Application of Cyenfin framework to facilitate decision-making in complex conditions in project portfolio management

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# Authors’ biography

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Saeed, PMP, is a Ph.D. student at the University of Technology Sydney and senior manager of project planning and controls in Aquenta-Jacobs. He has developed and applied a unique simulation as a research tool to study decision makers while they are exposed to replications of real-time events.

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Elyssebeth has worked with simulation as a learning and research strategy for more than 20 years. Her academic career includes teaching and research projects in Australia and internationally. She has published books, chapters and articles about a range of topic concerning adults in learning contexts, as well as original designs for simulation activities in academic and workplace contexts.

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Julien has completed an Action Research Ph.D. winning national and international awards. His research focuses on two broad themes: trends in project management research, and developing project management practice to meet the needs of ambiguous and contested projects, drawing on systems thinking, complexity theory, and change management.

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# *Key Words*

Project portfolio management, decision making, Cynefin, Simulation, Complexity

# Abstract

The majority of project mortfolio management tools are not flexibly responsive to complex and dynamic environments. This can results in business failures when management do not effectively direct adjust project portfolios to meet organisational and contextual needs. Insufficient attention has been given to the impact of individual decision making, perceptions of decision processes, and the influence of uncertainty on effective decision making in project portfolio management.

This research explores the impact of real-time events on managers during decision making processes for project portfolio management, using a purpose built simuation. The simulation devleopment was informed by the Cynefin framework. The Cynefin framework emphasise the importance of applying different leadership styles and decision making approaches dependant of the complexity of the situation.

Data collection involved four complete iterations of the simuation, resulting in 66 datasets of individuals’ perspections of the project portfolio management decision making process, under varying levels of complexity. The research data was focused on participants’ perceptions of their efforts to manage key decision turning points through two ‘real-time’ events simulating project cancellations and organisational change.

# Introduction

Project Portfolio Management (PPM) has been developed to assist in the management of interrelated groups of projects and programs, aid in the selection of projects within a portfolio, and their alignment to organisational intent, and to facilitate communication amongst internal and external stakeholders in regard to decision making on clusters of interrelated projects. PPM is particularly vital in contexts where complex decisions need to be made involving groups of stakeholders within, and external to, organisations. The dominant trend in decision making during the planning and implementation of multiple projects is driven by a rationalist perspective, emphasising financial analysis. Optimisation methods apply linear and stable assumptions to create decision trajectories for portfolio road maps (Ghasemzadeh, Archer et al. 1999, Belaid 2011, Project Management Institute 2012). However, in many cases the environment is changing so quickly that changes are not captured effectively by the decision makers working on project portfolios. Further investigation of decision making process in PPM contexts is needed, if organisations are to account for sudden changes. Management of the process for identifying and controlling uncertainty affecting project portfolios is a key challenge for project practitioners and researchers. However, understanding the perceptions of individual decision makers in connection with their decision making is not yet subject to much research.

This research explores how real-time events affect decision makers in a PPM context. This paper discusses the use of a novel approach to research, data generation and analysis to create recommendations for consideration by practitioners and researchers. The research problem being explored is:

 *What is the impact of real-time events on managers during PPM decision making?*

This paper extends the previous work of the authors (Cooper, Edgett et al. 2001), (Killen, Jugdev et al. 2012, Petit and Hobbs 2012, Martinsuo, Korhonen et al. 2014) and other researchers (Leigh and Kinder 2001, Kurtz and Snowden 2003, Remington and Pollack 2007) into the management of uncertainty and decision making for project portfolios. The research reported on in this paper included the development of a simulation (Hooshmand-1) for replicating scenarios involving unexpected change and complex PPM decision-making contexts. The Cynefin model of Domains of Knowledge (Kurtz and Snowden 2003) informed the devleopent of the simulation, and provided the research framework for this study. Data generation and analysis made use of SenseMaker software to provide insight into the types of actions and strategies required when facing unanticipated change during decision making in the context of PPM.

# Literature Review

Project portfolio management is a multi-disciplinary response to aligning corporate strategy with the specific tasks of choosing and executing the right projects. Project portfolio management is defined as the management of projects and programs to achieve strategic goals as set out in a corporate strategic plan (PMI 2006). The three key goals for implementing PPM across a corporation have been identified as 1. maximizing the value of the portfolio; 2. achieving the right balance and mix of projects; and 3. linking the portfolio to the strategy of the business, through implementation of PPM (Cooper, Edgett et al. 1997a, Cooper, Edgett et al. 1997b). Corporations with multi-project structures challenge top management team, as these practices begin with competing resources for projects at the same time and maturity of organisations to establish PPM as a key functional responsibility for senior managers. Engwall and Jerbrant (2003) stated that a multi-projects corporation carries out the majority of its business operations through the execution of projects. The standard of portfolio management (Project Management Institute 2012) concerns the common sense for the implementation of PPM across organisations. This standard discusses definitions and concepts aiming to achieve a balance among key goals for profitability, strategic alignment and resource utilisation.

Several models and frameworks discuss various perspectives to the alignment processes between corporate strategy and projects. Archer and Ghasemzadeh (1999) proposed an integrated framework for decision making on projects selection for portfolios. The strategic implications of project selections are complex as it depends on internal and external factors (Archer and Ghasemzadeh 1999). Connecting strategic management and PPM as a relevant capability for corporates to plan and implement strategically and effectively are proven for PPM context (Killen, Jugdev et al. 2012). Kodukula S.(2014) described funnel model as a good guide for practice to combine tactical and strategic views for PPM planning and implementation . The funnel model uses three gates 1. Initiation; 2. Development and 3. Production (Kodukula S. 2014). The production gate is when the delivery of project values commences. Furthermore, a strategic framework was introduced to lay out the sustainable decision criteria and fuzzy based decision making models for decisions on project portfolio selection and evaluation (Khalili-Damghani and Sadi-Nezhad 2013). Khalili-Damghani and Sadi-Nezhad (2013) argued that the framework use of Balanced Score Card (Kaplan and Norton 2001) provides feedback to evaluation and assessment processes.

Complexity on project portfolio management processes is inherent and contingent. Complexity is inherent in the process due to the multi-factor and multi-stakeholder process of analytic and rational decision making for project selection. The process of decision making for selection, prioritisation and authorisation of projects is complex (Gemünden, Kock et al. 2015). The complexity of the processes is concerned with key determinants for the number of elements, the degree of interdependencies between elements and the predictability and magnitude of changes to these elements and their interdependencies (Daft 1992, Dooley and van de Ven 1999, Levinthal and Warglien 1999, Ribbers and Schoo 2002, Dietrich 2007, Teller, Unger et al. 2012). Changes in the elements, and interdependencies can happen because of internal and external factors(Martinsuo, Korhonen et al. 2014).

There are a wide variety of advanced, computerised, and formalised processes for aiding project selection, prioritisation, and for aiding decision-making (Archer and Ghasemzadeh 1999, Gemünden, Kock et al. 2015). Several quantitative models and frameworks have been developed to aid with the complexity of multi-dimensional problems for PPM. Financial and non-financial indicators at the project level could assist decision-making process. According to Costantino, Di Gravio et al. (2015), project critical success factors is an important decision criterion for PPM as decision makers deal with probable causes of failures during project selection processes. They argued that using artificial neutral networks provide a simpler approach for top manager engagement in the decision making, facilitating communication loops between project managers and project portfolio managers to assess riskiness of project success based on the project managers’ past experience (Costantino, Di Gravio et al. 2015). Maged (2008) describes a Multiple Crieria Decision Making (MCDM) model to find the optimized solutions for R&D projects where resources dependencies pose constraints to decision making process for project selection. MCDM is also used to measure the performance of project portfolios to make decision on strategic changes to and use variety of criteria, which are required for decision maker to reprioritize the projects based on their performance(Rogério Tadeu de Oliveira, Ensslin et al. 2011).

Arguably, companies are struggling with sub-optimization and irrational decision making processes (Martinsuo 2013).Müller, Martinsuo et al. (2008) challenged the contribution of several tools and quantitative methods for project portfolio optimization to the performance of project portfolio management. Kaiser, El Arbi et al.(2015) emphasised that despite developments in project selection models for decision making, the key to successful implementation of PPM is the organization structure and its alignment with decision making criteria.

Some have argued that project portfolio management methods is not mature enough to support organisations during uncertain conditions because of its focus on rational decision-making (Arlt 2010, Martinsuo, Korhonen et al. 2014). In parallel with methods and processes, competencies of top management team who use the methods for decision making is at a great attention.Martinsuo and Lehtonen (2007) stated that skills and competencies for managing project portfolios should extend to the project management teams. Furthermore, senior managers need to support development of dynamic capabilities across the organisations to overcome uncertain and changing environment (Petit 2012).

Uncertainties are beyond the analysts’ ability to predict events and can not be reduced to the risk level (Quade 1989). Quick-changing environment is a reality of the business environment. The changes influence decision makers’ perceptions for choosing processes, and decision criteria. Christiansen and Varnes (2008) suggested that decision makers have to deal with multiple criteria and sometimes conflicting interests. Thus, decision makers move away from traditional rational thinking and try to adapt a sub-optimal problem solving approach. . Martinsuo, Korhonen et al. (2014) asserted that external uncertainty can be related to factors such as competitors’ actions, customers’ needs or changes to the macro-economic conditions.

Korhonen, Laine et al. (2013) asserted that managers cannot stick to their rational decision making approach while facing uncertain or unknown conditions. Furthermore, there is a need for further research into how to manage uncertainty in PPM (Petit 2012, Korhonen, Laine et al. 2013). The extended framework for managing uncertainty offers categorization of uncertainty based on the sources of uncertainty – External context, organizational context and single project changes - in which managers can identify and prepare contingency plan to overcome those events (Martinsuo, Korhonen et al. 2014).

Facilitation of decision making in a project portfolio committee through a crafted framework might provide top managers with a mechanism to manage unexpected events during decision making for project portfolio decision processes. Yahaya and Abu-Bakar (2007) argued that group decision making is across all decision making processes and is used as a powerful mechanism to overcome factors of uncertainties during decision making event for project portfolios of new product development. Group decision-making is known as a tactic for strategic planning where decision makers have to overcome uncertainties. Strategic decision-making and project selection and termination processes can benefit from group decision makign to mitigate risks or uncertainties (Khalili-Damghani and Sadi-Nezhad 2013, Shepherd and Rudd 2014).

Decision making in a PPM context is a complex process. The research discussed above demonstrates the need to account for individual contributions to decision making, group decision making, and a changing and uncertain context. Although many tools and application exist to assist in this process, the literature suggests that the ability of these approaches to deal with complex environments has been constrained by an underlying rationalist perspective.

## Framework for analysis

Complexity and uncertainty are being recognised as creating fundamental difficulties for decision makers, especially when senior managers have to make decisions without sufficient information (Gorzen-Mitka and Okreglicka 2014) . Remington and Pollack (2008) categorised four types of project complexity: structural; technical; directional; and temporal. For example, the physical size of projects or the extent of technical interdependencies can result in complexity for decision-making (Remington and Pollack 2008).

Seeking to make sense of complexity leads to more proactive identification of sources of uncertainty and for early signs of failure (Kappelman, McKeeman et al. 2006). Weick (1995) argued that people apply sense-making as a tool to overcome ambiguity and associated interpretation to that condition. Shrivastava (1995) stated that individuals engage in sense-making to find out what to do next, as well as a way of dealing with the anxiety and fear in complex conditions that may accompany the disastrous experiences. Hence, a framework of making sense of complex situations can be a mechanism to manage uncertainty for top management decision making.

Cynefin, a Welsh word means habitat (Kurtz and Snowden 2003), is used for knowledge exchange and as a framework that helps decision makers making sense of complexity through relaxing boundaries and assumptions deriving from existing theory, belief or practices (Krems 1995, Sardon and Wong 2010). According to Kurtz and Snowden (2003), five domains for the Cynefin framework: simple; complicated; complex; chaos; and unordered.

The Cynefin framework has been used in collective sense-making to enable emerging understanding through the discourses of group decision making (Tomasini 2013). According to Kurtz and Snowden (2003), the Cynefin model provides ways to open up discussions, identify barriers, stimulate attractors, encourage dissent and diversity, and manage starting conditions and monitor for emergence, to manage complexity and stabilise uncertain conditions. Application of Cynefin framework to boost project managers with their decision making capabilities is evident with the Legos (Tomasini 2013).

The application of Cynefin framework for creating simulation scenarios in complex and complicated domains and a reflection framework for participants in the simulation is discussed in next sections.

# Research Methodology

This research involved two main research methods: the design of an original simulation (Hooshmand-1) for generation and collection of data; and use of the SenseMaker software to to collect and analyse data. Each will be discussed in turn.

## Simulation

Simulation is ‘the abstraction of reality for a purpose’ (Leigh 2013, p. 200). It has been in use for thousands of years for many different purposes and in various modes such as war games and board games (Faria, Hutchinson et al. 2009).

Simulation has diverse uses for research and practice, and is an attractive tool for training and education where 'what-if' questions can be explored through the use of different scenarios, helping learners by providing experience-based activities (Banks, Carson et al. 1996, Aldrich 2005). Training for performance improvement in risk-oriented contexts such as those experienced by emergency medicine crews, fire fighters, and in surgery and nursing is often conducted via simulation which provides relatively safe environments for learning while avoiding adverse real life consequences (Rosen 2008, Okuda 2009, Sa. Silva, Pedrosa et al. 2011).

Simulation, as a research and exploration tool, is found in technical disciplines including crisis management (Walker, GIddings et al. 2011) and operations management (Zee and Slomp 2009). Simulation is also recognised in the human sciences as a means of building formally arranged structures that become temporary knowledge transmission spaces allowing researchers to explore specific aspects of human behaviour (e.g. Sa et al. 2011). The context in which specific simulations are applied greatly influences their design, as for example entrepreneurship education uses simulation as a method for teaching complex business interrelationships applying concepts unique to that context (Huebscher and Lendner 2010).

Use of simulations in project management is growing. While computational simulations are being used for discrete event simulation where the complex systems can be simplified to sequence of pre-defined events (Hengst, Vreede et al. 2007), role-play simulations are being used for strategic decision-making, and also the study of decision making on project portfolios as well as other educational purposes (Keys and Wolfe 1990, Leigh and Kinder 2001, Faria and Wellington 2004, Hussein 2007, Culpin and Scott 2012). Simulations are also used to improve understanding of the nature of complexity (Killen 2013, Leigh 2013).

Role-play based simulation has many applications for education of both adults and children and has a long history of use (Leigh and Kinder 2001). Role-play is “a technique (used in games and simulations) in which participants act out the parts of other persons or categories of persons” (Leigh and Kinder 2001, p. 10). Role-play simulation is used for close to reality settings that engage participants in experientially based events to help them enhance their skill and capabilities (Clapper 2010).

The design of a simulation is intimately connected to the features of the context being represented and is shaped by the nature of the intended research or learning objectives. Stainton, Johnson et al. (2010) identify three principles that contribute to a viable simulation design as being representation, content and implementation. Each of these is elaborated on below.

To be effective a simulation must provide a realistic representation of the real environment (Elgood 1993, Duffy and Cunningham 1996). Shalbafan, Leigh et al. (2015) argued that a viable model for simulation must replicate known conditions. To be effective a simulated representation must address complex and challenging situations without unnecessarily confusing participants (Leigh 2013).

Content is the second important principle in each simulation design. This includes the rules, materials, venue, processes, and support tools, all of which must be true to the context of the simulation (de Caluwé, Geurts et al. 2012). Well developed content needs to be challenging for participants and present a framework for generating knowledge (Shalbafan, Leigh et al. 2015).

Implementation refers to the facilitation processes that guide and manage the performance of the simulation. Timing is a key factor. A simulation must include time for sufficient analysis afterwards as well as allowing time for players’ decision making, reflection and discussion within the activity (Hall 2004). The facilitator needs to be a knowledgeable person to assist participants with technical knowledge (Wolfe 1997, Hall 2004).

The use of simulation has grown to include training, education, decision-making and crisis management for many groups including middle and senior managers (Faria, Hutchinson et al. 2009). The use of simulation for project management has helped students in postgraduate courses to understand the complexity that can occur during construction projects. For instance, BoBs Building is simulation software that covers subjects such as planning and controls, network analysis, risk management, earned value for training and education (Hussein 2007). other business simulations support learning about organisational changes and decision making on strategic matters (Joldersma and Geurts 1998, Faria, Hutchinson et al. 2009).

Simulations are also increasingly being used for research projects, demonstrating advantages such as allowing for participants’ subject expertise, motivation and opportunity for group discussions (Elgood 1997). Simulation also can address communications, critical thinking and emotions as research factors as well as proving participants with learning opportunities (Clapper 2010). Finally, simulations offer researchers opportunities to compare qualitative and quantitative data at the same time (de Caluwé, Geurts et al. 2012). Simulations enable researchers to study decisions and activities that are extraordinary, dangerous, risky, and obscure in organisational environments (de Caluwé, Geurts et al. 2012).

Simulation Hooshmand-1 was created to expose participants to two pre-defined scenarios. In each scenario, participants adopted a role and contributed to group decision making about items on a list of project portfolios. In the second scenario, two real-time events were introduced to assess participants’ capability for coherent decision making after receiving news of unanticipated but predictable events.

The simulation process follows these steps:

1. Briefing
2. 1st scenario
3. Reflection on the 1st scenario
4. 2nd scenario
5. Reflection on the 2nd scenario
6. Debriefing

The two scenarios were developed using data from a case study of IT companies in Canada (Petit 2012). Both scenarios are set in the Sydney headquarters of a fictional international IT company. The context is a meeting of the project portfolio committee chaired by the director of product development unit (PDU) based in Sydney and attended by heads of the application development (AD), and integration and verification (IV) divisions. The scenarios are dynamic and competitive, including sources of instability related to product content, unstable standards and unclear customer requirements about products.

Narratives are a commonly used sense-making tool for interpreting how people make sense of uncertain conditions or complex problems. Rituals, belief and experience and all ways that people make sense of events, and thus respond to organisational shocks, such as mergers, layoffs and expansions, using very different perspectives (Mills, Thurlow et al. 2010). Narratives (Weick 1995, Weick 2005) are active lenses to monitor individual behaviour, since participants’ stories discuss who said what to whom with what effect (Weick 1995, Weick 2005, Mills, Thurlow et al. 2010).

Narrative research can assist the research subjects to make sense of a complex situation and that contributes to data analyses with less researchers’ bias as a reliable research method (Browning and Boudès 2005). Storytelling (Callahan, Rixon et al. 2006), games and simulations (Leigh and Kinder 2001) are known tools to make sense of complexity. Stories are richer research instruments than conventional questionnaires and interviews since they bring the subjects’ opinion directly into the research field (Brown and Jones 2000, Berry 2001, Brown 2004, Boudes and Laroche 2009). SesneMaker software was introduced to narrative research which enables visual presentation and analysis (GORZEŃ-MITKA and OKRĘGLICKA 2014) of stories collected in a narrative research.

SenseMaker Software, associated with the Cynefin framework, can be used to support decision-making and meta data analysis when used with large numbers of participants. This software is becoming widely used for making sense of complex problems (Snowden and Boone 2007, Gorzen-Mitka and Okreglicka 2014). Sardon and Wong (2010, p. 5&6) have described the key benefits of using SenseMaker as follows:

a) Allows to distribute the analysis load across participants and makes it possible to analyze the stories in relatively short time

b) Reduces the authors’ bias that might be introduced in the interpretation of the stories. In doing so, each story contributor makes sense of one’s story

c) Engages the participants and positively prepares them for the next steps. Involvement is a key success factor for the long-term success of any intervention.

Sixteen attributes were selected as indicators of features relevant to understanding the research questions (Table 1). A questionnaire using the SenseMaker software was developed to collect data from participants as they made sense of their experience in each scenario.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Attribute Description** | **Code** | **Scenario** |
| **1** | **Participants’ Feeling**  | **Q9** | **SC1** |
| **2** | **Criteria of Decision Making** | **T1** | **SC1** |
| **3** | **Drivers for individual decision making** | **T2** | **SC1** |
| **4** | **Sources of Uncertainty** | **T3** | **SC1** |
| **5** | **Perception of Final Group Decision**  | **T4** | **SC1** |
| **6** | **Group Adaptation to Decision Making Process** | **T5** | **SC1** |
| **7** | **The focus of task on team vs. individual** | **Q11** | **SC1** |
| **8** | **Participants’ Feeling**  | **Q14** | **SC2** |
| **9** | **Perception of impact on decision makers for the first real-time event**  | **Q16** | **SC2** |
| **10** | **Perception of impact on decision makers for the second real-time event** | **Q17** | **SC2** |
| **11** | **Drivers for individual decision making** | **T6** | **SC2** |
| **12** | **Shift of Criteria for decision making because of real-time events** | **T7, T8 &T9** | **SC2** |
| **13** | **Group Adaptation to Decision Making Process** | **T10** | **SC2** |
| **14** | **Individual perception for factors to overcome changes on decision-making process** | **T11** | **SC2** |
| **15** | **Sources of Uncertainty** | **T12** | **SC2** |
| **16** | **Perception of Final Group Decision** | **T13** | **SC2** |

 Table 1 Attributes of simulation and codes in the sense-making framework

SenseMaker provided measuring mechanisms, including distribution diagrams to support the analysis of qualitative data. SenseMaker proved to be an efficient tool for data collection and data analysis for this research. SenseMaker allows provides a variety of data collection techniques, inlucing dyads, trtiads, micro-naratives, and multiple choice question. A dyad is a two-dimension signifier that assesses the subjects’ perception between 0-100. A triad is a a three-dimensional signifier and assesses. Respondents are asked to balance the reletaive significance of three signifiers, by placing a point within the area of a triangle. Micro-narratives are respondent’s short stories, images, videos or audios that they use to make sense of a complex situation.

To collect the data, participants responded to questions by writing a micro-narrative or a short story to describe their experience at the end of each simulation scenario. Participants were asked to describe key turning points during each. Participants were also asked to describe aspects of the simulation experience by positioning response points on a selection of triads, indicating their perception of the significance of a variety of factors.

Four simulations were conducted, using the SenseMaking software to collect data from participants. After each simulation scenario, participants underwent a reflection through listing turning points from end to the beginning of the scenario and they wrote a short fragment or micro-narative on their experience for each turning point followed by signifying their stories in a questionnaire. There were 33 participants, generating 66 data sets from two scenarios in each experiment. A standardised process of facilitation – simulation protocol – was used to minimise variations of facilitatotr’s performance between simulation sessions with different groups of participants.

The participant selection process was tailored depending on the type of volunteers and the context of each simulation. Participants were recruited from professional and postgraduate research students.

# Data analysis

Micro-narrative analysis and the Cynefin framework were used to assess participants’ perceptions about key turning points. The micro-narrative stories were considered in relation to three parameters a) Cynefin domains of knowledge used for decision making, b) experience of real-time events and c) turning points within those events. These fragments were assessed and led to identification of three distinct clusters of participants. Table 2 lists the participants in each cluster.

Cluster 1 – These six participants were people who identified real-time events and noted the influence they have on decision-making processes in their micro-narratives

e.g. " Before the cancellation of program 4, we had a list of potential projects that we wanted to choose for this exercise”. This was taken to indicate the simple domain of known information on the Cynefin framework. “After briefing the CEO and explaining the situation to them, we came to a disagreement”. This was taken to indicate the dis-ordered domain on the Cynefin framework.

Cluster 2 – These twelve participants were people who identified turning points other than real-time events and named their impacts on the decision-making process –

e.g. “ initially it was not clear for me that the first thing we needed to do was calculating the total numbers”. This was assessed as indicating the chaos domain. Or “we could go easier with the second-year projects”. This references the complicated domain.

Cluster 3 – These three participants were people who identified turning points other than real-time events, but do not indicate that these have any impact on the decision process -

 e.g. "Interpreting the data and the interdependencies on the spreadsheet was most difficult” Or “we've focused on scheduling of programs with high NPV. ENPV and Resource fit”. These were understood as indicating the complicated domain on the Cynefin framework.

Table 2 participants in three clusters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Code Either number or pseudonym  | Group Colour  | Role  | Workshop number | Cluster |
| 1  | White |  AD | 1 | 1 |
| 2 | Green | IV | 2 |
| 3 | Green | AD | 3 |
| 4 | White | AD | 3 |
| 5 | Green | IV | 4 |
| 6 | Green | PDU | 4 |
| 7 | White | PDU | 1 | 2 |
| 8 | Red | IV | 1 |
| 9 | White | IV | 1 |
| 10 | Green | IV | 2 |
| 11 | White | AD | 2 |
| 12 | Red | PDU | 2 |
| 13 | Green | IV | 3 |
| 14 | White | IV | 3 |
| 15 | Red | AD | 4 |
| 16 | Green | IV | 4 |
| 17 | Green | AD | 4 |
| 18 | Gold | PDU | 4 |
| 19 | Green | PDU | 1 | 3 |
| 20 | Red | PDU | 3 |
| 21 | Green | PDU | 4 |

Shifts and movements between Cynefin domains are considered significant as they affect the decision-making process. Participants whose responses contribute to the first cluster were able to recognise that events occurring during the simulation had impacts on the decision making. This was concludec after analysing all responses to the first prompt question for listing turning point. Participants depending on their background had shown very different approaches to identify real-time events in the simulation as a key change factor for decision making that their groups made. Those six participants, whose responses are included in this cluster, described different sequence of changes in decision-making as a result of real-time events. While these participants were not aware of the domains in Cynefin framework, their micro-narratives describe the awareness of immediate events and the influence on their own decision-making. The change in how each participant perceived the own group made decisions is discussed below, with reference to the Cynefin model. Analyses of each participant in the cluster 1 is presented below as coded in table 2.

## Shift from simple domain to chaos

Participant 1 recorded two real-time events in the second scenario of Hooshmand -1. The known situation outlines the simple domain in the beginning. The cancellation of a project triggers a shift to the complex domain where discussions among teammates help raise awareness on the changing situation. The increased understanding moves them to the complicated domain where prioritising techniques help decide outcomes. The second real-time event involved a change of lead. This shifted them to the un-ordered domain and agreement was not reached. They ended in an endless discussion in the Chaos domain. Figure 1 illustrates this movement.

 

Figure 1: transition of domains from familiar to chaos

## Shift from Complicated domain to Complex

Participant 2 identified real-time events in the sequence shown in Figure 2. The first real-time event forced the team to re-evaluate their work because of the emerging situation. The decision-making domain then shifts to complicated when an analytic approach was adopted. Figure 2 demonstrates the movements in different domains.



Figure 2: transition domains from Complicated to Complex

## Movements between Complicated and Complex domains

Participant 3 recorded two real-time events. Their group commenced work in the complicated domain where the expectation from headquarters is known to teammates, and they need to use their analytic expertise to find the solution. The change of team leader shifted the domain to complex on consideration that the new member may have different expectations that could emerge as a new strategy. However, the group shifted back to the complicated domain through discussion and knowledge sharing. At the cancellation of a project during the second turning point in scenario 2, the group kept their decision-making consistently in the complicated domain (Figure 3).



Figure 3: transition domains between Complicated and Complex

## From chaos to disordered

Participant 4 identified that there were two real-time events and used the future backwards approach (Gorzen-Mitka and Okreglicka 2014) to list turning points and micro-narratives. In the beginning, self-confidence helped this participant to use known facts in the next context; hence it resembles a simple domain. Upon cancellation of a project as a real-time event, the group wasted times on recalculations, indicating working in the chaos domain. When the new team leader arrived, team decision-making shifted into dis-order as conflict arose with different perspectives to the solutions and no real agreement about how to proceed this is what un-ordered would mean (Figure 4).



Figure 4: transition domains from Chaos to Disorder

## Shift from Disordered to Complicated domains

Participant 5 recorded two real-time events, but the micro-narratives described the impact of only one of the two on the decision process. The cancellation of project shifted them from confusion and conflicts on a sideline matter (how to define probability) to a more relevant matter in the simulation. This moved the decision-making from disorder to the complicated domain when they started working on known information with analytical tools. Figure 5 illustrates this.



Figure 5: Shift domains from Disorder to Complicated

## Movements between Complicated and Complex domains

Participant 6 reported two real-time events. The future backwards approach was used to write the micro-narratives. In this case, the cancellation of a project was treated positively, resulting in no change to the complicated domain to use analysis and expertise to find the best solutions. However, the second real-time event moved the new group into the complex, as one of the participants could not cope with the change properly (Figure 6).



Figure 6: Shift domains between Complicated and Complex

# Findings

## Key findings in relation to real-time events of the data analysis are listed in the blow:

1 – Emotion of decision makers during the simulation Hooshmand-1 scenarios and the real-time event of project cancellation by a client were identified as two impact factors on individual judgement. These impact factors influenced individual perceptions for identifying sources of uncertainty during simulation and decision making.

2 – Organisational changes and decisions by a client to cancel a project were two impact factors on individual judgement for identifying key drivers for final group decision of project portfolios. The factors are influenced by real-time events as per participants’ perceptions.

3 – Decision making processes are influenced by real-time events and turning points and decision style of participants

4 – Participants adapted to the change to adjust decision making processes after turning points or real-time events.

This research has resulted in a broad range of findings that can make crafting propositions quite difficult. However, at this stage the results support these two specific propositions.

Proposition 1: A successful model for decision-making of project portfolios in uncertain situations shall consider team work, decision makers’ feelings and emotions, and the organisational roles as the three key success factors.

Proposition 2: Diversity of decision makers should be encouraged for significant decisions across organisations. This diversity will help counter the unconscious bi`as of decision makers when selecting criteria and assessing the final quality of decisions.

1-The complexity of dealing with un-predicted changes, 2-organisational capacity to handle changes, and 3-individual decision makers’ ability to manage decisions in uncertainty are three key factors to improve decision making on PPM.

Rational and information based decision making strategies that are usual for major projects and strategic initiatives do not effectively deal with significant and unexpected change. This indicates a lack of knowledge about risk management in project portfolio management. Furthermore, poor establishment of information systems and communication in organisations can threaten the success of decision making for project portfolios if sudden changes are ignored during the process of decision making. Future research should focus on the ‘soft factors’ techniques and tools which enable decision makers to resolve issues that have their roots in more than one Cynefin domain of knowledge.

# Conclusion

As decision makers for project portfolios get exposed to unexpected change events in their decision making, the importance of research identifying sources of uncertainty and mechanisms to manage them become important. Increased global uncertainty has raised the vulnerability of business leaders to deal with unanticipated change. Project portfolio management has already been a competitive advantage for both service and industries as it facilitates communication of internal and external stakeholders for decision making on portfolios of projects in a planning time frame. However, previous research into portfolio decision-making has not focused on how decision-makers address unexpected change.

This research extends previous researchers’ works on increasing the readiness of industry to deal with uncertainty. Mechanisms such as engagements with decision makers’ emotions, team works and diversifications were identified as procedures that help practitioners with some guidelines how to tackle real-time events during decision making.

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