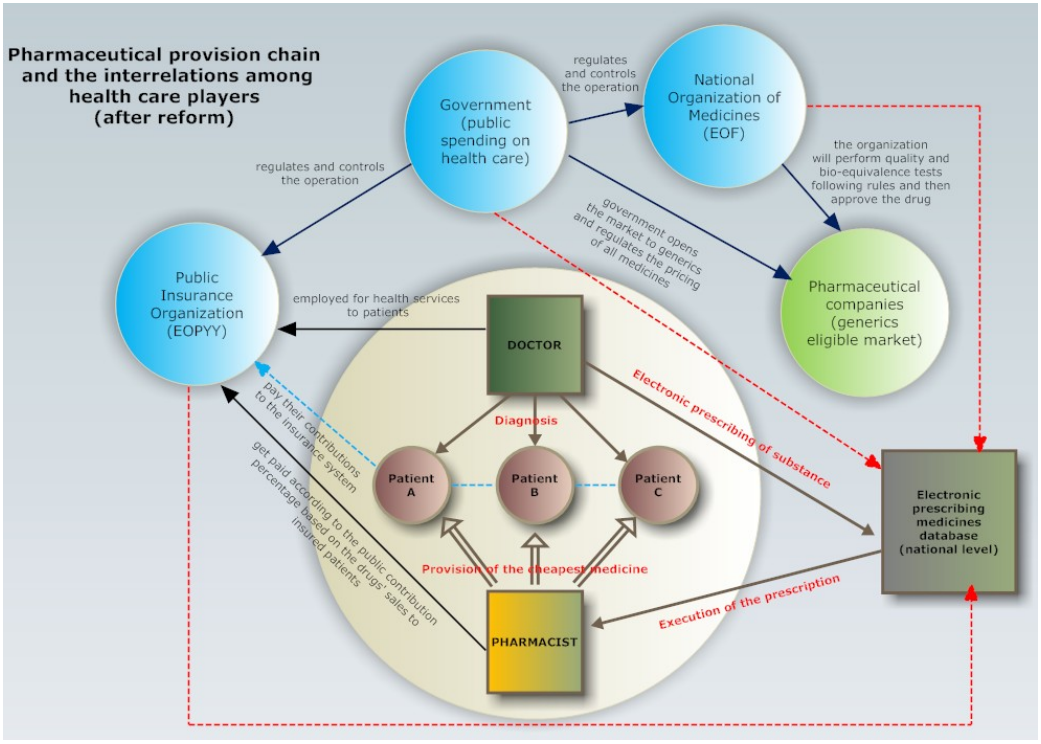

Figure 5. Eco-map of the pharmaceutical provision system – public spending (reformed system)

These reforms were nothing more than the ones already approved in the first Memorandum of Understanding, signed two years ago. Any laws and decrees since then were based on the above three-pronged strategy.

Moreover, some months later, during November 2012, the Government approved the Fiscal Strategy Framework 2013-2016, which went deeper in reforms regarding: (a) the stratification of medical staff's salaries, (not only) (b) the pricing of logistics' costs and procedures for the supply of medical products and services. Nevertheless, the main structural health intervention for the country is considered the one of the unique Health Association Organisation (E.O.P.Y.Y, the National Organisation for the Provision of Health Services). This was done in the effort to centralise and control inputs and outputs of the system. All transactions should be made electronically and there will be periodic reviews *(Greece, Fiscal Strategy Framework 2013-2016, 2012)*.

As it seems, November 2012, was a significant month for the country. The First Review of the Second Economic Adjustment Programme, by troika, was published on that month, as a result of the scrutiny which lasted for more than 4 months. The results were fairly disappointing. Lots of work still is necessary to be done in terms of prior strategies. Public health expenditure should be kept less than 6% of the country's GDP. On the other side, the new structures should be more efficient to maintain universal access to health services and improve the quality of healthcare delivery *(IMF-EC-ECB, First Review of the Second Economic Adjustment Programme, 2012)*.

It is questionable though, how this will be achieved in terms of human capital, meaning the medical staff. The central idea of internal devaluation, as discussed in previous sections, affects among others the labour cost. For example the payroll of doctors in public hospitals will range from 1,000 to 1,700 Euro per month (gross income), while the Institute of Labour in Greece, has announced that the amount of 580 Euro (net income) is the poverty's borderline.

3.3 Complexity

3.3.1 The monetary equilibrium

Complexity is bind to far-from-equilibrium status. Nevertheless, for a real economy to rebound, it is necessary to achieve a level of stabilisation rather quickly. Any change should be performed effectively and transitional period should be kept of minimum length. Even if the society decides to bounce back as a result of its resilient practices, the request is to acquire stability. On the other side, in case the society bounces beyond, by changing structures and not roles, again the end-

process is expected to be the search of stability. Therefore, economic stability remains as the primary objective since this, by itself, activates a series of positive consequences such as increase in foreign direct investments, high reserves, stable interest rates and business expectations. The main problem of Greece currently is economic instability. The situation as described in the previous section briefly creates a framework consisted of: fear-uncertainty-high risk. The stability mix, which may help the country to return quickly, is depended on:

1. **Anti-cyclical monetary policies**
2. **Debt management**
3. **Fiscal adjustments**

The participation of the country in Euro zone, a currency consortium, demonstrates both advantages and disadvantages in this specific case. Euro is considered as tough currency. Taking into consideration that the use of a currency mirrors the status of an economy, Greece has a challenge ahead to confront. On the other side, the common currency between countries usually leads to lower volumes of trade especially when these transactions do not create overvalue. Therefore, in broader terms, countries tend to look for markets with different currencies and variable exchange rates. In this case this is not possible. Greece belongs to the complex adaptive system of Euro zone, and as such should be treated and researched.

Undoubtedly, monetary policies have direct impact to economic developments and the shape of business environment. Changes in the stock of money affect the economic activity interfering with a lag which creates cyclical fluctuations. Moreover, monetary policies could be exploited as leveraging tools for the countries. The practices of devaluation and overvaluation usually help the economy to adapt into broader changes following a cycle of recession-development. On the other side, monetary policies can be used as a mean to impose structural reforms, especially when this follows external shocks for an economy. This fits more to a “white-page strategy”; creating shocks and vibrating an economy trying to eradicate old status quo; turning a new page in its economic history and accomplishing a reposition.

Real economic progress comes at a price equals to creative destruction. Joseph Schumpeter, who first identified and linked the essences of creative destruction and destructive innovation, highlighted that both undermine human values. Moreover, he asserted that entrepreneurs, no matter where they operate, they are agents of a system and they unleash innovation and creative destruction. Therefore, it is almost impossible to look for equilibrium in an environment where the phenomenon of entrepreneurship exists. This is what *Pichler (2010)* alternatively defines as the ever-self-renewing entrepreneurial drive. Besides, he insisted that a reproduction of a system stems from its own forces, and from within.

Borrowing definitions from criminology, the perfect guilt elevates when there exist three parameters: (a) motive, (b) mean, and (c) opportunity. In correspondence, these could be in this case: (a) motive: to activate changes, (b) mean: the monetary policy, and (c) opportunity: the economic recession.

Understanding complexity seems close to managing change, managing crisis situations and realising the structures of a living entity. In an extent this is useful to realise the complex system of a country as a whole, especially when this experiences a time of recession and economic shock.

3.3.2 Complexity and Complex Adaptive Systems (CASs)

Complexity science focuses on dynamic states that emerge in systems that find themselves in far-from-equilibrium status. The essence is the search and study of characteristics in such systems. This finds application in the study of patterns and relationships as well as the results of the interactions among the components of the systems. In complexity, this happens in a holistic view rather than a simplistic way. *McDaniel and Driebe (2001)* discussed the reductionist perspective, known as the Newtonian, which tries to understand the whole of a system through the understanding of its parts. Things can be broken into their constituent elements in order to be examined. This adapts to the mechanistic view of evolution, where systems are confronted as machine-like entities and run-like-a-clock is the dominant metaphor. *Batty and Torrens (2001)* defined as a complex system, an entity which is coherent in some recognizable way but whose elements, interactions and dynamics generate structures. They recognise the existence of surprise

and novelty in such systems, which cannot be defined a priori. Therefore, a complex system is more than the sum of its parts since it accommodates numerous interactions, dynamics and behaviours inside. The part, cannot replace the whole.

Various researchers *(Hassink, 2010; Simmie and Martin, 2010; Clark et al, 2010)* have attempted to understand complexity and complex systems through research of natural systems. A complex system demonstrates the attributes of a natural living system which incorporates different sub-entities with powers, links and concern. In other words, this could be perceived as the biology of business. Organisations, regions and countries has yet much to learn from biology and nature.

Complex adaptive systems (CAS) are self-organised systems which have the ability to adapt to any external affection including their radical change of inner structures, if necessary. *Scott (2008)* raised the issue of cooperative behaviours which could exist among the agents of a CAS. This is necessary to progress, if the system prefers to survive. Therefore, although a CAS demonstrates different dynamics and norms within its own substance, there must be some simple rules to survive. As *Janoff-Bulman (2009)* highlighted, although a self-regulatory environment seemed to gather many advantages there is always the issue of who will undertake the complex thinking. *Begun et al (2003)* gave a concise definition of complex adaptive systems as follows:

Complex implies diversity, a wide variety of elements

Adaptive means the capacity to alter or change, the ability to learn from experience

System is a set of connected-interdependent agents

Complex adaptive systems can respond in more than one ways to their environment, although they hide a sense of unknowability, meaning high risk of unexpected outcomes. This incorporates the elements of extensiveness, process and surprise. Moreover, it complies with emergence, differentiation and path dependence, as it was raised, by *Schneider and Somers (2006).*

3.3.3 Characteristics of Complex Adaptive Systems

It seems that complexity is born from diversity. And there is no better way to understand complexity than studying its characteristics. No matter the behaviour of a complex system and the response to the environment, there is a certain number of characteristics that this owns. In the next figure it is provided a small diagram of these characteristics *(Figure 6)*.

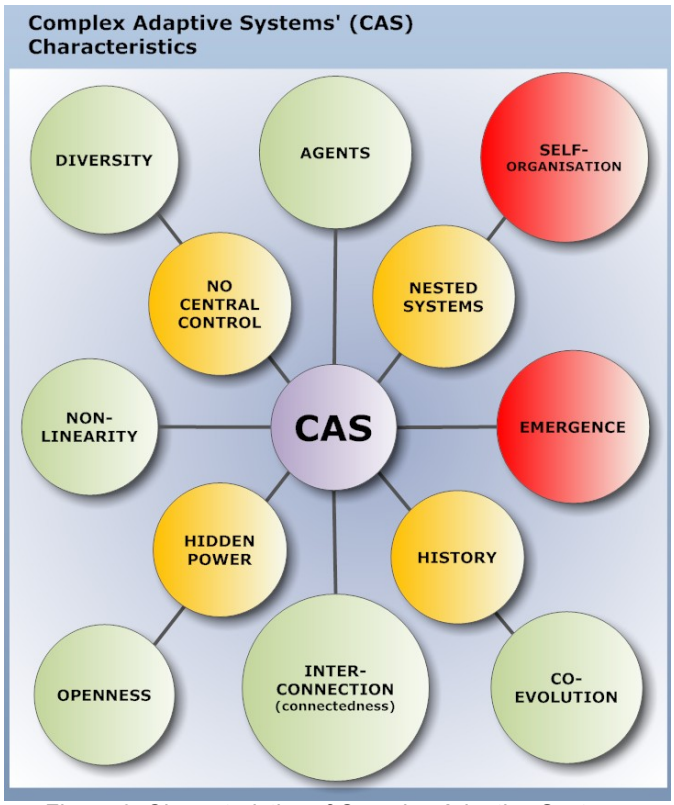

Figure 6. Characteristics of Complex Adaptive Systems

Some of the characteristics may encrypt greater significance (e.g emergence, self-organisation), than others (e.g. history), but here is considered crucial to cover them all equally. The aim is to bring forth and analyse these characteristics, taking into consideration any specialties and what these represents. Catching the essence of characteristics enables the ability to understand complexity as well as the difference between mechanistic and holistic approach. The intention is not to deepen rather than use them as a guide to discuss the case of healthcare in the country.

Complexity stems from **diversity**. According to *McDaniel and Driebe (2001)* diversity is the source of novelty and adaptability and in extent the source of invention and improvisation. All four attributes are living elements of complex adaptive systems which are made from a large number of **agents**. *Easton and Solow (2011)* specified that CAS consist of agents who act and react based on self-generated stimuli, and the actions of other agents, either from inside or outside the system. This agrees with what *Daskalakis et al (2009a; 2009b)*, as discussed in previous section, had identified regarding the game theory and the potential behaviour of players. Definitely agents are the central actors in the system and demonstrate a dynamic state *(Begun et al (2003)*. The specialty though is that none of the agents can understand the system as a whole, since they tend to attend their local environment (or microcosm). Therefore, none of them can acquire central authority to manipulate the system; there is no central agent. On the contrary, they act and react with each other and adjust their behaviour accordingly. In terms of diversity, although this could be a positive source for the system, this in the same time may be a source of frustration among agents. Diversity raises difficulties in communication, perception and stimuli. *Psychogios (2011)* highlighted that agents select with whom and how they will interact. Therefore, they have an embedded the element of selective behaviour.

There is an ingredient which links agents with the system and this is: information. Agents are information processors who exchange, evaluate, and feedback information among them and with other systems. Information on the other hand, is the blood of the system, which enables reactions and defines concerns. Complex systems demonstrate acute similarities with living organisms. Human beings are social entities who tend to organise themselves in a manner that is considered approved and necessary for their survival. In complex systems this practice is expressed through building blocks. During the evolvement of the system, different agents, based on their role and level of pervasion are grouped and form various blocks. As the system unfolds the blocks change their reaction and behaviour. So far, it is realised that agents do not only interact, but they adapt and live in a complex system while they **co-evolve** with it.

Co-evolution does not necessarily imply progress, since agents may experience obstacles which raise conflicts between them. In any case, co-evolution is the development of the system through time under the prism of the micro and macro environment. Moreover, co-evolution incorporates the actions of agents as a result of their own evolution within the system (nested evolution). Any change that an agent introduces is expected to affect existed patterns and relationships. This triggers the environment in a manner that other agents are obliged to demonstrate functions of placement and repositioning in the new-formed framework. This action is what *McDaniel and Driebe (2001)* identified as, the fitness landscape. Nevertheless, it is questionable which might be the ultimate fitness landscape for a complex system, since there is no agent that owns the big picture of it. This is probably a reaction of compromise and cooperation that agents express, as a result of finding a workable solution for the system to continue evolving. In this case, it could be claimed that the structure of a system is the result of the interaction among the agents and their environment both the micro and the macro.

The essence of complex adaptive systems is encrypted in the relationships among agents. Such relationships form a framework of **interconnections** which affects not only the agents within the system but the system's broader environment. Interconnections among living organisms, such as organisations, show a stratification of **connectedness**. In other words, it is not only the number of interconnections among agents but the richness of these connections that determines the character and the behaviour of the system.

Besides that, relationships follow patterns which have been established through interactions and such patterns enfold certain dynamics. *Begun et al (2003)* claimed that relationships among agents are complicated and enmeshed, one could also say, these are massively entangled. Further to this, *Psychogios (2011)* explained that relationships among agents are **non linear**, thus a small stimulus may cause a large effect or no effect at all. Also he ascertained that actions and behaviours of small non-average groups may result in unintended consequences. Non-linearity is the ingredient of complexity. Due to partly non-linear input-output functions, complex systems demonstrate unpredictable behaviour *(Keune, 2012)*.

In the same way, *McDaniel and Driebe (2001)* discussed that inputs are not proportional to outputs as simple deterministic equations may produce an unsuspected richness and variety of behaviour. However, complex and chaotic behaviour may enable ordered structures and relationships play an important role in this case, especially when these relationships are mostly received from near neighbours *(Psychogios, 2011)*.

This in simple terms, describes the range of interaction, but more important explains the range of influence among agents. The use of information, either through positive or negative feedback, either distorted or in plain terms, affects interaction and influence. Although these rules sound simple, complex behaviour can emerge from such rules. **Openness** is an additional characteristic of complex systems and this stands closer to patterns of interconnection and relationships. The exchange of energy and information opens the width of complexity. It is interesting though, that *Begun et al (2003)* had a different conclusion. He claimed that complex adaptive systems tend to maintain in general bounded behaviour regardless the small changes in initial conditions. This is called an **attractor**. Probably he saw that behind complex situations there are simple rules hiding, in terms of **self-organisation**. He doubted also the generality of butterfly effect. The sensitivity to certain small changes in initial conditions is depending in the exact path that the complex system follows. So, **emergence** is not only the product of context-dependent non linear interactions but also a product affected by the lock-in path, the path that the system will decide to follow. This is the ultimate behaviour of healthcare sector in Greece. An attractor pattern which denies to absorb changes and in response they build a lock-in path.

Keune (2012) defined **emergence** as a phenomenon that comes from the presence of simple components in a system that interact in a manner which cannot be explained by their individual characteristics. As a result, emergence is the source of novelty and surprise and this is one of the most critical characteristics of complex adaptive systems. Actually, emergence stimulates new structures and behaviours. It is not unrelated to other characteristics. On the contrary, according to *Psychogios (2011),* new structures may emerge in a CAS, as a result of the patterns of relationships between agents. Interconnection, co-evolution and their inner elements may direct to emergence. The level of connectedness among diverse agents, in relation to agents' building blocks practice, and the properties of the system create a fertile ground for repeating emergence, based on unpredictability.

This is usually the stage where **resilience** comes up as reaction. There is **hidden power** in complex adaptive systems, and this is due to the ability of allowing a massively entangled group of diverse individual agents the freedom to be adaptable and resilient *(Easton & Solow, 2011)*. Nevertheless, resilience has different natures or types. *Hassink (2010)* presented a four-dimension model of resilience assuming that a system always tends to find its equilibrium; these different types of equilibrium are: (a) the back to normal equilibrium, (b) the flip from certain equilibrium to another, (c) the path dependent equilibrium, and (d) the long-term equilibrium.

Hudson (2010) verified that resilience denotes the capacity of ecosystems, individuals, organisations or materials to cope with disruption and stress and retain or regain functional capacity and form. Therefore, although this is not incorporated in the characteristics that have been described so far, resilience is diffused as a mindset in the whole of a complex adaptive system. Above all, it is related to exogenous shocks and reflects the system's capacity to absorb disturbance and reorganise while undergoing change *(Bristow, 2010)*. *Simmie and Martin (2010)* claimed that the primary ingredient of resilience is **learning** and in extent the capacity for a system to have mechanisms of knowledge acquisition and knowledge assimilation. Systems that do not succeed in capitalising knowledge will experience harder conditions in their effort to apply changes and to align with broader necessities.

The collective result of non-linear interactions among agents brings new structures and establishes new patterns of relationships and behaviours. Since complex adaptive systems are dynamic, most of the times depending on their motives, they follow a path of self-regulation. This happens, when agents decide to shift and change both internally and externally affecting each other *(Psychogios, 2011)*. They demonstrate a self-organising behaviour which an adaptive response to the new situation and the new emergent properties. This is called **self-organisation** and is considered one of the important characteristics in complex adaptive systems. It is the situation where new status is adopted and the system operates through new patterns in a holistic way. There is no central body to administer this transformative situation but this arises as a new generated order.

Moreover, a complex system, as a living entity, has a **history** which cannot be ignored. Among others, such systems demonstrate **temporality**, meaning that they are reflecting their history, their memory of the past, in a selective non-linear manner *(Keune, 2012)*. History should be considered

crucial in the effort to recognise and analyse other characteristics, since may hide repeating behaviours, attributes, reactions and structures. As mentioned earlier, complex systems own the problematic attribute of **reduction**. Any knowledge available for the system is nothing more than a reduction of its complexity; a micrograph; a simplification.

3.4 Healthcare and Complexity

3.4.1 The Complex Characteristics of Healthcare

Healthcare systems demonstrate different specifications and characteristics. They are complex adaptive systems which have their own specialties and distortions, usually generated from the dominant metaphor of unknowability. Traditional administration in such systems still focuses in control which is defined by the following scheme: (a) better regulation, (b) financial restrictions, and (c) punishment of offenders (when possible). However, relationships and interconnections are critically important since healthcare incorporates many diverse agents. Besides, this is the challenge of the specific sector. There is a structure in the system but with variations.

In this section it is intended to bring forth some of the special characteristics of healthcare complex adaptive systems. It is considered that these characteristics are responsible for the differentiation of healthcare and the demand of a holistic approach rather than a common complex system.

Probably the most important special characteristic of the system is **information asymmetry** among agents. This applies between clinician providers of services and typical agents (patients and others) *(McDaniel and Driebe, 2001)*. Such asymmetries create interdependencies. No matter if healthcare is offered through public or private services, there are **weak links** among the main agents in this service experience, as figured below.

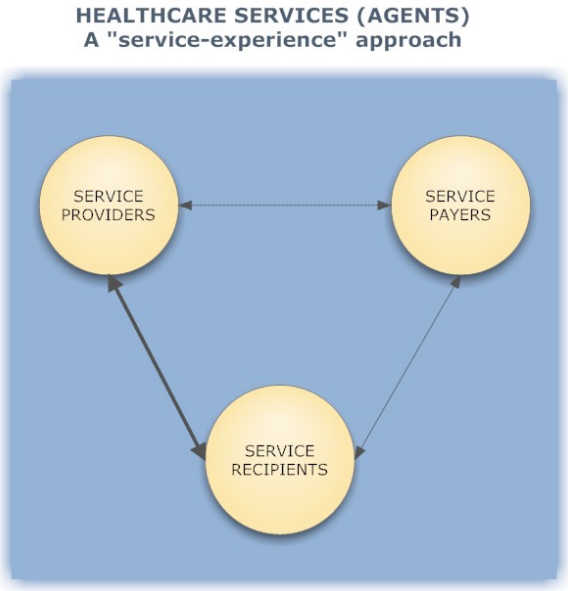

Figure 7. Healthcare services (agents' links)

There are three major agents in healthcare complex adaptive system depending on their role. Service providers are the one who holds inside information and this, by itself, position them in an advantageous place. Service payers may be either the same with service recipients (in case of private sector) or different (in case of public sector). In the former, the patient has a more direct participation while in the ladder this is more or less indirect. According to relationships and patterns of behaviour, as provoked via power, the links among these agents are varied. Potential weaknesses in links lead to distortions.

Pisek et al (2003) highlighted that relationships is the central component to understand the system. The behaviour of the system is the result of the interaction among agents. To be precise these are **generative relationships**, meaning that these mainly affect the system. Furthermore, **actions** of the agents are mostly based on **internalised simple rules** and mental models. For example, the specialty of the relationship, developed between doctor and patient may direct in

actions that follow instincts, constructs or mental models rather than predefined rules. The emergence of a case in Emergencies Section of a hospital stimulates initial instincts and puts aside administrative rules.

Besides that, the system enfolds attractor patterns which define the response to certain issues of change. *Pisek et al (2003)* for example, discussed the **desire for autonomy** as a strong attractor pattern. However, there is a paradox in healthcare and this stands in opposite practices that can be found simultaneously. There is one side in the sector which continuously adapt to changes, while the other side demonstrates a remarkable resistance. Non-linearity is inherent since healthcare accommodates nested complex systems. A hospital is a complex system embedded in a regional healthcare complex system, which in extent is part of the national healthcare complex system and so forth. Imagine that these systems co-evolve.

Additionally, there is considerable **technological and professional heterogeneity** within a healthcare organisation *(McDaniel and Driebe, 2001)*. Such heterogeneity increases the difficulty of understanding the agents and the system. As *Orr et al (2006)* mentioned, two agents of the same system (regional healthcare organisation) may approach the same problem in a different way and with different resources, getting into different conclusions. For example the forthcoming problem of ageing population, is confronted differently by Public Health System and Ageing Networks. **Experimentation and pruning** is an ingredient of the system but it seems that applies to specific cases and not holistically. *Lessard (2007)* argued that **complexity thinking** is a characteristic of the sector but has to be collective. He introduced the issue of **collective reflexivity** as the mean that should be taken into account in terms of changes. Quantitative methods are not enough in assessing sector's results. On the contrary, healthcare needs to deal with complex social problems through multiple factors mediated by individual and social contexts. Tradeoffs across multiple objectives and perspectives of different stakeholders are parts of critical thinking in complexity. On top of all, concern should be given that decisions are strictly connected to human lives, quality-of-life and health of human capital.

These represent the so-called **ethical climate**. *Mills et al (2003)* have placed ethical climate as the decisive factor which either can endanger or empower the whole sector. She insisted that cost constraint and quality improvement cannot co-evolve. In the same manner, she claimed that placing sales techniques and market solutions in healthcare changes the nature of the service to market commodity rather than a social service. However, cost strategies and relevant measures should be placed carefully towards services' nature.

On the other side, healthcare systems financing is a considerable issue for World Health Organisation, as rising healthcare costs is the current challenge in global measures. The Organization through various surveys and reports concluded that 20-40% of all health spending is wasted inefficiently. Therefore, improving efficiency is the main target. Certain actions are suggested, which involve: (a) better procurement practices, (b) broader use of generic drugs, (c) better incentives for providers, as well as (d) streamlined financing and (e) efficient administrative procedures *(World Health Organisation, 2010).* Such recommendations obviously provoke industry and systems' restructuring not only in Greece.

The socioeconomic position of a country has a direct impact on its healthcare strategies *(Davey, 2000)*. Poor strategies raise inequalities and diminish worthiness of human capital. When a system accommodates human beings, these have the freedom and ability to **respond to stimuli** in many different and unpredictable ways *(Mills et al, 2003)*. Consequently, the relationship between environment and healthcare is the most challenging complex field, since contexts and relationships are ignored or marginalised in the attempt to make economic evaluations. *Batty and Torrens (2001)* highlighted wisely, that a complex system is one that can respond in more than one ways to its environment, revealing the mutual relationship between such systems and their environments. This statement incorporates the elements of extensiveness, process and surprise. Moreover, it aligns with emergence, differentiation and path dependence, as it was raised later in 2006, by *Schneider and Somers (2006)*. To this extent, emergence and non-linearity show an even sharper behaviour in healthcare; especially when unrecognised patterns reveal and unpredictive agents emerge without authority, but with power that stems from structural changes.

It is a matter of conceptualisation and how healthcare is perceived in terms of metaphor (complex or mechanistic). The most complex systems are social systems and healthcare sector is the most complex within this sub-domain *(Begun et al, 2003)*. Further, **resilience** fits the complexities of healthcare more effectively than principles of high reliability since this provides the framework to learn and adapt *(Jeffcott et al, 2009)*. Complexity accommodates the view of human error and is the result of an environment that is fraught with gaps, hazards, trade-offs, and multiple goals. In addition, in the centre of it remain erratic people who have their personal initiatives.

3.5 Demystifying Complexity

3.5.1 Using Complexity in practice

There is no ultimate model to suggest in the effort to use complexity as a one-size-fits-all strategy. On the contrary, the intention is to combine and apply practices taking into account what various researchers and practitioners have identified so far. Therefore, for each complex situation there is a critical path to follow by joining its points to reach the end-result.

This practice could be applied both for independent or broader cases of complexity, probably not only in healthcare. Recognising the specialties of each case, the practice will include the following three-pronged cyclical strategy:

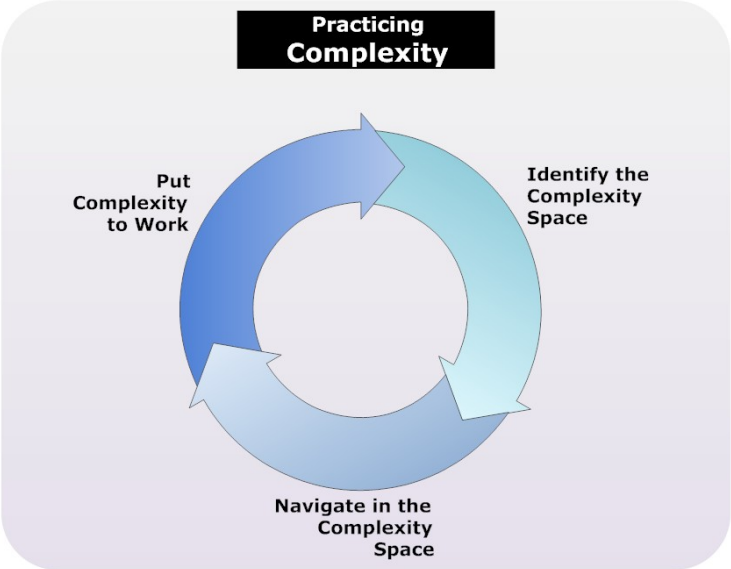

Figure 8. Practicing Complexity (perpetuity)

Zimmerman et al (1998), claimed that machine-metaphor is not adequate, in explaining complex practices. The apparent compressions of space and time, as well as the series of thoughts presented in the first section of this study, verify that there are strong connections of micro and macro phenomena. Likewise, complexity seems to incorporate biology and technology.

3.5.2 Identify the Complexity Space

Characteristics of complexity can be used as a guide to start framing the complexity space. Although complexity incorporates perpetuity, it is difficult for a human mind to capture something obscure unless this has certain attributes. When practicing complexity there are certain elements to discover, and can help in this attempt.

- Who are the central agents in healthcare CAS?
- Is a stakeholder analysis adequate to identify them?
- Which are the patterns of interaction among them?
- Is there any trust among them?
- Are there rich connections among agents?
- What is the level of connectedness (interconnections)?
- Are there any barriers?
- Which are the patterns of behaviour? Who defines them?
- Which are the interdependencies?
- Does the ability of alertness exist among agents to identify constant changes?
- Does the managerial ability exist to administer highly uncertain emergent properties?

The above could outline the framework within the system operates at present time and provide a possible space that complexity exists. It is difficult to determine boundaries of the system in complexity, since any attempt may raise ambiguities *(Psychogios, 2011)*; but it would be practical to conceptualise the system in concentric circles in order to prioritise in a sense the components that are considered more important per case.

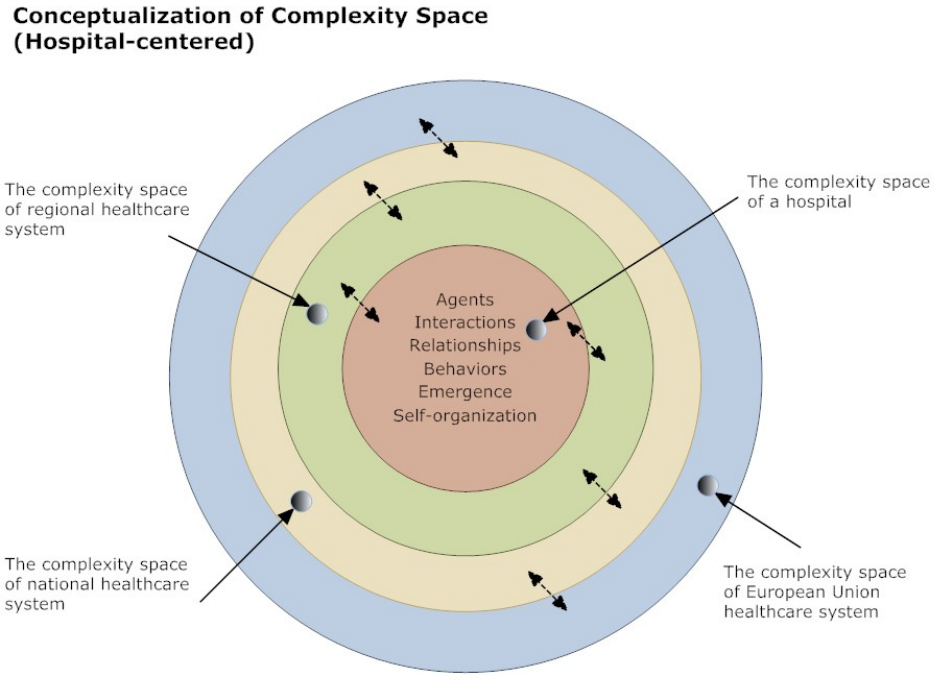

Figure 9. Conceptualising the Complexity Space (in healthcare)

Identification is imperative for realising and accepting the space of interest, the arena where practically system evolves.

3.5.3 Navigating in the Complexity Space

Easton and Solow (2011) have identified three key components to set the conditions for co-evolving in complexity. These are: (a) the Healthcare Ecosystem, (b) the Impact Variables, and (c) the Adaptive Change Cycle. It is almost inevitable to navigate in the sector unless the above are put into practice and serious consideration.

Healthcare Ecosystem is the embedded dimensions of the sector including human capital. To be more precise this includes the underlying patterns and context in which the healthcare sector operates. It is necessary to recognise them prior to any introduction of change. The aim is to perform the move from current to desired state with greater agility and fewer surprises.

Further to that, another weak link is the identification of variables that are more readily influenced (impact variables). This could be revealed during the study of smaller changes and how these take place within the sector. Such tactics help in uncovering patterns and in appreciating current dynamics. According to *Easton and Solow (2011)*, there are seven impact variables which are the components of the activity in the sector (*Figure 10)*.

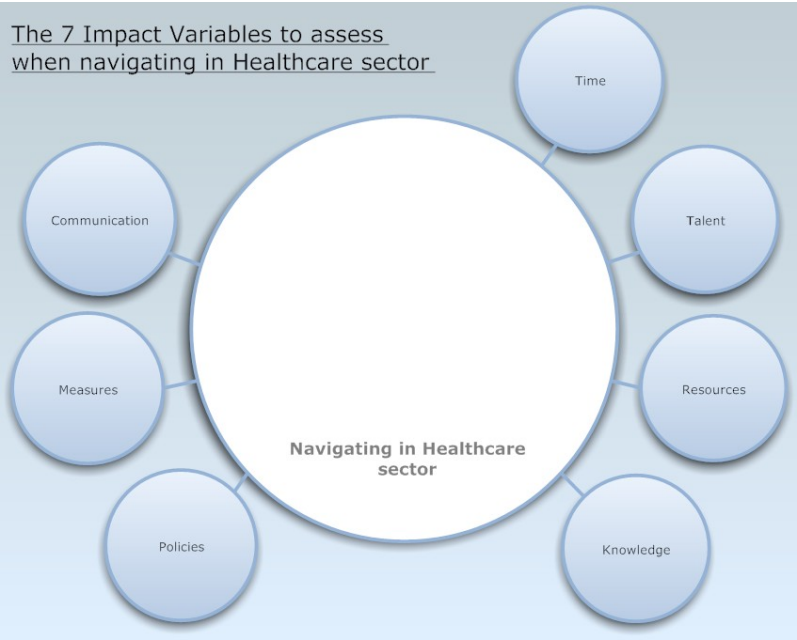

Figure 10. The 7 Impact Variables when navigating in healthcare sector

The intended or unintended affection in any of the specific variables influences the activities within the sector. Therefore, it is crucial to assess and monitor each one, in case of a change.

The third key component is the application of adaptive change cycle. Co-evolving with complexity implies a cycle of acquisition, adaptation, application, results and learning. This is a dynamic multi-process which needs to be accommodated in an organisation especially when changes are about to take place *(Figure 11)*. Changes could be compared in regards to these steps between prior and new-introduced situation.

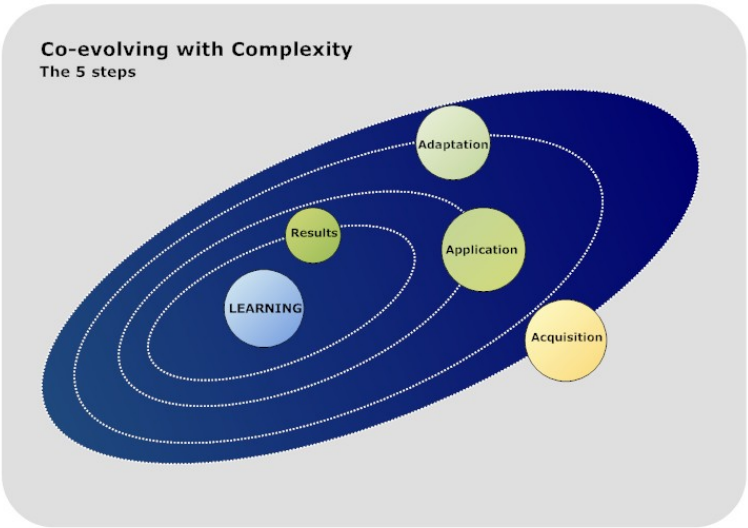

Figure 11. The 5 steps for Co-evolving with Complexity

This is an infinite operation, which starts from acquisition and ends in learning, as the ultimate component for performing a change. However, it is questionable if learning corresponds to knowledge. Here stands the difference between learning and knowledge. According to *Simmie and Martin (2010)*, economies are based on and driven by, knowledge. Knowledge is never static but constantly changes. There is a certain distance from knowledge acquisition to knowledge

assimilation and how this is applied in practical terms. Therefore, the search of any equilibrium in a healthcare organisation is an on-going process which involves knowledge and learning. Living in the knowledge era successor of industrial age, new emerged structures come on top, especially when new knowledge is acquired and this is accompanied by capital accumulation. This directs living entities in performing faster the adaptive cycle, jeopardising their cohesion and questioning their resilience limits, close or far from equilibrium *(Figure 12)*.

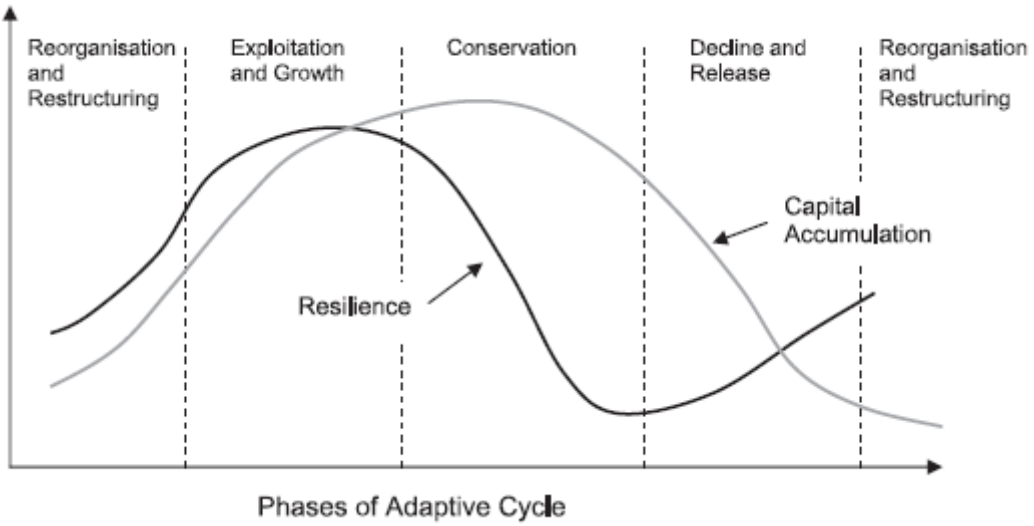

Figure 12. The phases of adaptive cycle (through resilience and capital accumulation)

(Source: Simmie, J. And Martin, R. (2010) The economic resilience of regions: towards an evolutionary approach. *Cambridge Journal of Regions, Economy and Society*, 3, p. 34)

Resilience is related to capital and both their progress follows supplementary paths during the adaptive cycle. When the process of capital accumulation decreases, resilience follows an increased path; it reaches its peak time during the reorganisation and restructuring phase of the entity. *Elliott (2009)* highlighted that the process of knowledge transfer and assimilation, is a key component for the learning framework in an organisation. He presented a mapping of this process which is given in *Appendix H*. Although local forces or other barriers block learning, learning from crisis directs to knowledge acquisition that depends on agents, and how they will handle and acclimatize it- which ultimately may be translated into new norms and practices or plain history. This is the phase where remembering or forgetting history plays its role.

Gaining knowledge on complexity is related to acting based on limited knowledge and ambiguity *(Keune, 2012)*. Navigating in a specific complexity space, such as healthcare, imposes dealing with ambiguities and different types of dynamic behaviour, but towards rebound and sustainability.

3.5.4 Putting Complexity to Work

Easton and Solow (2011) concluded that since you cannot control a complex system you have to understand how it works, thus penetrate in its DNA. Therefore, it is necessary to adopt the mindset where patterns replace predictions and adaptation replaces control. Such strategy incorporates the observation of conditions and the focus on patterns of interaction rather than reified structures. As *Sweeney and Mannion (2002)* discussed, it is imperative to scrutiny the healthcare system by investigating the coming together of the different elements that share the environment, check their interconnection and reveal their purpose. They have identified complexity as one of the fours generic types of dynamic behaviour that a complex adaptive system exhibits *(Figure 13)*.

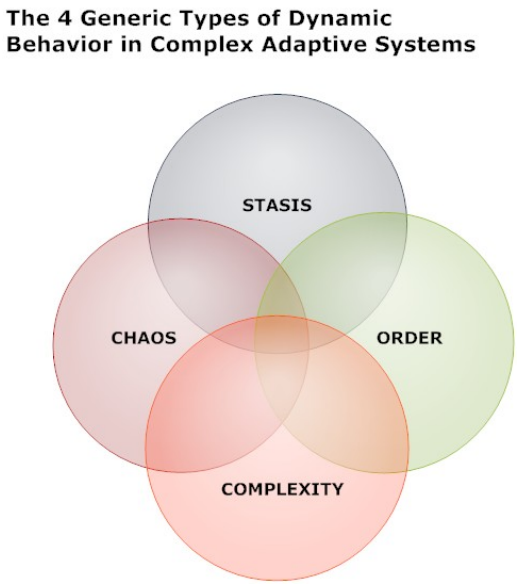

Figure 13. The 4 Generic Types of Dynamic Behaviour In Complex Adaptive Systems

It is important to identify where the system stands and "play" with the corresponded dynamic behaviour through emergence and towards self-organisation afterwards. Although it is not feasible to control, it may be practical to affect.

Stasis, actually depicts the absence of dynamic behaviour, while **Order** depicts a behaviour that is predictable, linear and stereotypical *(Sweeney and Mannion, 2002)*. **Chaos** on the other side is a behaviour which appears randomly but with hidden order and determinism. Further to this, **Complexity** is the dynamic state, which operates as mediator between order and chaos. As discussed in earlier sections, in complex adaptive systems, agents have a degree of independence in terms of their possible actions. Adaptation and re-organisation cultivate a fertile ground to produce emergent behaviours. Such behaviours tend to affect the system's attractors, which accommodate the practice of how things used to work so far. Thus, the heart of the healthcare system is that attractors. The way these entities accept, and react to external stimuli defines the behaviour of the whole system.

When changes are introduced, such entities tend to focus on what is going wrong in the system during the transition phase; this is considered as a reaction of survival, trying to prolong their status and avert risks. On the contrary, the healthy powers of the system focus on what succeeds and investigate why this results so. This is a method to recognise the positive powers that contribute in performing a plan effectively. Moreover, pushing emergence of new agents and introducing new patterns of interaction and relationships, this in extent, moves forward self-organisation processes and the system follows the lock-in path of change.

The way that the system deals with difference, defines its evolution in practical terms. One tactic is to collect and review different viewpoints and accept criticisms. This is a way to test the endeavour and define the ontological boundaries of the complex picture that is presented. Checking the robustness of our picture stems from applying correctly the practice of integrated assessment, focusing on stakeholders. This assessment could check four parameters; (a) ethics, (b) the notion of power, (c) who are the actors, and (d) which factors are important and relevant. By affecting one of the above, this might raise changes in structures.

Diversity is an important characteristic in healthcare complexity. The diversity of agents brings heterogeneity which could be seen as an advantageous potential to exploit any stemmed strengths. This diversity supports sense making, a useful strategy to follow for complexity. Sense making is the ability to observe, to capture, to process information, to follow rules and to connect and share with other agents. Therefore, it requires interaction. This strategy cultivates a collective mind among agents who - in this way - can deal better with emergence and self-organisation. Making sense of what you know in complexity is the replacement of decision making in management, and stands forward from knowledge and learning. The capacity of learning can replace control in such a system especially when this endures through time. Time is a key factor and is strongly linked to the non-linear trajectory of the complex system.

Non-linearity is often the cause of time-dependent events *(McDaniel and Driebe, 2001)*. In addition, the system has encrypted memory which is expressed with predisposition. This is another hidden ingredient of the healthcare system. Predisposition is a key factor either in enabling or inhibiting certain patterns of behaviour. The path through which agents have unfolded their capabilities to learn and act trying to co-evolve with the system creates a historical framework. This is history for the system and is useful for the newer agents to retrieve models of action and thinking ways. Nevertheless, knowing whether to stand on the remembering or forgetting side of history is a talent which could be proved saving in dealing with complexity.

Predicting the future is uncommon and cause-effect relationships are no longer in the centre of coping strategies. In thinking about the future, scenario planning still may help a system to deal with uncertainty but not with unknowability. In the first case, possible scenarios are given and there is uncertainty in terms of which will emerge while in the second case, there is no ability to define scenarios. In complexity, such cases could be confronted through bricolage. *Begun et al (2003)* defined as bricolage: the ability to make creative and resourceful use of whatever materials are at hand, regardless of their original purpose. This hides the ability to create positive outcomes from what emerges, through confusing and mixed-up situations. In other words, this means to create something out of nothing *(Zimmerman et al, 1998)*. Healthcare system is a complex system of interconnections which accommodates social processes which in extent shape a significant part of its own environment.

Thinking about the future in complexity presupposes learning to deal with surprise. However, surprise drives evolution such as utopia motivates creation. Therefore, working with ambiguity in a system with the characteristics that discussed in previous sections, cannot be productive unless there is knowledge capacity, and innovation. Acute occasions demand analogical responses. Dealing with surprise requires improvisational behaviour. In complex adaptive systems loose-tight coupling is an attribute experienced many times. Traditional ways of reaction are not enough, as they need to be supplemented through intuition guiding actions. Agents could build a basic form of action using their instinct, knowledge, skills and risk. This is necessary especially in chaos-order-chaos phases. Action could focus in small inputs which always provide room for learning and development. In healthcare the essence of the system nests in relationships not in pieces, therefore quality of connections is important. Especially in healthcare complexity means interdependencies and the range of agents' influences. Taking action presupposes to find ways in: revealing new agents, unleashing hidden powers and creating the conditions for new structures. The widening of systems' actors is expected to resolve healthcare issues.

It is agreed that CAS cannot be controlled but there is a dynamic to administer effectively the predetermined complexity space; to achieve that, there is a need to develop a stable cognitive process. This is called mindfulness *(McDaniel and Driebe, 2001).* It is the capacity to induce a rich awareness of discriminatory detail and a capacity for action. It is necessary to apply continuously a set of processes as given in *Figure 14* which are supported by the acceptance that survival means a struggle for alertness.

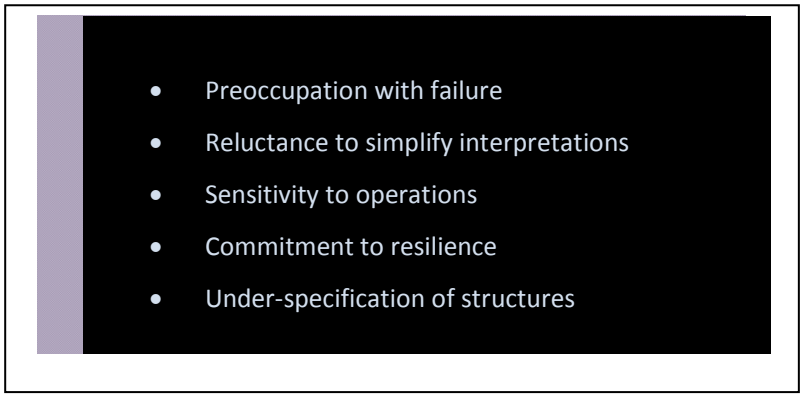

Figure 14. The processes for developing mindfulness

Attention is another function, as important as, information in CAS. Healthcare systems do not stand in one-world but in a matrix of co-evolving worlds within which they must function. These processes are key practices where the mindset is the heart and observation is the blood for the

system to survive. The observation should be done from the inside perspective, as agents of the system and not as external observers. Observation remains in the centre of behavioural patterns and is the essential component of the future non-linear interactions causing emergent behaviours.

In the next figure, there is an attempt to represent what have been discussed so far in the section; these are the strategic components, necessary to let complexity to work.

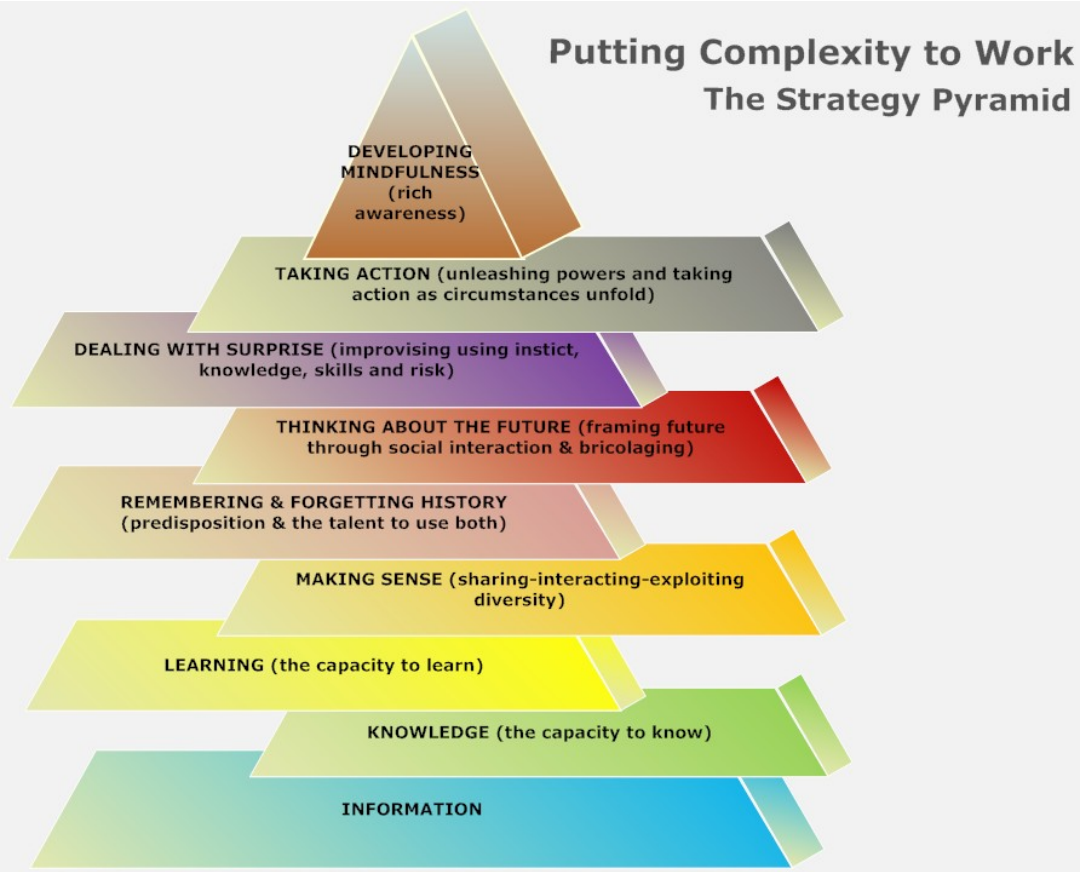

Figure 15. Putting Complexity to Work (strategic components)

Such components form a strategy in dealing with surprise and unknowability. It is imperative to have all of them. Lack in any of them diminishes the power of agents to affect the evolvement of the complex system.

4. Methodology

4.1 Semi-structured interview

Interview is the most suitable method of data collection, especially when the focus of the research is to generate qualitative data *(Whiting, 2008)*. The bottom line in interview is reflexivity, which in the case of healthcare research may be proved valuable. Reflexivity could be applied during the whole process of data collection, since this will enable values, assumptions, and prejudices and influences to be acknowledged.

Furthermore, the rich framework of literature provided in this study, demands a more challenging interview type to be adopted since the challenge is to reveal the insights of healthcare experts. This study aims to learn about individual experiences and perspectives on a given set of issues. Therefore, it is necessary to establish a two-way communication with interviewees and secure a convenient environment where they feel comfortable to discuss and share their opinions, thoughts and knowledge. This interaction falls to the semi-structured type of interview *(DiCicco and*

Crabtree, 2006). Although this follows a predetermined path, semi-structured interview demonstrates loose structure of open-ended questions, which aim to explore the area rather than get specific data. Nevertheless, this method has the pitfall of not reaching a clear conclusion, if emerging insights are not recognised properly. For this reason, the key function is to identify concepts and variables that will emerge and will be different from what have been predicted *(Britten, 1995)*. Questions should be clear, sensitive and neutral. They could be based on: (a) behaviour or experience, (b) opinion or value, (c) feeling, (d) knowledge, (e) sensory experience, and (f) background details, of the interviewee *(Britten, 1995).*

It is scheduled to take place 5 (minimum) to 10 (maximum) personal interviews, with experts in healthcare sector. The interview includes 20 open-ended questions which are based on research objectives and research questions' framework as presented in the beginning of this study. *Baker and Edwards (2012)* in their research about how many qualitative interviews are enough, they have tried to identify the figure asking a significant number of experts. This varies on the nature of research, in terms of what this intends to reveal.

4.2 Selecting interviewees

Depending on what has been discussed so far, it is imperative to incorporate in this study the opinion of various experts from healthcare sector, though from different perspectives. These are: (a) the official, (b) the operational, and (c) the community perspective. Therefore, the intention is to include respondents from the following areas:

- Government Officials (national, sub-national, local)
- Community leaders
- Technical professional staff
- Academia
- Non-Governmental Organisations

The ideal aim should be to achieve the participation of two experts from each area in order to reach the maximum of 10 personal interviews. If not, 5 is the minimum.

4.3 Process of the interview

The arrangement of interviews will comply with the following process.

- Schedule the interview meeting in advance in a designated time.
- Location preferably should be outside everyday events.
- Interview will be organised around a set of predetermined questions (open-ended).
- Additional questions are expected to emerge from the dialogue and will be included in the research's notes.
- Interview is expected to last minimum 30 minutes to several hours.
- Interview will be recorded, unless interviewee will not agree, so notes will be kept alternatively.

4.4 Means of the interview

It is necessary to use technology during the process of interview.

- USB audio recording interview data (depending on permission), otherwise keep notes and wrote down the responses
- Transcribing data
- Use of software to assist with data management and analysis
- The questions will be illustrated in cards

Interviews are planned to take place within two months upon submission of this report, meaning that will not exceed late February 2013. Information material and useful notes will be sent in prior to the potential interviewees. The aim is to allow participants to create options for responding in order to voice their experiences and perspectives. We will form an interview protocol to follow during the process. The concern is to increase the potential of a more successful data collection.

Such method is expected to ensure validity; furthermore, the personal contact enables more messages to be interpreted and more effective interaction to take place.

Regarding the population and sampling, based on the research objectives, it is recognised that such special subject needs special approach due to the specialties of the sector. The intention is to give equal chance to sector's representatives to discuss their thoughts and experiences.

5. Ethics and Ethical duties

Ethical issues are a priority for this study. Since interviews intend to bring forth and discuss a series of thoughts, objections, inside information etc., of participants, the study: (a) guarantees confidentiality and (b) respects the potential vulnerability as may be derived through the interactive process. This means that interviewees' opinions should not be exploited for personal gain. On the contrary, it is intended to be provided with the study's results as a feedback for their contribution.

Protection of study's participants' remains in the centre of ethical duties, and this is reflected practically through anonymity, privacy and destruction of any recordings and transcribed data, upon publication of this study. Moreover, they will be provided in prior with adequate information about the nature of the study. This is expected to ensure effective communication on the intent of the investigation.

6. Expected Outcomes

This study aims to identify and describe the new pragmatic conditions as to be stemmed both from literature review and statistical analysis. This is expected to provide useful information for the country and healthcare sector. Through the examination of sector's characteristics, it is expected to identify ways on how the sector could be transformed through complexity, and in extent how emergence and self-organisation will form towards new status.

Furthermore, it is expected to be able to provide answers in the research questions and raise further issues on the complex adaptive system of healthcare. Since Greece is expected to continue experiencing distortions for the next years, healthcare, among others is the first to confront with difficulties. Nevertheless, studying on implications and identifying challenges could be a useful compass for future use. Therefore, this is not a research for the research but research for immediate action even as an alternative.

7. Implications of the study

This study does not intend to spread beyond its research objectives while is planned to focus in the research questions as described earlier. The investigation of any impact and the outcomes are expected to contribute for future reference, further study and for any additional consideration.

The case of Greece is unique globally, at least until current times where this paper is in process, since there was no prior example of an advanced country belonging to a currency consortium and demonstrating fatal economic indicators. The intention of the research is to analyse, discuss and bring forth any issues related to health governance stemmed from the difficult situation that country experiences.

However, it is expected to reveal chronic weaknesses of the sector, which actually illustrate the willingness and motives of societal partners.

8. Timescale of study

The first part of the study (research proposal) described the broader perception as initially captured, and suggested a certain path to follow for further consideration. That part was submitted on August 2012. The intention was mostly to present a clear image of the topic, its motives as well as an adequate work on literature review to support the case. The topic proposed is stemmed from the combination of current recession and the healthcare issues as discussed and studied in the last two modules of the Executive MBA course. The modules concerned health economics, logistics, broader contemporary issues and health governance issues. The second part, which is the current one (interim report), covers literature review and discussion on thoughts and proofs as registered by other researchers. In addition, it clearly presents the proposed methodology to apply for the completion of qualitative research. Also, it includes preliminary conclusions and loud thinking based on literature and current experience. The *Appendices J, K, L,* at the end of the study, present a structural mind-map of thoughts and findings, as derived from the study on literature. The focus is to combine health with economic disruptions. This part is about to be submitted on late December 2012. Next two months are planned for the qualitative research to take place. Late April 2013 is the expected date of submission of current study.

Conclusions

Economy is the propeller of society. For more than a hundred years, expansion of GDP, leveraging, growth and other economic indicators were the ultimate goal of economic policy *(Levallois, 2010)*. Nevertheless, the constant growth that Greece experienced, during last decade, among others, ended with corruption, confusion and structural disorders. Such effects were mostly derived from the cultivation of inequalities and imbalances of wealth distribution. Growth was synonymous to distortions and to an increasing paternalism, although that was kept hidden behind economic neo-liberalism. Current situation proved that the country dealt with an unaffordable modernity all these years, which created needs and dependencies difficult to disentangle.

On the other side, geopolitical and geo-economical powers have demonstrated an increasing interference in the Mediterranean area due to energy reserves. The repositioning of global players has started and the whole area, from Turkey to Tunis and from Portugal to Greece, including Spain and Italy, seems that live political and economical shocks. Greece is positioned in the middle. Since nothing yet provides the big picture, the country is obliged to develop a contingency plan towards sustainability and rebound no matter the cost. Healthcare is considered a crucial factor for the survival of a country. This study aims to give a contribution on how the sector should prepare to react in defining a resilient scheme in terms of keeping health provisioning stable and untouched, trying to exploit lessons from complexity.

Real progress comes when restructures and changes drive society towards a fair distribution of resources and wealth. This in extend implies a fair and unhindered provision of healthcare services to citizens. It is still questionable though, among many local players, whether the mechanistic metaphor stands below or above complexity.

In the doorstep of *quantal complexity*, the country is obliged to confront with inevitable challenges. In response, putting complexity to work may prove to be wise choice.

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APPENDIX A

GREECE: GDP in the decade 1951-1961 (growth rates)
Comparison with other OECD countries

GROWTH RATES OF GDP FOR SELECTED COUNTRIES,[a/] 1951-1961

	Growth Rate*
Austria	5.5
Denmark	3.5
Germany	7.5
GREECE	6.1
Iceland	4.9
Italy	6.1
Netherlands	4.6
Norway	3.8
Portugal	4.7
United Kingdom	2.4
United States	3.2

a/ Similar data for the remaining OECD countries were not available.
* Calculated at constant (1954) prices

Source: OECD, Statistics of National Accounts, 1951-61.

(Source: Bowles, Samuel (1966) Sources of growth in the Greek Economy, 1951-1961. *Harvard Economic Development Report*, No. 27, p. 9).

APPENDIX B

GREECE: GDP in the decade 1951-1961
Distribution of growth rates per sector

RATES OF GROWTH OF GDP BY SECTOR
IN THE GREEK ECONOMY, 1951-61

	Rate of Growth*
Agriculture, Forestry, Fishing	4.8
Mining	11.3
Manufacturing	7.3
Construction	13.5
Electricity, Gas, and Water	12.1
Transportation and Communication	5.4
Wholesale and Retail Trade	5.6
Banking, Insurance, Real Estate	6.6
Ownership of Dwellings	9.6
Public Administration, Defense	1.1
Health and Education	4.1
Miscellaneous	5.2

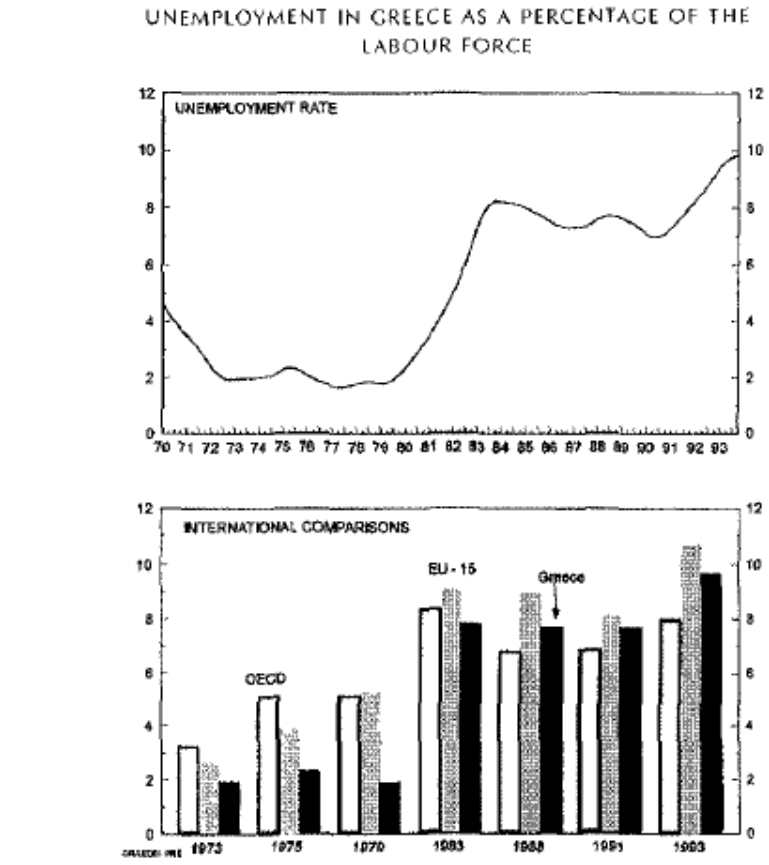
* Calculated at constant (1954) prices

Source: OECD, Statistics of National Accounts, 1951-61, p. 107, Table 2B.

(Source: Bowles, Samuel (1966) Sources of growth in the Greek Economy, 1951-1961. *Harvard Economic Development Report*, No. 27, p. 10).

APPENDIX C

GREECE: Unemployment 1970-1993



Source: OECD Labour Force Statistics; and European Economy No. 60, 1995

(Source: Demekas, Dimitris and Kontolemis, Zenon (1997) Labour Market Performance and Institutions in Greece. *Journal of South European Society and Politics*, 2(2), p. 79).

APPENDIX D
Directives in controlling pharmaceutical spending
(Structural fiscal reforms in Greece)

Controlling pharmaceutical spending

In order to achieve EUR 1 billion of reduction in outpatient pharmaceutical spending in 2012, the Government will simultaneously implement a set of consistent policies comprising changes in pricing, prescribing and reimbursement of medicines that enhance the use of less expensive medicines, control prescription and consumption and prosecute misbehaviour and fraud. The Government defines a consistent set of incentives and obligations for all participants along the medicines supply chain (including producers, wholesalers, pharmacies, doctors and patients) to promote the use of generic medicines.

The Government will revise the co-payment system in order to exempt from co-payment only a restricted number of medicines related to specific therapeutic treatments. **[Q1-2012]**

(Source: IMF-EU-ECB (2012) Memorandum of Understanding on Specific Economic Policy Conditionality, p. 13).

APPENDIX E
Directives in adopting the use of generic medicines
(Structural fiscal reforms in Greece)

Increasing use of generic medicines

A comprehensive set of measures is adopted simultaneously to promote the use of generic and less expensive medicines. The aim of these measures is to gradually and substantially increase the share of the generic medicines to reach 35 percent of the overall volume of medicines sold by pharmacies by **end-2012**, and 60 percent by **end-2013**. This will be achieved by:

- reducing the maximum price of the generic to 40 percent of the price of the originator patented medicine with same active substance at the time its patent expired. This is set as a maximum price; producers can offer lower prices, thus allowing an increased competition in the market. **[Q1-2012]**
- automatically reducing the prices of originator medicines when their patent expires (off-patent branded medicines) to a maximum of 50 percent of its price at the time of the patent expiry. Producers can offer lower prices, thus allowing an increased competition in the market. **[Q1-2012]**
- creating dynamic competition in the market for generic medicines through price reductions of at least 10 percent of the maximum price of each generic follower. **[Q4-2012]**
- associating a lower cost-sharing rate to generic medicines that have a significantly lower price than the reference price for reimbursement (lower than 40 percent of the reference price) on the basis of the experience of other EU countries, while increasing substantially the co-payment of more expensive medicines in the reference category and of new molecules. **[Q1-2012]**
- allowing the reimbursement of newly patented medicines (*i.e.* new molecules) only after at least 2/3 of the EU countries are already reimbursing them and on the basis of a proper assessment of their cost-effectiveness carried out in other European countries. **[Q1-2012]**
- excluding from the list of reimbursed medicines those which are not effective or cost-effective on the basis of the experience of other countries. **[Q1-2012]**
- making it compulsory for physicians to prescribe by international non-proprietary name for an active substance, rather than the brand name. **[Q1-2012]**
- mandating the substitution of prescribed drugs by the lowest–priced product of the same active substance in the reference category by pharmacies (compulsory "generic substitution"). **[Q1-2012]**

The Government takes further measures to ensure that at least 40 percent of the volume of medicines used by public hospitals is made up of generics with a price below that of similar branded products and off-patent medicines. This should be achieved, in particular by making compulsory that all public hospitals procure pharmaceutical products by active substance, by using the centralised tenders procedures developed by EPY and by enforcing compliance with therapeutic protocols and prescription guidelines. **[Q2-2012]**

The Government, pharmaceutical companies and physicians adopt a code of good conduct (ethical rules and standards) regarding the interactions between pharmaceutical industry, doctors, patients, pharmacies and other stakeholders. This code will impose guidelines and restrictions on promotional activities of pharmaceutical industry representatives and forbids any direct (monetary and non-monetary) sponsorship of specific physicians (sponsorship should be attributed through a common and transparent allocation method), based on international best practice. **[Q1-2012]**

The Government simplifies administrative and legal procedures, in line with EU legal frameworks, to speed up the entry of cheaper generic medicines. **[Q2-2012]**

(Source: IMF-EU-ECB (2012) Memorandum of Understanding on Specific Economic Policy Conditionality, p. 15-16).

APPENDIX F
Directives in pricing of medicines
(Structural fiscal reforms in Greece)

Pricing of medicines

The Government continues to update, on a quarterly basis, the complete price list for the medicines in the market, using the new pricing mechanism based on the three EU countries with the lowest prices. **[Q1-2012]**

The Government introduces an automatic claw-back mechanism (quarterly rebate) on the turnover of pharmaceutical producers which guarantees that the outpatient pharmaceutical expenditure does not exceed budget limits. **[Q1-2012]**

Starting from **Q1-2012**, the pharmacies' profit margins are readjusted and a regressive margin is introduced - *i.e.* a decreasing percentage combined with flat fee of EUR 30 on the most expensive drugs (above EUR 200) - with the aim of reducing the overall profit margin to below 15 percent.

Government produces an implementation report on the impact of the new profit margins by **Q1-2013**. If it is shown that this new model to calculate profit margins does not achieve the expected result, the regressive margin will be further revised.

Starting from **Q1-2012**, the wholesalers' profit margins are reduced to converge to 5 percent upper limit.

(Source: IMF-EU-ECB (2012) Memorandum of Understanding on Specific Economic Policy Conditionality, p. 13).

APPENDIX G
Directives on prescribing and monitoring
(Structural fiscal reforms in Greece)

Prescribing and monitoring

The Government

- takes further measures to extend in a cost-effective way the current e-prescribing to all doctors, health centres and hospitals. E-prescribing is made compulsory and must include at least 90 percent of all medical acts covered by public funds (medicines, referrals, diagnostics, surgery) in both NHS facilities and providers contracted by EOPYY and the social security funds. **[Q1-2012]**
- introduces a temporary and cost-effective mechanism (until all doctors are able to use the e-prescription system) which allows for the immediate and continuous monitoring and tracking of all prescriptions not covered by e-prescription. This mechanism will make use of the web-based e-prescription application established by IDIKA, which allows the pharmacies to electronically register manual prescriptions from a specific doctor to a specific patient. For medicines to be reimbursed by EOPYY (and other funds), pharmacies must register in the web-based application all manual prescriptions. For this service, doctors who prescribe manually will be charged a monthly administrative fee by EOPYY to compensate the pharmacies. The introduction of this temporary mechanism would ensure that all prescriptions are electronically recorded, allowing for the full and continuous monitoring of doctors' prescription behaviour, their compliance with prescription guidelines. **[February 2012]**
- continues publishing prescription guidelines/protocols for physicians. Starting with the guidelines for the most expensive and/or mostly used medicines the government makes it compulsory for physicians to follow prescription guidelines. Prescription guidelines/protocols are defined by EOF on the basis of international prescription guidelines to ensure a cost-effective use of medicines and are made effectively binding. **[Q1-2012]**
- enforces the application of prescription guidelines also through the e-prescription system, therefore discouraging unjustified prescriptions of most expensive medicines and diagnostic procedures. **[Q1-2012]**
- produces (Ministry of Health and EOPYY together with the other social security funds until they merge) detailed monthly auditing reports on the use of e-prescription in NHS facilities and by providers contracted by EOPYY and other social security funds (until they merge). These reports are shared with the European Commission, ECB and IMF staff teams. **[Q1-2012]**
- implements (Ministry of Health and EOPYY together with the other social security funds until they merge) an effective monitoring system of prescription behaviour. They establish a process to regularly assess the information obtained through the e-prescribing system. **[Q2-2012]**
- produces regular reports, at least on a quarterly basis, on pharmaceutical prescription and expenditure which include information on the volume and value of medicines, on the use of generics and the use of off-patent medicines, and on the rebate received from pharmacies and from pharmaceutical companies. These reports are shared with the European Commission, ECB and IMF staff teams. **[Q1-2012]**
- provides feedback and warning on prescription behaviour to each physician when they prescribe above the average of comparable physicians (both in NHS facilities and contracted by EOPYY and other social security funds until they merge) and when they breach prescription guidelines. This feedback is provided at least every month and a yearly report is published covering: 1) the volume and value of the doctor's prescription in comparison to their peers and in comparison

to prescription guidelines; 2) the doctor's prescription of generic medicines vis-à-vis branded and patent medicines and 3) the prescription of antibiotics. **[Q2-2012]**

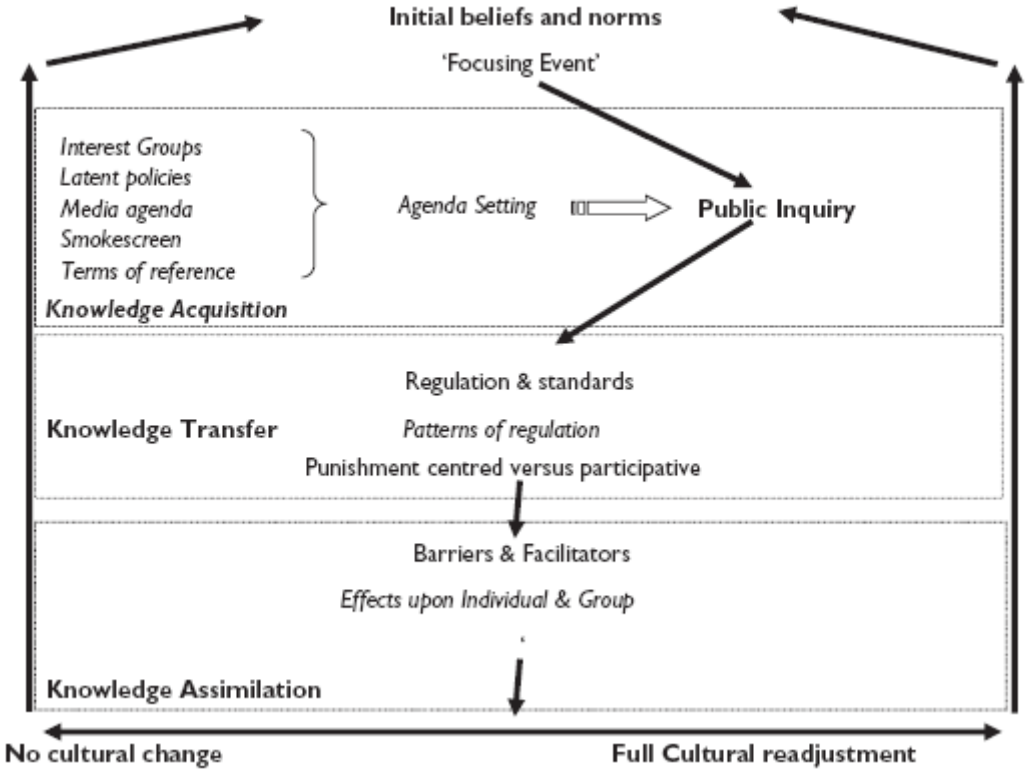
- enforces sanctions and penalties as a follow-up to the assessment and reporting of misconduct and conflict of interest in prescription behaviour and non-compliance with the EOF prescription guidelines. Continuous or repeated non-compliance with the prescription rules will lead to the termination of the contract between the doctor and the EOPYY and the doctor's permanent loss of his/her capability/right to prescribe pharmaceuticals which are reimbursed by the government/EOPYY in the future. **[Q1-2012]**
- continuously updates the positive list of reimbursed medicines using the reference price system developed by EOF. **[Q1-2012]**
- selects a number of the most expensive medicines currently sold in pharmacies, to be sold in hospitals or EOPYY pharmacies, so as to reduce expenditure by eliminating the costs with outpatient distribution margins, and by allowing for a strict control of the patients who are being administered the medicines. **[Q1-2012]**

If the monthly monitoring of expenditure shows that the reduction in pharmaceutical spending is not producing expected results, additional measures will be promptly taken in order to keep pharmaceutical consumption under control. These include a prescription budget for each doctor and a target on the average cost of prescription per patient and, if necessary, across-the-board further cuts in prices and profit margins and increases of co-payments. **[Q2-2012]**

In compliance with EU procurement rules, the Government conducts the necessary tendering procedures to implement a comprehensive and uniform health care information system (*e-health system*). **[Q1-2012]**

(Source: IMF-EU-ECB (2012) Memorandum of Understanding on Specific Economic Policy Conditionality, p. 14-15).

Appendix H
Mapping the process of organizational learning from crisis



(Source: Elliott, D (2009) The Failure of Organizational Learning from Crisis – A Matter of Life and Death? *Journal of Contingencies and Crisis Management*, 17(3), p. 159)

Appendix I
Semi-structured interview
Proposed open-ended questions (questionnaire)

Discussing Complexity in the Greek Healthcare Sector

This paper can be used as a guide to perform the semi-structured interview with the participant in the study. There are 20 questions grouped in 6 categories according to Research Questions Framework.

1. Information Asymmetry	1.1 Who are the major players/agents in healthcare?
	1.2 Can we prioritize them according to their power in regards to health services supply chain? Who are the agents that play primary role?
	1.3 Who has inside information due to current structure? Can this change? What is necessary to do in order to restrain information asymmetry?
2. Interdependencies	2.1 How important are the relations among agents in healthcare? Do relations play a decisive role for the system? Is this positive or negative or even neutral?
	2.2 Who defines the relations patterns in the system? Who is responsible for the relations; the system or the building blocks of agents?
	2.3 Do relations create interdependencies? Does this create paradoxes in the system? Does this reveal weaknesses?
	2.4 What is the real nature of interdependencies? Do they enable or block emergence and self-organisation?
3. Heterogeneity	3.1 What is heterogeneity in healthcare?
	3.2 Where and how this is identified? What kind of problems does this create?
	3.3 Can heterogeneity be a source for development?

Discussing Complexity in the Greek Healthcare Sector

4. Attractor Patterns	4.1 What is an attractor pattern? Who is an attractor in the current healthcare system in the country?
	4.2 How these patterns work in the system? Do these impose contexts? Is this possible for a new attractor to emerge from changes in structures?
	4.3 Can the system work without attractors? When attractors take responsibility and protect the system?
5. Generative Relationships Patterns of Behavior	5.1 What are the generative relationships and what is the difference with relationships as discussed earlier?
	5.2 Do generative relationships create contexts in the system? Who is the main source of such relationships?
	5.3 Do generative relationships have responsibility for fighting or enabling changes in structures towards self organization?
	5.4 Which is the relation among generative relationships and patterns of behavior? Can this relationship be the cause of emergence?
6. Collective Reflexivity	6.1 What is collective reflexivity? What is the relation with complexity?
	6.2 Who is responsible for reflexivity? The system or the agents?
	6.3 How reflexivity works in healthcare sector?

Appendix J
The study at a glance
(Structural mind-map of literature review
and
main thoughts and findings)

Appendix K
Characteristics of Complex Adaptive Systems

Appendix L
Characteristics of Complex Adaptive Systems in Healthcare

Characteristics of Complex Adaptive Systems (CAS) (adapted in health-healthcare)

McDaniel, R. Reuben and Driebe, J. Dean (2001) Complexity Science and Health Care Management. Journal of Advances in Health Care Management, 2, p. 11-36.

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Easton, D and Solow, L (2011) Navigating the Complexity Space. Proceedings of International Conference on Complex Science , 15 June 2011, p. 665-677

EMERGENCE

- emergence is a product of context-dependent non-linear interactions
  - agents interacting in a non linear fashion may self organise and cause system properties to emerge
  - individual agents do not know the **behaviour** of the whole system and they cannot control emergence of the system
  - emergence is the **source of novelty and surprise** in CAS
    - CAS demonstrates sensitivity to certain small changes in initial conditions (butterfly effect)
    - nevertheless, this sensitivity has to do with the exact path that the complex system follows in the future, rather than its general pattern
  - the properties of the whole system are distinctly different from the properties of the parts
  - it comes from the presence of a great number (often simple) of system components that interact in a manner that cannot be explained by the characteristics of individual components
- organisational mergers and their issues need to be viewed through the complexity perspective in order to detect their emerging properties
- but it is more than connectivity
  - emergence rises from the pattern of connections among diverse agents
- it is an emergent property of the whole unit
  - e.g the quality of a surgical team is the properties and the talents of the individual medicals but it is not reducible to this
- emergence is a repeating attribute in a CAS since there are emergent structures and agents which in result modify the self organising characteristics of CAS
  - emergent order is always changing in unpredictable way
  - emergence is mostly related to the generation of new properties at the macro level of analysis as a result of non linear dynamics
  - some behaviours and patterns emerge in complex systems as a result of the patterns of relationships between the elements
- the existence of **building-blocks** is crucial since, when constrained by simple rules can generate an unbounded stream of complex patterns

INTERCONNECTIONS (the essence of connectedness)

- the essence of CAS is captured in the **relationships** among agents
  - as a result in a CAS, there may be many interdependent agents who interact with each other in many ways
  - the dynamics of these interactions makes CAS qualitatively different from static complicated systems
  - to understand a CAS it is necessary to understand the **patterns of relationships** among agents and not simply their nature
    - e.g the personal relationship between the patient and the physician is a significant moderating factor
    - e.g the relationship among the clinical staff is critical to the overall performance of the organisation
    - e.g failure to resolve relationships problems is the major cause of difficulty to apply any progress in the health system such as information technology practices, tele-medicine etc
  - **massively entangled** — **relationships** among agents are complicated and enmeshed
- the environment of the agents is the function of interconnections that each agent has with other agents in the system and with agents in the system's environment
  - it is not simply the number of connections that determines the character of a CAS, but **the richness of these connections**
- relationships among agents are non-linear
  - a small stimulus may cause a large effect or no effect at all
  - actions and behaviours of small non-average groups may result in unintended consequences
  - inputs are not proportional to outputs
  - small changes can lead to big effects and big changes can lead to small effects
  - simple deterministic equations may produce an unsuspected richness and variety of behaviour
  - complex and chaotic behaviour can give rise to ordered structures
  - relationships are short-range mostly received from near neighbours
- another issue, **except the range of interaction** is the **range of influence** of an agent to the others
- information that is carried out through feedback mechanisms create **patterns of interaction**
  - interactions may be pooled, sequential or reciprocal and define the level of adaptability of CAS
  - both positive and negative feedback are key ingredients of the relationship and the system itself
- the different interactions as derived among agents' interconnection create **patterns of interconnection** and in turn introduce non-linearity in the dynamics of the system
  - CASs tend to maintain in general **bounded behaviour** , called an **attractor,** regardless os small changes in initial conditions
  - such patterns of interconnection can follow simple rules and **complex behaviour** can emerge from these rules
  - interconnections among agents define the width of complexity
- complex systems are **open** exchanging energy and information

OTHER CHARACTERISTICS

- **HISTORY**
  - complex systems have a **history** which cannot be ignored
  - **Temporality:** complex systems echo their history, their memory of the past in a selective, non-linear manner
- **NESTED SYSTEMS**
  - complex systems are nested systems
  - the components of the system are themselves complex systems
- **NO BOUNDARIES**
  - boundaries of the system is difficult to be determined since any attempt may raise ambiguities
- **MICRO-DIVERSITY** — **DIVERSITY**
  - the importance of local; what happens to an agent depends on the response of other agents at a particular place
- **THERE IS NO CENTRAL CONTROLLER**
- **Non-linearity:** due to partly non-linear input-output functions, complex systems will show unpredictable behaviour
  - **UNPREDICTABILITY**
- the problematic issue of **Reduction**
  - any knowledge we have about the system is a reduction of its complexity
    - reduction=micrograph
    - reduction=simplification
- there is a **hidden power** in CAS and this is its ability to: allow a massively entangled group of diverse individual agents the freedom to be adaptable and resilient
  - this is considered the main motive for self-organisation and self-preservation of the CAS
- CASs are dynamic, massively entangled, emergent and robust

CO-EVOLUTION

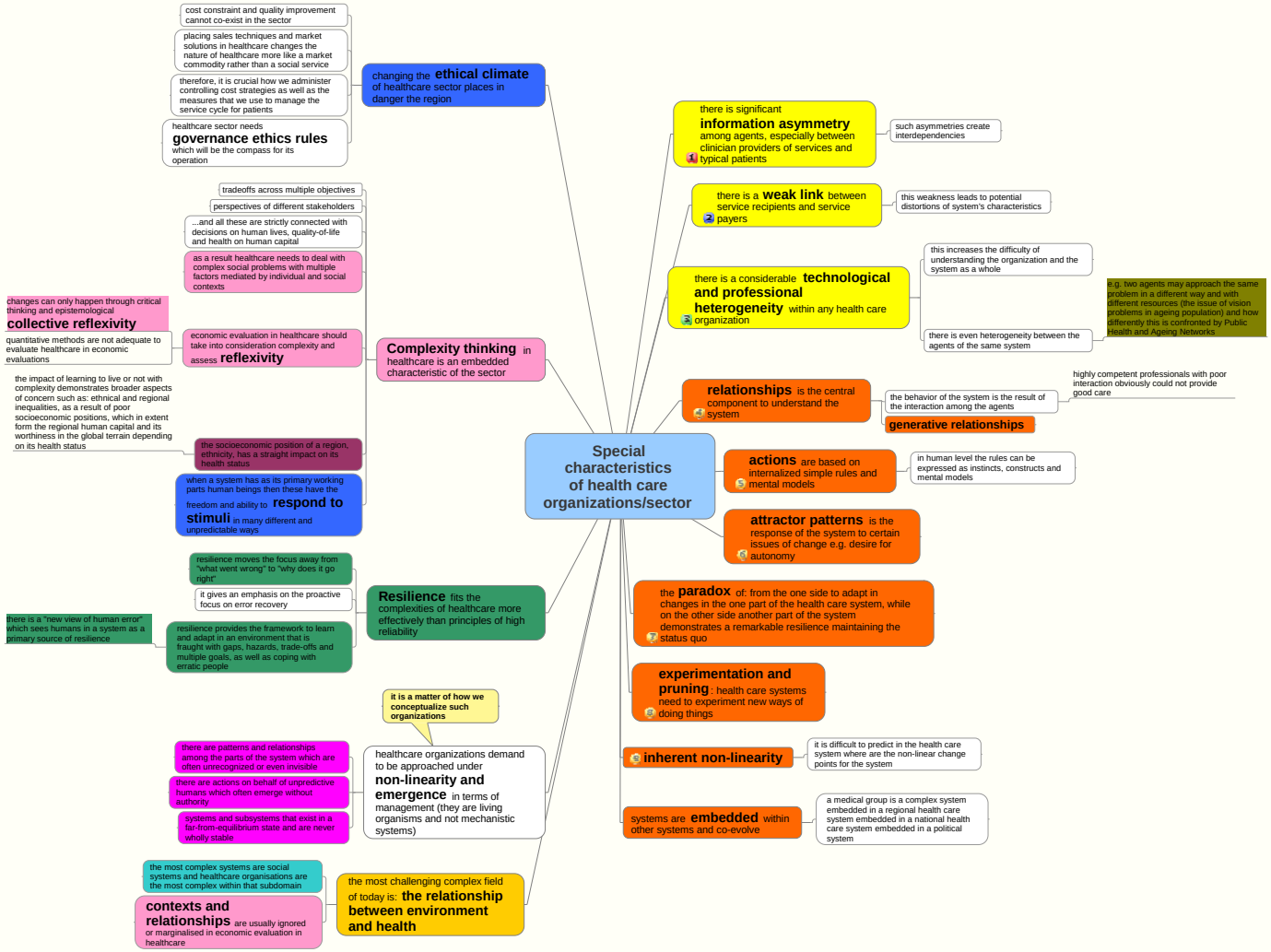
- when CAS self organises and emerges in a dynamic fashion, this also affects the world around CAS
- co-evolution means that each change in CAS fundamentally influences its environment and vice versa
  - agents do not simply adapt and interact, they co-evolve with the environment in a constant ambient of change
    - e.g. when a hospital changes the control system of pharmaceutical supplying, this affects its relationship with pharmaceutical providers, and this affects possible competitive advantages, even business models etc.
  - there will always be an agent who will pose new patterns and introduce new methods in a way that this will change the overall environment and simply impose other agents to adapt and co-evolve
  - co-evolution encrypts **the function of placement and repositioning** , since each agent tries to place itself in the new framework
  - repositioning is necessary for the agents to find their **fitness landscape**
    - Healthcare systems are constantly attempting to improve their functioning through seeking new places of competitive advantage on their fitness landscape
    - nevertheless, its difficult to find the fitness landscape since no agent has the big picture of CAS
- co-evolution limits the developmental processes in a CAS since agents posses conflicting constraints with other agents
  - compromise and cooperation may lead to a workable solution
  - the structure of a system is not a result of an a priori design rather than a result of interaction between the system and its environment
  - real organisms constantly circle and chase each other in an infinitely complex dance of co-evolution

SELF-ORGANIZATION

- this is the spontaneous emergence of new structures and new forms of behaviour in CAS
  - arise from the changing patterns of relationships in CAS
  - self organisation usually describes the situation where new emergent properties may arise without being imposed
  - there exists a self-organising behaviour
  - nevertheless, more tightly coupled structures tend to **lock-in** to a certain response
    - many changes depend on the nature of structure of the agents and the CAS
    - **resilience** usually derives from a **robust response** in the effort to adapt to a wide range of environmental change
- the structure and form of CAS is a function of patterns of relationships among agents and interactions of these agents with their environment
- CAS has distributed control rather than centralised control
  - there is **no central body** that controls CAS
  - CASs are **robust** or **fit,** since they exhibit the ability to alter themselves in response to feedback
    - moreover, they are **dynamic** depending on their motives
- in the complex systems approach the order is not only the sum of individual intentions but the collective result of nonlinear interactions
  - also order in the system may be the result of the properties of the system itself
- self organisation is linked to order and the capacity of self organisation is the function of the number of connections among agents and the intensity of these connections
  - it is not true that the more connections the better
  - on the contrary, too many connections may lead to behaviour that never settles into any recognizable pattern of self organisation
  - on the other hand, too few connections may lead to frozen behaviour rather than dynamical self organisation
- CAS consist of agents, interconnected, generating order
  - the conditions for self-regulation happen when agents decide to shift and change both internally and externally affecting each other

AGENTS

- **CAS are made of a large number of agents**
- agents are information processors
  - agents process information and react to changes
  - they exchange information between themselves and with the environment
  - agents have different information about the system
- they can adjust their behaviour
- they are acting and reacting to what other agents are doing
- agents are diverse from each other
  - nevertheless, this diversity among agents can be a source of frustration
    - e.g. in healthcare the accounting processes could be in conflict with healing processes
  - agents select with whom and how they will interact
- diversity is the source of novelty and adaptability
  - additionally could be the source of invention and improvisation
- none of the agents can understand the system as a whole
  - this consists the bottom line of complexity
  - if an agent could perceive the system as a whole then he would accommodate all the complexity on his own
- there is no any central agent who could manipulate the system
  - each agent pays attention to its local environment
  - the agents in a complex system cannot know what is happening in the system as a whole
  - agents are the central actors in abstract models of CASs
- **BUILDING BLOCKS**
  - agents at any one level in a CAS serve as building blocks for agents at a higher level
  - different agents take different roles as the dynamic of the CAS unfolds
  - CAS are constantly revising and rearranging thei building blocks as they gain experience
  - as building blocks change over time the whole system/organisation changes
- CAS consist of agents who act and react based on self-generated stimuli, and the actions of other agents from either inside or outside the system
  - agents demonstrate a **dynamic state**



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there is a thought to substitute "The monetary change" with "Leaving from a monetary consortium" but i consider it slightly provoked.

proposal for specifying the dissertation's topic

THE CHALLENGE OF STAYING RESILIENT IN A TRANSFORMING GLOBE

Using complexity as a guide for acting in Healthcare

more focused subject than the one suggested in the research proposal

Specify the dissertation's scope (THE DISSERTATION at a glance)

following a three-pronged approach

in terms of literature and research we could focus on:

the literature review discussed, actually demonstrates the path of complexity

the CAS of health care is interconnected with the CAS defined by geopolitics, limits to growth etc

in terms of specifying the scope of the dissertation we proceed the review and the application of research tools towards the concrete subject

COMMENTS: we can keep the literature review as discussed in the research proposal, as it reveals the essence of complexity starting from the limits to growth till geopolitics, economic geography and shock effects

monetary change

the issue of stabilisation and how quickly this could affect the real economy (is depended on:)
- anticyclical monetary
- debt management
- fiscal adjustments

stabilisation, is the first issue to focus in the case of a change
- the question in the transition phase is how long this will last for the real economy
- this phase is called: "the length of the lag"

the strong relation between monetary change and economic developments / business conditions
- changes in the stock of money exert an independent influence on cyclical fluctuations in economic activity with a lag that is both long and variable relative to the average length of such fluctuations

one can seldom get something for nothing in economics

the stability of equilibria: a necessity to achieve
- there is no bounce-back resilient practice but instead bounce-beyond meaning a change to the bones
- the society has to change its structures and not its roles

the common currency between countries lead to much lower volumes of trade especially when they do not create overvalue through this transaction
- therefore, in the long run they tend to look for markets with different currencies and variable exchange rates

curiously, neither current account, nor government budget deficits appear to play an important role in a typical currency crash
- on the contrary, crashes occur when FDI inflows dry up, when reserves are low, when domestic credit growth is high, when interest rates rise, and when the real exchange rates shows overvaluation, and of course when we face sharp recessions

complexity

CAS: **complex** implies diversity, a wide variety of elements/ **adaptive** means the capacity to alter or change, the ability to learn from experience/ **system**, is a set of connected-interdependent agents

expectations create new equilibria
- the dependence on market expectations which cannot be finally adhered from different groups direct to multiplicity
- the multiplicity problem is raised by preferences and constraints of the different groups plus the government itself

the essence of complexity science is in the study of patterns and relationships and in the search of characteristics of systems far from equilibrium
- complexity science looks not at the parts but in the wholes and results from the interactions between the components of a system
- complexity try to explain why there is an order in the universe although this is consisted of seemingly unrelated powers

complexity and chaos
- complexity science focuses on how order can emerge from a complex dynamical system
  - complexity means we have structure with variations
- the study of chaos focuses on how complexity can arise from simplicity

complexity science focuses on dynamic states that emerge in far from equilibrium systems

there is the Newtonian perspective which is a reductionist perspective, where understanding the whole of a system is dependent on understanding its parts. Things must be broken into their constituent elements in order to understand them.
- run like a clock is the dominant metaphor
- this is a mechanistic view of evolving things, machine-like systems
- but healthcare systems demonstrate different specifications and characteristics

complexity and health-healthcare

it is a challenge to identify the collective result of nonlinear interactions in the CAS of health-healthcare

healthcare organisations are complex adaptive systems and share the characteristics of CAS

Healthcare organisations as CAS
- there are many diverse agents and the effort to manage such systems of agents creates major concerns
  - relationships and interconnections are critically important
- healthcare organisations have the capacity for self organising and emergence and they co-evolve
- traditional healthcare administration has been about control
  - better regulation
  - financial restrictions
  - punishment of offenders
- healthcare organisations accommodate **unknowability** since there are always under change, self organisation and emergent properties

managers in healthcare organisations
- managers should use complexity to re-focus attention from creating a better run organisation to maximise the potential for the organisation to co-evolve in ways that increase the organisational fitness
- managers are agents in the system and not external controllers who manipulate the system with some well thought out logic
- the patterns of interaction between the manager and other agents in the system affects the dynamic behaviour of the system
  - there is no guarantee though that this affection will have a predictable outcome
- when a manager realises that hc org are CAS then his focus shifts from knowing the system to making sense of the system, from forecasting the future to prepare to meet the **unknowable future**, **from controlling the system to unleashing the system's potential**
  - there are three proposed ways for long term success:
    1. being prepared to understand and adapt to unanticipated consequences
    2. to be ready to respond to emerging opportunities
    3. to implement business practices based on the nature of CAS

managerial strategies rising from complexity in Healthcare

1 making sense

sense-making vs decision making

the difference between knowing and making sense
- when facing non linear connections with emergent properties people in hc should develop a **collective mind** about: what the situation is, who we are, why we are here, an what is going on around us
- sense making requires interaction among agents
- sense making enhanced through paying attention

sense making requires agents with: processing information ability, rule following ability, ability to connect with other agents

the characteristics of CAS suggest heterogeneity as the most fruitful managerial strategy for enriching sense making
- get advantaged from the existed diversity of agents

managers help order emerge in CAS through sense making but this is not a stable equilibrium

2 remembering and forgetting history

- the arrow of time is a key factor and the non linear trajectory of the system is often a function of the time-dependent events that occur
- Predisposition is a key factor in both enabling and inhibiting hc organisational behaviour
- success in the CAS is coming for the capacity to lean and learning replaces control as a key managerial function
- the most important learning comes from the **trial-an-error action** as well as the reactions taken during this
- remembering history is important because gives examples of how the agents on that period unfolded their capabilities to learn and act trying to co-evolve with the system
  - it is the capacity to learn rather the capacity to know the significance encrypted in a CAS

3 thinking about the future

- traditional planning based on cause-effect relationships is an inappropriate managerial strategy in CAS
  - predicting of future states and feed forwarding modelling are not useful
- scenario planning is a managerial strategy widely used as this helps an organisation to deal with surprise
  - it helps in developing organisational capabilities for dealing with uncertainty

CAS is about **bricolage**
- being a **bricoleur** rather than a traditional manager
- **bricolaging** means creating positive outcomes from what emerging usually through confusing and mixed-up situations
- create something out of nothing

Bricolage: to make creative and resourceful use of whatever materials are at hand (regardless of their original purpose)

CAS maintains capacity to think about the future through framing the future by social interaction
- CAS are systems of interconnections and they produce or construct through co-evolutionary social processes, a significant part of the environment they face

4 dealing with surprise

uncertainty is an essential ingredient of progress

surprise drives progress
- innovation depends on a sort of knowledge no one can gather in a central place
- **improvisation: intuition guiding action in a spontaneous way**
- dealing with surprise requires improvisational behaviour

surprise is the constant companion in a CAS
- order-chaos-order are phases experiencd in a CAS
- loose-tight coupling is an attribute and status experienced in a CAS

source of surprises in a CAS could be: the non linear trajectory of the system; bifurcations; qualitative changes in behaviour resulting from parameter changes or sensitivity to initial conditions;

working with ambiguity necessitates improvisation
- improvisation recognises the existence of a basic form of structure where each player should build upon it using its instinct, knowledge, risk to further maintain the development of CAS

5 taking action

- traditional beliefs in HC mean "getting ready to do it right", while in CAS this is "taking action as circumstances unfold"
- action should focus in small changes that are expected to provide positive feedback to the system
  - small inputs, in general term, provide more room for learning and organisational development
- in CAS the essence of the system nests in relationships not in pieces, therefore the quality of connections is more important than the quality of anyone agent
  - increases in complexity is result of increases in interdependencies and not increases in differentiation
  - an agent's range of influence may be wide not through the range of interactions but through overlaps in information domains
- managers should help agents to develop skills to identify changes in their small environments
- participation in decision making may be a tactic to resolve healthcare issues, which brings increased information in the decision table, creates increased sense-making capacity and broadens the organisational actors
  - unleashing local actors' powers enables emerging networks that could bring in return new structures for coping with surprise

6 developing mindfulness

- traditional mindset on HC implies that since managers could understand the cause-effect relationships then organisations function in an efficient way
- the HC system should be understood in terms of non-linear dynamics, self-organisation, emergence and co-evolution
- to administer effectively HC systems you need to develop a stable cognitive process that will enable CAS to evolve and operate in a reliable manner; **this is called mindfulness;**

mindfulness is the capability to induce a rich awareness of discriminatory detail and a capacity for action

to cultivate **mindfulness** **you need a set of processes** to apply continuously:
- preoccupation with failure
- reluctance to simplify interpretations
- sensitivity to operations
- commitment to resilience
- under-specification of structures

do accept that survival means a struggle for alertness
- attention is most important than information in CAS
- **observation** and mind process are key practices
  - but...**observation as agents** of the system and not as external observers; do realise that our behaviour is a fundamental part of the pattern of non-linear interaction that is causing emergent behaviour
- remember that we do not live in one-world but in a matrix of co-evolving worlds in which we must function

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