The Influence of Enforced Changes on Systems Performance

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Abstract--**Progressively more tumultuous times are experienced by organisations in the manufacturing and service sector in South Africa. The Higher Education Institutions (HEI'S) is not excluded. The HEI's are required to be adaptable and responsive to student's demands. It brings into stark contrast the relations linking the recognized organisational configuration and casual systems. Consequently, improvement programmes do not succeed in a shifting systems performance. The result is changes are made to systems and processes the way it looks rather than change their objectives. Industry settings currently are characterized by vigour, nonlinearity and evolving properties. In a nutshell, it is identified through its complexity. Affirming the world and thus industry systems are multifaceted, denotes it is impractical to appreciate each by allowing for individuality of elements in isolation. Replication of complexities linked with service systems continues to be an opaque question for most HEI's struggle with. The mission is acutely made complex by student activism and their changing demands on HEI's and the uncertainties coupled to it. The Cynefin Framework is an important tool in this regard. The purpose of the paper is to enlighten how the utilisation of systems thinking and complexity theory and associated methodologies could prevent negative influences on HEI's.**

I. INTRODUCTION

Higher Education Institution's (HEI's) in South Africa is confronted by countless difficulties. The obstacles are wide ranging in nature and include economic, social and political influences. Institutional difficulties in the present milieu appear to be more complex than in years gone by. Each new technological solution causes unforeseen outcomes. Therefore, HEI's is not immune to this phenomenon. HEI's need to adapt to the new milieu and find improvements which would assist in finding cost savings without shedding jobs.

The research question is to measure the influence of systems thinking, complexity theory and the Cynefin framework on decision making processes. The unforeseen outcomes could result from insufficient planning by senior management, harmful process improvements and detrimental conduct of decision makers in the institution. Consequently, managers within the education sector must realise every decision taken will impact negatively on the institutions. The impact would be felt across various systems and subsystems.

The result is a clear research question should be posed namely "Can the understanding systems thinking, complexity theory and the Cynefin framework assist managers in taking improved decisions?"

It being the case, the oversights committed, compound the hazard of a calamitous collapse of processes and the system. Management often prefer stopgap remedies to the more substantive remedies. A stopgap remedy instigates instability and unstableness in processes and ultimately the system. Exploiting Systems Thinking and the Cynefin Framework would render certain benefits. The benefits can be summarised as follow:

a. Solutions to extremely complex system difficulties can be resolved by researchers. It is achieved through the combination of hard and soft modelling practises.
b. Through the exploitation of advanced computer simulation tools, researchers and practitioners would be able to determine the veracity of possible consequences of improvements regarding the appropriateness of envisaged improvements [5, 9, 14 and 20].

The manner, in which management and practitioners respond to the difficulties they experience, is of paramount importance. The reason it is important is because it is a contributing factor to the complexity in systems and processes and is due to a non-holistic approach to change. Decisions are made without grasping their impact on the institution. It must be understood that different improvement methodologies is required for different processes and systems. If this understanding is lacking, the impact on the processes and systems can be disastrous. It is specifically important where changes would impact on processes and systems [7, 23, 28 and 34].

An effective process improvement venture encourages realisation of tactical and operating objectives. Subsequently, process evaluation assists institutions in improving their capability in attaining institutional objectives by ascertaining crucial process difficulties and authenticating improvement primacies. Strategic success dynamics for process improvement have been distinguished. Regrettably, various improvements are not put into effect or the advantages remain unmeasured. Owing to their influence on complexity it is more or less unfeasible to calculate the bearing on attaining institutional objectives.

It is specifically pertinent where changes would affect the processes and system. A crucial facet affecting the constancy of a process or system is the sustainability of the improvements put into effect. Consequently, sustainability cultivates additional institutional difficulties for improvement teams. A major obstacle is the fact that sustainability is an equivocal expression at best. It is difficult to define unambiguously. An improvement which would be sustainable in one institution may well be unsustainable in another. The management of sustainability will promote complexity in a process or system [2, 4, 5, 7, 12 and 28].

Thus, vagueness and vacillation can be defined as a characteristic of sustainability. Institutions have to discover

an approach of dealing with sustainability since it is insisted on by stakeholders and society at large. The complexity of improvements to processes and systems increase the likelihood of failures. Improvements applied to processes and systems will have inhibited usefulness if complexity of the setting in which is applied is not observed. It is particularly relevant in the Higher Education Sector. A rounded methodology should be abided by through the application of the Cynefin Framework.

The framework judges the institution to be a system. Hence, process improvements grow to be a function of the system. Application of the Cynefin Framework reiterates the reality improvement techniques are not universally applicable. Researchers and practitioners must identify the most appropriate techniques for individual circumstances. Moreover, it is imperative cognisance must be taken of the impact of improving a particular process on other processes and the system. It is vital to appreciate the diverse facets impacting on the complexity in processes and systems. It can be segregated into the resulting collective tactics:

a. It has to be unpretentious – It symbolises the condition where the fundamental characteristics are recognised by all participants. They all concur on the concerns that are essential and must be focussed on without delay. Consequently, activities necessary and their effects are appreciated.
b. It could be complicated – Participants are customarily unaware of the fundamental characteristics. Hence, participants might disagree on the type of activities to be embarked on. Thus, activities would be knowable if the participants possess the germane capabilities. The significance of the actions is not anticipated.
c. The situation can be complex – It occurs when the majority of characteristics in the current situation are unknown. Substantial difference of opinion is a characteristic of this state of affairs. It requires immediate action to be taken in resolving the difference of opinion. The dispute could embrace the topics of the nature of the state and the conduct expected to alleviate the difficulties. Moreover, it could include the reasoning for the difficulties occurring in the first place. Thus, the interface linking the exploit required and the outcome thereof is unknowable. The setting of the state would inform actions to be undertaken [3, 5, 6, 7, 14 and 28].

The paper explores the impact of Systems Thinking and Cynefin Framework on process improvement in a Higher Education Institution. The principal premise of the paper is aligned to the understanding that Systems Thinking and the Cynefin Framework is in all probability the most efficient manner to deal with complexity in a Higher Education Institution. The researcher appreciates the existence of an underlying difference which occurs amongst the interaction of processes and systems. Hence, improvement of one process will impact on other processes and ultimately the system.

II. BACKGROUND

Higher Education (HE) institutions in South Africa are publicly funded. It allude to the fact that these institutions are funded by the Department if Higher Education and Training (DHET). Public funds are limited and can be classified as a scarce resource which must be managed prudently. Another characteristic of being publicly funded is that money available to the Treasury must be shared with other public institutions. The DHET funds universities by means of a subsidy system payable on a yearly basis. Subsidy is paid only for students that graduate and not the cohort in the system completing their studies.

The subsidy system did not keep up with the increases in managing the HE institutions. Subsequently, HE, institutions must find alternative sources of funding to cover the shortfall. It result in a percentage of students that could not graduate since they had a maximum of two modules outstanding would not be subsidised. The researched institution currently has a student cohort of 350 000 students. If a small percentage of these students are unable to complete their studies due to the fact they require no more than two outstanding modules, the strain on the funding model of the institution is huge.

The result will be that the scarce resources would be thinly spread. The possibility of an increase in the subsidy is non-existent. Alleviating the problem became a priority. Currently students are afforded two opportunities to pass a module. The first examination and if they fail that a supplementary examination is available. If a student fails this he or she must enrol for the module again in the next academic year. Many of the students in this kind of situation have 2 modules outstanding which are not core modules for their qualification. The result is many students are clogging the system and no subsidy is earned.

A process was instituted that would allow these students an extra opportunity to complete their studies. The process is known as the Final Year or FI concession process. The student must be identified as qualifying by the appropriate department. Thereafter the student will be informed that he or she qualify for the additional opportunity. Problems arose in identifying eligible students, informing them of the opportunity, rendering the necessary academic support to succeed and capturing the final mark. The process is and remain cumbersome and not customer friendly.

The stakeholders in the process operated in silo's resulting in students being sent from pillar to post. Many deserving students were omitted from the process as a result. A committee was established to investigate and improve the process and the researcher was member of it. Upon investigation a large number of wastes were identified. A decision was taken by the committee to determine whether Lean principles can be utilised in the service sector and the HE sector in particular. In the discussion that follows the appropriate methodologies will be discussed.

III. METHODOLOGY

Action or case research has countless applications with the proviso it is utilised correctly. The innovative methods and information revealed during action research can be applied universally to attain pioneering improvements to processes or systems. A fallacy perpetrated in academia undertaking action research is the method would be the preferred method in undertaking research. Whilst the majority of processes are developed by administrative staff members, they are unaware of the benefits of action research. In reality a division in understanding endure. The division develop as a consequence of not being appreciative of the rationale that research is embarked on to acquire information. In general, academics and administrative staff members have separate objectives whilst designing new processes or improving existing processes. [1, 11, 19, 24 and 38]

An assortment of researchers has acknowledged the following vital characteristics must be present for action research to be successful:

a. It is important for both participants in the research, Academic and administrative staff member, has to acquire the necessary research skills. It is particularly factual during the scrutiny of information obtained, clarification and the deliberation of results arrived at. It would be obligatory for administrative staff members to submit to training in the methodology of action research. Without the training, they would be incapable to comprehend the details of the methodology. Moreover it would lend support to the administrative staff members in comprehending the rationale for applying specific lean methodologies.
b. A foremost prerequisite for utilising action research correctly, rely on a mutual comprehension of the appropriate lean methodologies applicable in the service sector.
c. The most important prerequisite in harnessing action research is the ability to jointly delineate research questions.
d. Team members must play an active role individually during the crucial reflection on the specifics affecting the research questions.
e. Stakeholders must actively contribute to the examination of remedies identified which is appropriate in the existing state of affairs. [11, 17; 22, 24, and 37]

It is postulated by [9, 17 and 32] a permutation line of attack is appropriate where dissimilar strategies are employed discovering practical end results. Moreover action research is accepted as a contradictory, collective, qualified and layered methodology unearthing suitable resolutions to existing problems. Subsequently, the consequence is researchers embark on frank and honest research in the service sector. It is feasible given that action research is known for dealing with complex problems. The methodology present the researcher with an informative and critical conception of the combined and established exploitation of the methodologies explored.

The authors [1; 8 11, 21, and 37] postulates on the meditative and advanced articulation of the research embarked on which could show the way to a powerful conceptualisation of outcomes. The outcomes could have been up till now unfeasible. The methodology promises interactions would occur involving the researcher and researched organisation resultant in the original hypothetical perspective. Furthermore, the result would be supplementary research of the observable facts presently being explored. Action research improves and generates an unequivocal representation of literature applicable to the subject being analysed. Additional to the accentuation and fundamental classes of information exposed, the conclusion of the research would be advantageous to all concerned.

Action research directs attention to the essential topics of accepted wisdom on practical and premeditated levels to support problem solving. Subsequently, the effect is a practical foundation leading to results where promotion of novel and enhanced actions and processes can occur. In addition, action research authorizes a researcher to describe original, unique and inspired conclusions. The effects embrace the essentials of concepts researched and understanding thereof. Equally, action research advances the research process to a fruitful conclusion. It appraises and investigates the conventional attitudes prevailing in the existing state of affairs under scrutiny. Previously, outcomes attained owing to the deployment of action research were unanticipated tactical projections which were uncovered for upcoming exploitation [8, 32, 39 and 43].

The precept of action research is strongly located to shape a transformation of research inferences into pragmatic strategies. Decision makers and senior managers will be capable of acknowledge outcomes and promptly execute the conclusions attained during action research. Appropriately, an improvement which has a foundation in the findings of action research will represent a studier starting point for prospective implementation of improvement projects. In conclusion, action research relate to the individual and shared sphere biased towards the fiscal growth attainable owing to fresh and pioneering philosophies. Due to action research, researchers grow to be flexible in probing and modify processes and procedures to an elevated level which was possible in the past [10, 11, 19, 32 and 43].

IV. LITERATURE REVIEW

The existence of complexity theory has been known and practiced for many years. It resulted in the substitution of fundamentals interior and exterior of processes and systems. The phrase connectivity came to the fore. Connectivity implies the effect human beings can have on the performance of a process or system through their decisions. Due to the complexity, the results might not always be predictable. Terms such as wicked and messy problems were coined.

Managers of processes and systems within the HE sector are faced with complexity. Wicked problems require innovative solutions within a complex environment.

The following has been well-known as being representative of wicked problems:

a. All wicked problems are fundamentally original and rare
b. A trial and error methodology would not provide for a workable outcome. Every outcome implemented would change the dynamic of the challenge. There will not be another opportunity available to find a new outcome
c. Outcomes cannot be classified as correct or incorrect. A more apt description could be to classify it as useful or imperfect. The latter could signify there are many other possible outcomes possible and should be investigated.
d. Problems are poorly defined at the commencement of projects and it results in the inability to furnish an extensive list of potential outcomes.
e. The solutions to wicked problems have no ultimate test and it may well influence groundswells of effects throughout time. It is difficult to predict the length of time that would result.
f. Wicked problems lack a imperative which would indicate it has been solved and productively put into effect [13, 16, 25, 28, and 45]

When a complex problem is addressed, tactical judgements must be crafted. This type of decision-making infers that an understanding needs to be achieved whilst studying the problem at hand. The following major actions can be taken into account:

a. Scanning – it typified by a wide-ranging and non-bounded exploration and scrutiny of the problem.
b. Scoping – during this stage the aim is to decisively generate a selection of decision choice options
c. Assessing – during this stage it is envisaged tangible tactical functions will be identified.
d. Choosing – identify and implement the most appropriate solutions [16].

Spontaneously, replacements for complexity are convoluted or arduous. The phrase has numerous explanations in diverse spheres of knowledge. It can be described as a position between stability and anarchy. A complex system is where a minimum of two elements network vigorously with the performance of the system as a whole. As a result, it becomes necessary to differentiate between complexity and simply being complicated. A complicated system is defined by a considerable sum of elements with distinct relationships and functions. The relationships and functions are linear and organised according to the length of time.

Furthermore, a complex system has commonly a sizeable sum of elements with non-linear relationships and functions which advance with time. Complexity theory is the ideal vehicle to understand the reasoning behind the huge impact certain changes to processes and systems can instigate. The reason being it is a dominant influence in the perception and labouring with actions not directly foreseeable. It will demonstrate the manner in which staff members will react to changes in processes and systems. The fundamental component of scrutiny is the complex adaptive system of significance which is regarded being a compliant object.

There will be a perpetual interface in conjunction with additional systems. The forthcoming probable courses of the system of interest is facilitated and empowered. It occurs across diverse categories of comments evolving from the association with other co-dependent systems. Transformation influences or actors within the system are deemed to be everything which influences the system. The future expansion that individuals mould their milieu and concurrently being moulded by their milieu is an important hallmark of complexity [9, 12, 15, 27 and 40]. The purpose of systems thinking is to discover find rational resolutions to complex circumstances confronting organisations.

Systems thinking originated from the need to discover improved solutions to complex challenges as a result of existing methods. It is a philosophy of rounded theory thinking and is applicable over a large number of disciplines. The existing methodologies at the time were mostly responsive by nature. The need has arisen to modify the responsive manner of thinking to an analytical and pro-active method of thinking. Systems thinking are primarily involved with the exploitation of a wide range of methodologies to achieve a rational routine to support effective intercessions in complex businesses and communal problem areas. System thinking proposes certain prerequisites for the successful application of the methodology. They are:

a. The portrayal of the system
b. Create potential resolutions to challenges
c. Investigating the operational associations currently in existence
d. Managing and modification

In the course of creating solutions, the time disparity of variables can be studied for diverse reasons. A specific solution can be found in the investigative form. The investigative procedure, if appropriate, will be able to advance a beneficial vision regarding the performance of a process or system. In the course of the assessment of the basic interactions stage, the validity of designated system constraints results can be considered by means of supporting models. The examination affords the prospect to acquire an instinctive awareness into the system's performance and anticipate the opportunities for developmental adjustment. Scrutinising physical characteristics could be beneficial in grasping essential ideas. There are key benefits to be derived from applying systems thinking. They are:

a. The practitioners can determine the stability of the system
b. The practitioner can determine whether the population of the system is in a expansion period or declining period
c. The key constraints informing the functioning of the system can be ascertained

Revision and management procedures or policies are concluded subsequent to finalising the analysis. On way to ascertain the result is by embarking on an effectiveness analysis. A suitable procedure or stratagem is required and should be established spontaneously, in the majority of instances it will occur after studying all the outcomes [16, 21, 26, 29, 46 and 47] Complexity requires a comprehension whether an improvement in the process or system will contribute to the complexity presently experienced. Thus, the most appropriate style of overseeing the system must be decided on. Dealing with complexity in processes and systems, three categories of problems has been identified. They are:

a. The degree to which know-how and competences are dispersed
b. The intensity of indecision concerned
c. The degree of accord concerning project objectives or tactics to attain it

The likelihood of processes and systems being complex in totality is slim. The three categories of problems as listed above will be present. The focal point therefore should be on the permutation of said problems and their particular importance. The ideal would be if an ultimate match could be identified. The match can be achieved if the problems are centred on comparable philosophies and perceptions. Consequently, it can be argue a suitable match must be identified involving objectives, capabilities in addition to benefactors of processes and systems. It is demonstrated in figure 1. The figure was adopted from [26].

Hence, a determination must be made whether clear forward-looking information exist about the problems. If so, the appropriate result will be achieved within the given circumstance. E.g. if lean will be implemented, the practitioner can rely on the tried and trusted lean techniques. Thus, it is sensible to apply the appropriate elementary and exhaustive practices. In doing so, the projected results would be attained. If any uncertainty exists regarding the optimal manner in finding a solution, a scan must be embarked on to ascertain whether viable substitutes or novel outcomes can be exploited.

A comprehensive appreciation of functions and accountabilities of individuals must explicitly be grasped. From this, the team could compile a growing directory of tasks to be undertaken to accomplish the desired outcomes. A further resolution must be made whether the achievement of actions are reliant on issues external to the influence of the practitioner. It is of particular importance if the improvement exercise requires shared scarce resources including close cooperation from other individuals. At conception, the degree of agreement between participants on the challenges and how to address them must be agreed upon [30, 31, 33 and 35].

Non-coinciding attributes must be defined. In the case of lean implementation, it can be defined as small changes in improving a process or system. An appraisal of the available capabilities must be undertaken. It will facilitate an understanding of where the capabilities reside. In doing so, it would determine whether collaboration between role players is possible [26]. Presently within the Higher Education sector a complex network of non-linear causality affiliations traversing numerous hierarchies which escalates volatility. It could conceivably cause formidable reactions swiftly triggering disaster.

The challenges confronted by Higher Education (HE) fluctuate from unpretentious to extremely complex. It is found a deep-rooted association involving a trigger and an avertable undesired consequence exist. HE management realises the mounting importance in tackling problems impacting on student cohort. Unfortunately, the issues do not fit run of the mill norms, sameness and orderliness. Political interference can be identified as at source subjects who instigate complex networks and spheres. The result is capricious and wide-ranging. The challenges described can be interpreted utilising complexity theory.

The theory is comparatively unknown in the HE sector. The applicability of the theory has been illustrated in other disciplines. An understanding of key concepts of complexity theory must be understood to reap all the possible benefits

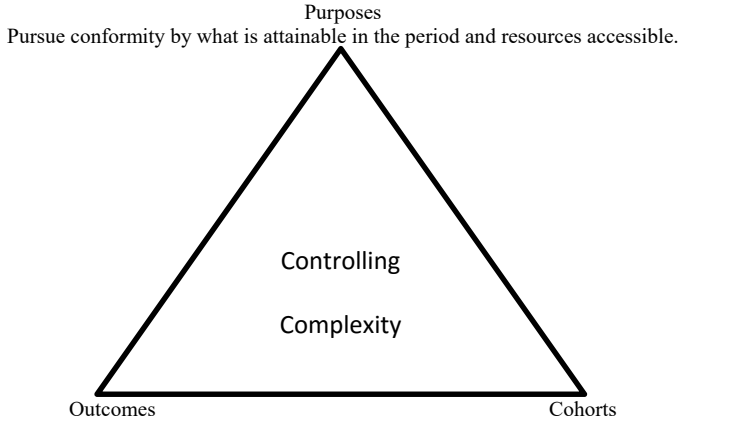

Figure 1 – Appropriate fit between Purposes, Outcomes and Cohorts [26]

available. In complexity theory, it is postulated overseeing of the theory is diffused and dispersed. As a result behaviour of the system will be influenced by decisions made every single instant by countless persons. Due to the decisions, it is possible that a small change in a process or system variable can push it outside a perilous limit.

The result will be a movement to a fundamentally special state. Therefore, the failure of the process or system is not farfetched. The process or system can be modified through individual actions. It would be advantageous if individuals within a process or system to take cognisance of the wider intricacies. Variances in conventional beliefs preceded the advancement of Complexity Theory. Hence Complexity Theory assist researchers to better grasp the subtleties of multi-causality in context [36, 41, 42, 45, 46 and 47.

The aforementioned discussion maintains the best means to grasp complexity, is to understand the elements in relation to the system in its entirety. Hence, utilising Systems Thinking encourages the understanding of the system. An authoritative mechanism which could assist in this regard is the Cynefin Framework. The Framework describes the behaviour of complex systems through a sense-making framework. Sense-making is characterised as a cognitive and communal process. Sense-making will be unsuccessful if no interface with and expansion of a communal mentality comes about.

It implies a mutual wisdom of connotation in the circumstances ought to transpire. Hence, the cognitive perspective and social dimensions is brought together by the Cynefin Framework. If the Cynefin Framework is utilised as a sense-making instrument, in addition it assists in achieving a fine distinction of the system under investigation. It would facilitate an appreciation all systems and processes remains in a condition of instability [3, 13, 23 and 36]. It further assists in awareness how decision-making and procedures in the manner an individual's functioning in a system would influence the system.

The Cynefin Framework can be utilised as a diagnostic instrument in relation to distinct state of affairs as occurring in the functional milieu. It includes the definition of the conduct if state of affairs alters. It is a handy tool in depicting relationships involving official and off the record systems [3 and 36]. The best term describing Cynefin is habitat. The word habitat alludes to the myriad affiliations such as kinship, culture and location. Functioning in a system, staff members are not altogether knowledgeable what the habitat represents. Accordingly, relationships of numerous up-and coming practices would have some bearing on relations staff members have with the system [36 and 42].

People encounter numerous rich experiences within the habitat they operate in. The Cynefin Framework promotes usage of a descriptive methodology to comprehend complexity and stressing the collective features of sense-making whilst recognising the numerous conditions the system operates in [3 and 36]. Therefore, individuals are subjected to a complex set of facets in their working milieu. The main tenet of the framework is when faced by a complex state of affairs; an individual would resort to the methodology of sense-making. It would occur through the application of patterns to institute order in the system.

The most basic application of the framework is as a tool for categorising issues and strategies. As such, it helps in deciding on the most appropriate organisational structures for effective team governance. A further application is to determine when conditions should be created for emergent innovations instead of applying more rigid constraints [36 and 42]. The framework assists decision-makers in breaking the mould of clinging to the tried and trusted traditions of accepted wisdom. Consequently, decision–makers have to contemplate obdurate difficulties in a novel manner.

Then, at the most basic level, the Cynefin Framework subsists to assist decision-makers to appreciate the fact every condition in a system is not fashioned to be harmonious. It would result in understanding the fact each problem faced is unique and should be responded to in a unique manner. The framework is depicted in figure 2 below. The figure was adopted from [2].

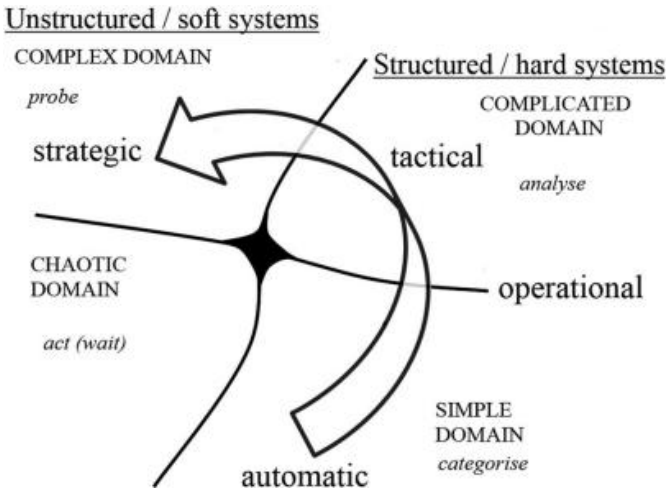

Figure 2: Cynefin Framework adopted from [2]

Studying the framework, it illustrates how difficulties are observed by individuals. The manner in which they make sense of the problem they are faced with, will ultimately determine the decision the individual will make. The framework consists of two significant domains which can be identified as order an unordered. The aforementioned two significant domains can be subdivided into two lesser domains namely simple and complicated. The identified lesser domains operate in the domain of order. In the unordered domain, the domains of complex and chaotic can be found.

The domain of disorder resides in the centre of the framework. In this instance, several viewpoints are in competition for eminence. Discord between actors in this domain is the order of the day and disharmony reign. The domain of disorder should be avoided at all costs. It will

result in an interruption of work. Sense-making has very clear and distinct confines in the domain of order. They are the known and the knowable. The known can be defined as information which can be utilised immediately. Knowable is the issues decision-makers must exhaust time and energy on clarifying what the information should be.

Unambiguous differences must be made in the unordered domain. A determination what characterise complex and the characteristics of chaotic must be made. Complex can be defined as those things a decision-maker can pattern. Chaotic can be defined as the needs for steady the system which in turn would facilitate the surfacing of relationships. The Cynefin Framework postulates in the ordered domain the system is represented by the totality of its elements. The decision-maker would be unable to exploit the system fully if the elements within the system are not exploited first.

It is hypothesised, in the unordered domain the entire system is in no manner of speaking the totality of its elements. The reason being, if a decision is made in this domain, the system's complexion is transformed. The most important benefit of the Cynefin Framework is it allows for decision-makers to establish where the system they operate in fits in the midst of the domains discussed. Thus, the decision-maker will know the procedures, tactics, practices or approaches which would be relevant to ensure a well-functioning system. A further deliberation on the domains that has been identified in figure 2 is required. They are:

Simple or known – In this domain the cause and effect association tend to be predominantly linear, experimental and established. Furthermore, in this domain best practices in all disciplines will be utilised. Nominal know-how is required to solve problems because they are in the public domain. Staff members operating in the domain could solve the majority of the problems unaided. It is achieved through the utilisation of standard operating procedures (SOP's). It allows for the identification of problems within the domain. Consequently, the staff members should be able to identify a recognisable configuration.

From this step it would be easy for staff members to exploit a recognised and prospective established response to the problem. As a result, the domain guarantees a proficient approach to problem solving. Well thought-out practices and procedures are considered necessary and obligatory. The fitting managerial style is the perception of inward bounded information. In this domain the apt purpose of the group assume a structure of harmonization.

Complicated or knowable – Similar to the previous domain, a steady and regimented rapport is present relating to the cause and effect. It differs from the simple domain in one important aspect. In this domain, difficulties are split in moment in time and space and are not completely comprehended. In the domain, good practices in a discipline will be utilised. In all probability staff members would know the problem to be addressed. They would be well-versed in attaining the solution to the problem. In this domain, the decision-maker must be an expert. If it is not the case, he or she will be unable to determine an apt option in finding a solution to the problem.

The decision-maker should apply common sense to the problem and thus exploit specialist experience to gauge the state of affairs and settle on a choice. The management of this type of situation is through teamwork. To manage the domain would require a practitioner to utilise common-sense, probe and react in an appropriate manner to a problem.

Complex or domain of emergence – the domain is characterised by evolving results. Decision-makers must deal with unfamiliar unfamiliarity's. As soon as the resolution to the problem has been identified, it is recognised as a valid outcome. The random relationships materializing from the combination can for that reason be grasped only in retrospect. Thus, the decision-maker has to expand and carry out trials to garner sufficient know-how in developing an appropriate outcome. The goal of doing so is to change the domain to the complicated domain.

There is no indication to the decision-maker that the seeming replicating relationships would be maintained. The decision-maker would be ill-equipped to respond if an unanticipated or fresh relationship transpires. Hence, the opening out of investigations towards discovery of evolving relationships is mandatory.

Chaotic or domain of speedy reaction – Unlike the preceding domains described, this domain is characterised as an unstable and volatile domain. No discernible cause and effect associations are identifiable in this domain. The domain is characterised by the exploitation of innovative resolutions in resolving difficulties faced by decision-makers. The main concern of the domain is one of control. The first step to be undertaken by the decision-maker is categorization of the difficulty. It is necessary to secure a degree of command over the problem. Thereafter the decision-maker must consider the state of affairs to uncover an apt response. Once the goal has been achieved, the difficulty can be relocated to another domain.

Disorder – The domain inhabit the centre of the Cynefin Framework. It is characterised by uncertainty regarding the state of the system. The most important step is to reposition the system to one of the domains discussed above. Then, the decision-maker would be able to determine what he or she is not on familiar terms with. It would result in the decision-maker being able to move to a defined domain.

The domains to the right of the framework in figure 2 can be defined as order. The domains to the left of the framework in figure 2 can be defined as unordered. Not any of the four domains identified is more acceptable over and above any of the other. The abovementioned is evidence the Cynefin Framework would assist in defining the area in which the difficulty is operating. It is achieved through the thorough analysis of the cause and effect interactions present within the area the difficulty is to be found. If the interaction is uncomplicated and evident the difficulty will reside in the simple domain.

If the interaction concerning the cause and effect is concealed, but can be investigated ahead of time, the difficulty resides in the complicated domain. A characteristic a difficulty in the complex domain is one where the cause and effect interaction can be agreed on through personal experience. In the chaotic domain none of the characteristics discussed her will be present [2, 4, 9, 13, 15, 25, 29, 31, 33, 36, 42 and 45].

V. RESULTS AND CONCLUSIONS

Acknowledging complexities early in the piece is decisive for the beneficial administration of and establishment of Systems Thinking and the Cynefin Framework since it grants an understanding regarding the manner in which ordered and nebulous state of affairs influence the insight of management. It is postulated, Complexity Theory and Cynefin Framework is such a typical opportunity to stimulate decision-makers considering thinking further than the imprisonment of present techniques. Consequently, the capability exists to afford management with the investigational mechanism to enhance the administration of processes and systems.

Continually, the interaction involving Systems Thinking and Cynefin Framework is exemplified. Decision-makers would like nothing more than to function in an uncomplicated along with a controllable environment. Simultaneously, decision-makers have to agree ambiguity is intrinsic to the briskly shifting and multifaceted milieu. The extent to which the Higher Education (HE) sector demonstrates a way of thinking exclusively directed at its specific welfare, equated to where it perceives it welfare concurrent to that of stakeholders definitely a major characteristic.

Collective wisdom from the study has exposed the fact scrutinizing intricate conditions, it is essential to be familiar with a grouping of diverse methodologies. In this instance, the reference refers to the two methodologies discussed in the paper namely Complexity Theory and Cynefin Framework. Even though the methodologies were exploited scrutinizing in relation to official and unofficial arrangements in the HE sector, these methodologies can be appropriate in examining the powerful observable facts in all categories of establishments. The mission of management in any establishment is the exploitation of limited means.

A reference can be made to an adversary of all establishments namely the milieu which is ever-changing and able to astonish. Traditionally, Systems Thinking and the Cynefin Framework, with its manifold points of view is a practical instrument in comprehending, reframing and observing diverse topic and state of affairs. The methodologies can be exploited to recommend an assortment of potential conclusions. If the methodologies are applied in the research milieu, it can be exploited to symbolize veracity in diverse manners in exploring evolving subject matter and to scrutinize multifaceted relationships.

Complexity Theory and the Cynefin Framework offer decision-makers a magnifying glass through which to examine complications and confronting it. The methodologies can be applied equally at the functional and theoretical level in the milieu of system and process management within the HE sector. The application can be exploited to enlighten practice by assisting decision-makers to decide on the most suitable tactic reliant on the intricacy of the subject to be concentrated on.

REFERENCES

[1] Acosta, S., Goltz, H.H. & Goodson, P. 2015, "Autoethnography in action research for health education practitioners", *Action Research,* pp. 1-21.

[2] Alexander, A., Walker, H. & Naim, M. 2014, "Decision theory in sustainable supply chain management: a literature review", *Supply Chain Management: An International Journal,* vol. 19, no. 5/6, pp. 504-522.

[3] Ali, I. 2014, "Methodological Approaches for Researching Complex Organizational Phenomena." *Informing Science: the International Journal of an Emerging Transdiscipline,* vol. 17. Pp. 59-73.

[4] Balch, A. & Balabanova, E. 2011, "A system in chaos? Knowledge and sense-making on immigration policy in public debates", *Media, Culture & Society,* vol. 33, no. 6, pp. 885-904.

[5] Bartolomei, J.E., Hastings, D.E., de Neufville, R. & Rhodes, D.H. 2012, "Engineering Systems Multiple-Domain Matrix: An organizing framework for modelling large-scale complex systems", *Systems Engineering,* vol. 15, no. 1, pp. 41-61.

[6] Baxter, G. & Sommerville, I. 2011, "Socio-technical systems: From design methods to systems engineering", *Interacting with Computers,* vol. 23, no. 1, pp. 4-17.

[7] Bicheno, J. 2012, The lean toolbox for service systems, PICSIE books.

[8] Bladt, M. & Nielsen, K.A. 2013, "Free space in the processes of action research", *Action Research,* pp. 1-17.

[9] Botchkarev, A. & Finnigan, P. 2015, "Complexity in the context of information systems project management", *Organisational Project Management,* vol. 2, no. 1. pp. 15-34.

[10] Bruce, C.D., Flynn, T. & Stagg-Peterson, S. 2011, "Examining what we mean by collaboration in collaborative action research: A cross-case analysis", *Educational Action Research,* vol. 19, no. 4, pp. 433-452.

[11] Brydon-Miller, M. & Coghlan, D. 2014, "The big picture: Implications and imperatives for the action research community from the SAGE Encyclopaedia of Action Research", *Action Research,* vol. 12, no. 2, pp. 224-233.

[12] Burman, C., Mamabolo, R., Aphane, M., Lebese, P. & Delobelle, P. 2013, "The South African developmental landscape: restricted potentials or expansive, complex adaptive opportunities?", *TD: The Journal for Transdisciplinary Research in Southern Africa,* vol. 9, no. 1, pp. 17-37.

[13] Cavallo, A. & Ireland, V. 2014, "Preparing for complex interdependent risks: A system of systems approach to building disaster resilience", *International Journal of Disaster Risk Reduction,* vol. 9, pp. 181-193.

[14] Chan, W.T. & Ying, F. 2014, "A social complexity approach to investigate trust in Agile Methodology", *Intelligent Transportation Systems (ITSC), 2014 IEEE 17th International Conference on*IEEE, pp. 172.

[15] Childs, S. & McLeod, J. 2013, "Tackling the wicked problem of ERM: using the Cynefin framework as a lens", *Records Management Journal,* vol. 23, no. 3, pp. 191-227.

[16] Connery, A.M. & Hasan, H. 2014, "Towards a modified framework for informer emancipation in complex contexts", *Proceedings of Informing Science and IT Education Conference (Insite)*, pp. 91-102.

[17] DeHoratius, N. & Rabinovich, E. 2011, "Field research in operations and supply chain management", *Journal of Operations Management,* vol. 29, no. 5, pp. 371-375.

[18] Drake, D.H. 2014, "Researching prisoner experiences with prison officers: An action research-inspired approach", *Action Research,* vol. 12, no. 1, pp. 94-109.

[19] Flessner, R. & Stuckey, S. 2014, "Politics and action research: An examination of one school's mandated action research program", *Action Research,* vol. 12, no. 1, pp. 36-51.
[20] Fodness, D. 2015, "Managing the wickedness of socially responsible marketing", *Journal of Business Strategy,* vol. 36, no. 5, pp. 10-17.
[21] French, S. 2012, "Cynefin, statistics and decision analysis", *Journal of the Operational Research Society,* vol. 64, no. 4, pp. 547-561.
[22] Hacklin, F. & Wallnöfer, M. 2012, "The business model in the practice of strategic decision making: insights from a case study", Management Decision, vol. 50, no. 2, pp. 166-188.
[23] Hammer, R.J., Edwards, J.S. & Tapinos, E. 2012, "Examining the strategy development process through the lens of complex adaptive systems theory", *Journal of the Operational Research Society,* vol. 63, no. 7, pp. 909-919.
[24] Hartmann, T., Van Meerveld, H., Vossebeld, N. & Adriaanse, A. 2012, "Aligning building information model tools and construction management methods", *Automation in Construction,* vol. 22, pp. 605-613.
[25] Helquist, J.H., Deokar, A., Meservy, T. & Kruse, J. 2011, "Dynamic collaboration: participant-driven agile processes for complex tasks", *ACM SIGMIS Database,* vol. 42, no. 2, pp. 95-115.
[26] Hummelbrunner, R. & Jones, H. 2013, *A guide to managing in the face of complexity,* Working Papers, October 2013, Overseas Development Institute.
[27] Jaaron, A.A. & Backhouse, C.J. 2014, "Service organisations resilience through the application of the vanguard method of systems thinking: a case study approach", *International Journal of Production Research,* vol. 52, no. 7, pp. 2026-2041.
[28] Karvetski, C.W. & Lambert, J.H. 2012, "Evaluating deep uncertainties in strategic priority-setting with an application to facility energy investments", *Systems Engineering,* vol. 15, no. 4, pp. 483-493.
[29] Koskela, L. & Kagioglou, M. 2005, "On the metaphysics of production", *Proceedings of 13th International Group for Lean Construction Conference.*, pp. 37.
[30] Leleur, S. 2012, "Setting up the Decision Support" in *Complex Strategic Choices* Springer, pp. 55-70.
[31] Lepmets, M., O'Connor, R.V., Cater-Steel, A., Mesquida, A.L. & McBride, T. 2014, "A Cynefin based approach to process model tailoring and goal alignment", *Quality of Information and Communications Technology (QUATIC), 2014 9th International Conference on the* IEEE, pp. 166.
[32] Locke, T., Alcorn, N. & O'Neill, J. 2013, "Ethical issues in collaborative action research", *Educational Action Research,* vol. 21, no. 1, pp. 107-123.
[33] McLeod, J. & Childs, S. 2013, "The Cynefin framework: A tool for analysing qualitative data in information science?", *Library & Information Science Research,* vol. 35, no. 4, pp. 299-309.
[34] Mehmet, S.D. & GÖÇER, Ö. 2015, "Cynefin Framework for Decision Makers for Information Systems Security in the face of Information Asymmetry", *ISTANBUL JOURNAL OF INNOVATION IN EDUCATION,* , pp. 1-14.
[35] Nilsson, F. & Gammelgaard, B. 2012, "Moving beyond the systems approach in SCM and logistics research", *International Journal of Physical Distribution & Logistics Management,* vol. 42, no. 8/9, pp. 764-783.
[36] O'Connor, R. & Marion, L. 2015, "Exploring the use of the Cynefin Framework to Inform Software Development Approach Decisions", ICSSP '15, Tallinn, Estonia, pp. 97
[37] Parker, L.D. 2012, "Qualitative management accounting research: assessing deliverables and relevance", *Critical Perspectives on Accounting,* vol. 23, no. 1, pp. 54-70.
[38] da Mota Pedrosa, A., Näslund, D. & Jasmand, C. 2012, "Logistics case study based research: towards higher quality", *International Journal of Physical Distribution & Logistics Management,* vol. 42, no. 3, pp. 275-295.
[39] Stowell, F. 2013, "The Appreciative Inquiry Method—A Suitable Candidate for Action Research?", *Systems Research and Behavioural Science,* vol. 30, no. 1, pp. 15-30.
[40] Sharif Ullah, A. & Tamaki, J. 2011, "Analysis of Kano-model-based customer needs for product development", *Systems Engineering,* vol. 14, no. 2, pp. 154-172.
[41] Valerdi, R. 2011, "Heuristics for systems engineering cost estimation", *Systems Journal, IEEE,* vol. 5, no. 1, pp. 91-98.
[42] Van Beurden, E.K., Kia, A.M., Zask, A., Dietrich, U. & Rose, L. 2013, "Making sense in a complex landscape: how the Cynefin Framework from Complex Adaptive Systems Theory can inform health promotion practice", *Health promotion international,* vol. 28, no. 1, pp. 73-83.
[43] Walsh, E., Forsyth, K., Senior, J., O'Hara, K. & Shaw, J. 2014, "Undertaking action research in prison: Developing the Older prisoner Health and Social Care Assessment and Plan", Action Research, vol. 12, no. 2, pp. 136-150.
[44] Wingo, R.S. & Tanik, M.M. 2015, "Using an agile software development methodology for a complex problem domain", *SoutheastCon 2015*IEEE, pp. 1.
[45] Yearworth, M., Edwards, G. & Rosenberg, G. 2011, "Systems practice in engineering: reflections on teaching research methods and contribution to methodological development", *9th Annual Conference on Systems Engineering Research (CSER 2011),* pp. 1.
[46] Yurtseven, M.K. & Buchanan, W.W. 2011, "Control system design: A General Systems Theory perspective", *Technology Management in the Energy Smart World (PICMET), 2011 Proceedings of PICMET'11:* IEEE, pp. 1.
[47] Yurtseven, M.K. & Buchanan, W.W. 2012, "Educating Undergraduate Students on Systems Thinking and System Dynamics", *Technology Management for Emerging Technologies (PICMET), 2012 Proceedings of PICMET'12:* IEEE, pp. 1837.