

# Towards Reinforcing Decision Making Skills of Higher and Vocational Education and Training Students

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# Good Decisions at Right Times

## Deliverable O1: Towards Reinforcing Decision Making Skills of Higher and Vocational Education & Training Students

*version 1.0, 21 September 2018*

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# Preamble

DAhoy project is an Erasmus+ KA2 Strategic Partnership to support Innovation. Its name should be understood as “DecisionShip Ahoy!”, a reference to A. G. Bell, the Scottish-born scientist who patented the first telephone and originally suggested 'Ahoy' as the standard greeting when answering a call.

The project purpose is to investigate, over 3 years (2017-2020), innovative educational ideas around Decision Making, with a view to deeply reinforcing Decision Making skills for renewed and rejuvenated integrative educational programmes in Higher Education (HE) and Vocational Education & Training (VET), for continuous development of HE and VET practices

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# Introduction

The world is changing at a rapid pace, and is becoming increasingly Volatile, Uncertain, Complex, and Ambiguous (VUCA). Worldwide, there is a growing concern about responsibility for Decision Makers. Decision is not only about knowledge, it's also a question of skills. Now education is about helping students develop a reliable compass and the navigation skills to find their own way through an increasingly uncertain, volatile and ambiguous world. Embedding decision skills into a curriculum is essential for future professionals to be ready for unforeseen VUCA situations. Business and industry sectors have recognized a growing need to enhance skills that enable them to deal with VUCA situations, i.e. with unexpected scenarios and events such as financial crisis, unstable software systems and natural disasters. Universities may want to consider instilling some VUCA aspects into their programs, aiming to prepare students to confront unexpected situations in the context of decision-making and leadership and for facing rapidly changing world.

Decision Making skills are to be more deeply considered among Higher Education (HE) and Vocational Education & Training (VET) students in the regions and Europe, as they are to be future decision-makers. A. Bell, Scottish-born scientist who patented the first telephone, originally suggested 'Ahoy' as the standard greeting when answering a call. DAhoy project, to be understood as 'DecisionShip Ahoy!', is to invite, with methods, processes and tools, HE and VET stakeholders to integrate Decision Making skills in curricula.

The first innovative aspect of DAhoy is to support the coherent inclusion of active and engaging pedagogical models. The second is to investigate Decision Making (DM) as transversal key competence, along three complementary dimensions:

- MDM: Math-based Decision Making, with rationality for large projects, including models and processes as found in multi-criteria and risk analysis;
- SDM: Social-based Decision Making, for VUCA contexts, including people's interdependencies and social identities;
- CDM: Career-based Decision Making, to choose owns career path and manage his/her competence development.

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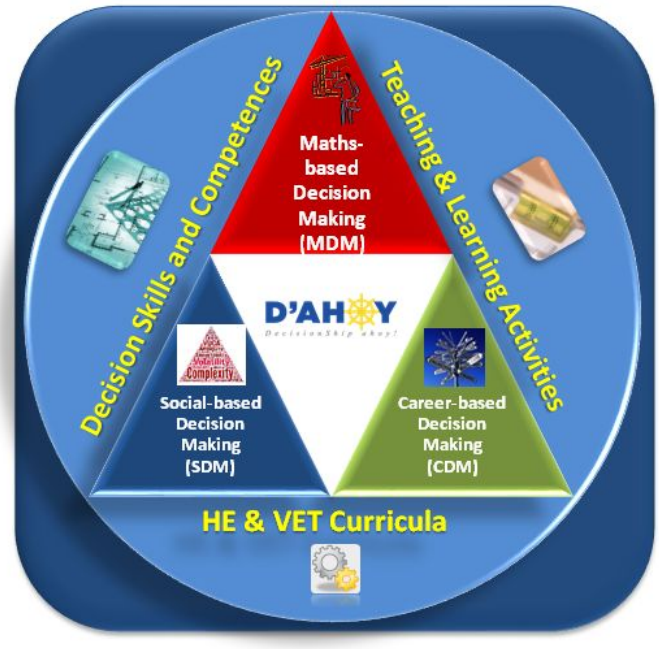



Figure. The DAhoy 3 dimensions of Decision Making.

But the nature and dynamics of change creates unpredictability in the European society. Professional life environments are more than ever Volatile, Uncertain, Complex, and Ambiguous (VUCA). This context makes decisions even more strategically critical. Entrepreneurship and Leadership skills have been extensively investigated during the last decade to meet EU Modernisation Agenda strategies It is now time to explore 'Decisionship'. Yet, decision is not only about knowledge, it is also about skills. Whether they are to act as experts in Science, Technology, Engineering, Maths (STEM) or other fields, future Decision Makers should also be specifically prepared to making decisions in VUCA environments. This is the responsibility of HE and VET institutions: training future graduates, through a transversal skills approach, in *Decisionship*, so that they are able to turn knowledge into skills, and provide the best professional answer when faced with VUCA circumstances

DAhoy is grounded in a clearer understanding of the perceptions and expectations of students and fully aligned with the strategic challenges of the partners to accelerate pedagogical innovations and nucleate their HE and VET systems. Through an exchanges of best practices among Schools, in the STEM and Business fields, DAhoy seeks:

- to share and confront HE & VET educational innovations, practices and methods, in light of professional needs,
- to catalyse the engagement of learners with innovative courses, integrated in existing but evolving programmes, through novel educational initiatives,
- to develop and disseminate tools for assessment of such skills, via the learning outcomes approach, and
- to assesses their quality and achievements.

DAhoy analyses Decision skills Teaching & Learning activities, defines and evaluates innovative Teaching and Learning (Teaching & Learning) activities to be integrated in educational frameworks at a systemic level for HE and VET institutions, in line with the Bologna processes and quality assurance purposes, from regional scale first, to European scale. The objective of DAhoy for its first year, according to this deliverable is to conceptualize Decision learning outcomes, share and analyse good Teaching & Learning practices on Decision Making in STEM first, in order to gain experience in transnational cooperation and strengthen DAhoy partners capacities. This report is delivered within the context of the *DecisionShip Ahoy!* Project, 2017-2020. In this report, the review of decision making theories, of existing learning activities in DAhoy institutional partners and of staff training events operated in 2018 in three DAhoy institutions prepares a transversal decision skills learning outcomes framework for the iterative development of students, in line with the evolution of graduate profiles and their proficiency levels in VUCA contexts.

This first DAhoy report is structured as follows: The next section recalls the new contexts and needs in the modern business world; sometimes referred to as the VUCA world, echoed in Industry 4.0 forecasts; It overviews the four VUCA terms in context of decisions. It addresses the main theories impacting decision, theories that will could be applied in training students. The chapter 1 reviews some elements of decision making models, respectively focusing on Math, Social, and Career dimensions. The chapter 2 presents some course examples for decision making that are in the curriculum place of DAhoy project partners. Chapter 3 analyses the three DAhoy decision making staff trainings events that were operated in the early 2018, including several learning activities. VUCA categorization of these activities, as pros and cons are listed thanks to qualitative and quantitative feedbacks. Finally, the last section presents some reflection for future learning activities with HE & VET learners, takeaways, and DAhoy project perspectives for the coming 2018-2019 year.

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# New contexts

On one side, the world is more complex, with multiple forces and no cause & effect chain. Major societal risks are to be faced (e.g. earthquake, nuclear accident, toxic gas, intrusion, terrorist attacks, etc.). The organizational reliability depends on the ability of the actors to organize and reorganize, in order to anticipate and cope with unexpected and crisis situations, with skills of improvisation, creative bricolage, and attitude of wisdom. On an other side, many new challenges are emerging, impacting the HE and VET sectors in Europe. Learning styles and generational expectations have changed (e.g. access to personalized and e-learning, generation Z, pastoral care), learning needs have changed (need for lifelong learning, confidence, enjoyment, multiple jobs and career, metacognition), and social expectations are changing rapidly (customer mentality, education and a private good). The influence of the employment market is important for young graduates, in terms of vision, as geographical location. Indeed, HE and VET institutions need to adapt their courses to issues faced by their country or territory. Within the DAhoy team or its advisory board members, it is possible de find examples of strategies in the scope of:

- Countries / territories in economic and social situations without employability tensions
- Isolated countries / territories
- Developing countries / territories

In Iceland, the labour market is very open and many opportunities are available for their HE students after graduation – unemployment rate is 4,5%. In France, for IT, the labour market is very positive. All students find a job within 3 months of their graduation at IMT Atlantique. Some have already found their first job before they finish their studies. In South Africa, country of a DAhoy advisory board member, the situation is totally different. All are owerever facing new professional contexts and needs, as echoed for example with the Industry 4.0 concept.

## Industry of the future issues

According to Wikipedia[1], "Industry 4.0 creates what has been called a ‘smart factory’. Within the modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real-time both internally and across organizational services offered and used by participants of the value chain". There are four design principles in Industry 4.0. On relates to decentralized decisions: “the ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomously as possible. Only in the case of exceptions, interferences, or conflicting goals, are tasks delegated to a higher level.”

The concept of industry 4.0 or industry of the future presents itself as the convergence of the virtual world, numerical design and the management of real world products and objects. The

[1] https://en.wikipedia.org/wiki/Industry_4.0, consulted 30 July 2018

great promises of this fourth industrial revolution tend to attract consumers to unique and personalised products and, despite small volumes of manufacturing, to maintain gains. This type of automated production is called the 'Smart Product'. Sensors allow robots in a production line to communicate et adapt the production tool to different needs (changes to client orders in real time), but also anticipate maintenance, the needs of series. But the complexity increases with the further development and application of Industry 4.0 (e.g. autonomous robots, cybersecurity, IoT, cloud computing, additive manufacturing, augmented reality, big data, etc.).

Besides the technological aspects, this fourth industrial revolution influences different aspects of modern societies. New issues appear through this new way of producing. Industry 4.0 obviously impacts the economical aspect as well the social, political and environmental aspects. It raises the question of millions of employments across the world. Indeed, the coaching of current employees and the training of future managers and workers have to be taken into account. More generally, it is necessary to reflect upon the place of humans in industry 4.0.

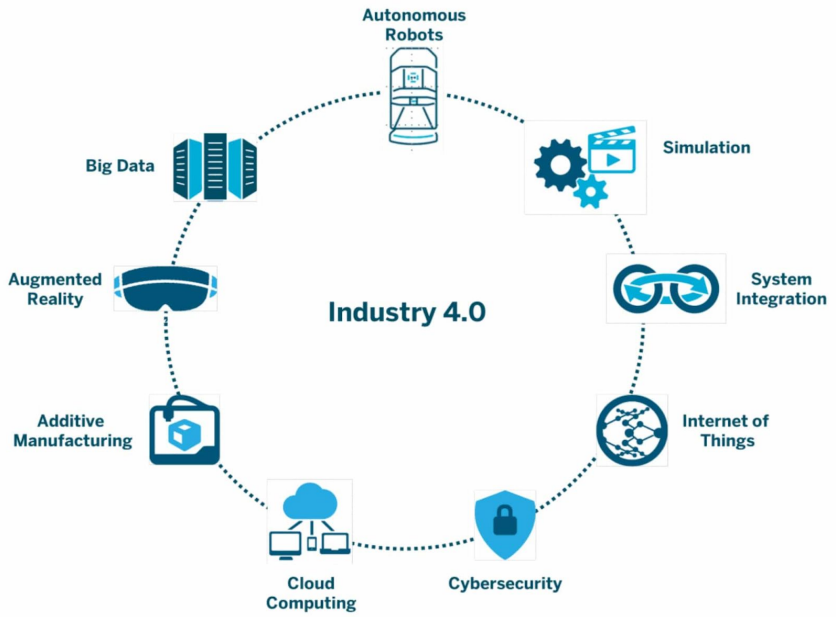



Figure. Industry 4.0: Technologies transforming industrial production.

## New skills to integrate in HE & VET education

Education is about knowledge but is now more and more about skills, e.g. mechanical skills, practical and psycho-social or emotional skills. HE and VET institutions are to enable young professionals to react with the right choices for them, their team, their company and manage their careers. Robin Karvo[2], HR Consultant at Nokia France and DAhoy advisory board member, recalls that today's business world is changing more quickly than ever before: rapidly

[2] Video available here https://www.youtube.com/channel/UC06_8Z8LageKeghBH3kJfow/videos

evolving markets, regulations, and technologies make it hard to see very far into the future. We all have to work in increasingly volatile, uncertain, complex and ambiguous business environments. That is why it is important for schools and universities to train future workers to be flexible, adaptable, and resourceful life-long learners. Academic courses and hands-on training - like internships and apprenticeships - can help you learn how to manage - and even thrive - in volatile, complex situations! Isabelle Leclerc, international Human Resources manager from Amadeus indicates that this mental and emotional agility will help you to adapt to the fluctuating business conditions. A variety of experiences - both inside and outside the classroom - will help you develop the skills you'll need to respond calmly and quickly to new situations. These international companies confirm that these qualities and skills are very attractive to companies like Nokia and Amadeus – and they will surely become even more important in the future.

As reported by the World Economic Forum[3] in 2016, the Fourth Industrial Revolution "is interacting with other socio-economic and demographic factors to create a perfect storm of business model change in all industries, resulting in major disruptions to labour markets. New categories of jobs will emerge, partly or wholly displacing others. The skill sets required in both old and new occupations will change in most industries and transform how and where people work. It may also affect female and male workers differently and transform the dynamics of the industry gender gap. The *Future of Jobs Report* aims to unpack and provide specific information on the relative magnitude of these trends by industry and geography, and on the expected time horizon for their impact to be felt on job functions, employment levels and skills."
http://www3.weforum.org/docs/WEF_FOJ_Executive_Summary_Jobs.pdf

The latest Cedefop skills forecast recalls us about this change of contexts. These forecasts offers "quantitative projections of the future trends in employment by sector of economic activity and occupational group. Future trends on the level of education of the population and the labour force are also estimated. Cedefop's forecasts use harmonised international data and a common methodological approach with the aim to offer cross-country comparisons about employment trends in sectors, occupations and qualifications. The latest round of forecasts covers the period up to 2030."
http://skillspanorama.cedefop.europa.eu/bg/skills-themes/future-jobs

## VUCA affecting decision makers

Nowadays, reliability depends on the ability of the actors to organize and reorganize in order to anticipate and cope with unexpected situations, which requires skills of improvisation, creative bricolage, and attitude of wisdom. The world is complex, with multiplex of forces and no cause-and-effect chain. But what skills should future professionals possess and reinforce during their curricula to be prepared to reliable Decision Making in new environments?

[3] http://reports.weforum.org/future-of-jobs-2016/




Figure. A VUCA lens ((c) H. Audunsson).

## What is VUCA?

Future professionals should be specifically prepared to making decisions in VUCA environments, i.e. Volatile, Uncertain, Complex, and Ambiguous situations. VUCA is a concept that originated with students at the U.S. Army War College to describe the volatility, uncertainty, complexity, and ambiguity of the world after the Cold War. And now, the concept is gaining new relevance to characterize the current environment and the leadership required to navigate it successfully.




Figure. The VUCA context.

Innovation is the engine of sustainable economic growth and decisions are the fuel to that engine. In the McKinsey Quarterly from May 2012 the following quote can be found: ‘‘Across many industries, a rising tide of volatility, uncertainty, and business complexity is roiling markets and changing the nature of competition.’’ Unpredictable events happening outside an

organization can be negative or positive, but either present greater VUCA, which makes it more difficult for leaders to make decisions.

Decisions making in theory are based on what Daniel Kahneman refers to as System 1 and System 2 reflections of the human brain. The two different ways the brain forms thought are:

- System 1: Fast, automatic, frequent, emotional, stereotypic, unconscious.
    - System 1 thinking in context of VUCA refers to how cognitive, emotional and behavioral subjects impacting the decisions we make in a reactive way.
- System 2: Slow, effortful, infrequent, logical, calculating, conscious.
    - System 2 thinking in context of VUCA refers to how logics, data and engineering procedures can be applied to optimize the decision making process.

It can therefore be argued that the risk that due to the increased VUCA impact in the business world is affecting decision makers are facing bigger challenges than ever before.

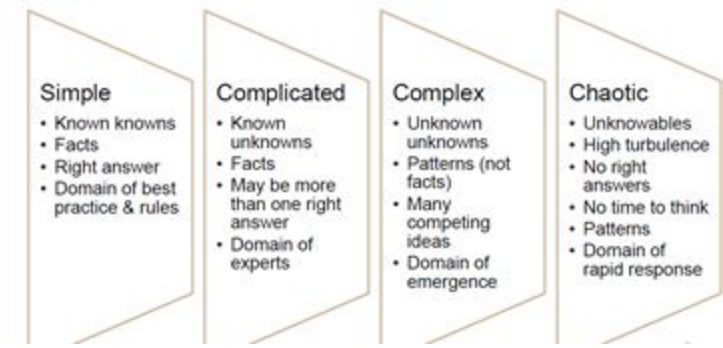



Figure. The development from the known known´s to the VUCA situation of unknown unknown's.

The undercurrent of changes can i.e. be verified by the trend in brand value of companies and organizations. In 2006 these were the Microsoft, General Electric, Coca-Cola, China Mobile and Marlboro. A little more than decade later, in 2017, the list is Google, Apple, Microsoft, Amazon and Facebook. (Source: http://www.millwardbrown.com/brandz/top-global-brands/2017).

All technology companies that have changed the world in more disruptive manners than the world has seen before. To name an example currently it is estimated that 25% of global ad spend goes to Google and Facebook (Digital Advertising Report 2017 - Social Media Advertising, https://de.statista.com/statistik/studie/id/36293/dokument/digital-advertising-report-social-media-advertising). "We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private

sectors to academia and civil society" (14 Jan 2016, Klaus Schwab, Founder and Executive Chairman, World Economic Forum Geneva). The Erasmus+ project on Construction Managers' Library (ERASMUS+ 2015-1-PL01-KA202-01) recalled that "what we know is that the future will be full of surprises even more now than before. Many of the events, technical developments, social circumstances, etc., we now take for granted would have been considered impossible only few years back. The jobs that are in top demand today did not exist in few years ago. We are in fact preparing students for jobs that do not exist today and educating decision makers and problem solvers to solve problems we do not know yet. Uncertainties are a fact of life and it is a mistake to allow them to postpone business decisions. According to some estimates, about 90 percent of what we historically 'knew' to be correct has subsequently been disproved. Obviously it is difficult to accurately predict the future, let alone control it. But uncertainty—not certainty—is the norm for strategic planning and decision making. In hindsight, most surprises should have been predictable and sometimes even preventable. Here are some statements that in light of history should have been challenged (courtesy of The Freeman Institute™. Hundreds of them!, http://freemaninstitute.com/quotes.htm):

- "This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us." (Western Union internal memo, 1876)
- "Heavier-than-air flying machines are impossible." (Lord Kelvin, president, Royal Society, 1895)
- "Everything that can be invented has been invented." (Charles H. Duell, Commissioner, U.S. Office of Patents, 1899)
- "Airplanes are interesting toys but of no military value." (Marshall Ferdinand Foch, Professor of Strategy, Ecole Supérieure de Guerre, 1911)
- "Stocks have reached what looks like a permanently high plateau." (Irving Fisher, Professor of Economics, Yale University, 1929)
- "I think there is a world market for maybe five computers." (Thomas Watson, chairman of IBM, 1943)
- "Computers in the future may weigh no more than 1,5 tons." (Popular Mechanics, forecasting the relentless march of science, 1949)
- "I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year." (The editor in charge of business books for Prentice Hall, 1957)
- "We don't like their sound, and guitar music is on the way out." (Decca Recording Co. rejecting the Beatles, 1962)
- "But what is it good for?" (Engineer at the Advanced Computing Systems Division of IBM, 1968, commenting on the microchip)
- "There is no reason anyone would want a computer in their home." (Ken Olson, president, chairman, and founder of Digital Equipment Corp., 1977)
- "640K ought to be enough for anybody." (Bill Gates, 1981)
- "$100 million dollars is way too much to pay for Microsoft." (IBM, 1982)

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Arguably the best attempt to define VUCA, what it is and how to approach it comes from Nathan Bennett and G. James Lemoine see the figure below.

| | What it is | An example | How to effectively address it |
|---|---|---|---|
| Volatility | Relatively unstable change; information is available and the situation is understandable, but change is frequent and sometimes unpredictable. | Commodity pricing is often quite volatile; jet fuel costs, for instance, have been quite volatile in the 21st century. | ***Agility*** is key to coping with volatility. Resources should be aggressively directed toward building slack and creating the potential for future flexibility. |
| Uncertainty | A lack of knowledge as to whether an event will have meaningful ramifications; cause and effect are understood, but it is unknown if an event will create significant change. | Anti-terrorism initiatives are generally plagued with uncertainty; we understand many causes of terrorism, but not exactly when and how they could spur attacks. | ***Information*** is critical to reducing uncertainty. Firms should move beyond existing information sources to both gather new data and consider it from new perspectives. |
| Complexity | Many interconnected parts forming an elaborate network of information and procedures; often multiform and convoluted, but not necessarily involving change. | Moving into foreign markets is frequently complex; doing business in new countries often involves navigating a complex web of tariffs, laws, regulations, and logistics issues. | ***Restructuring*** internal company operations to match the external complexity is the most effective and efficient way to address it. Firms should attempt to 'match' their own operations and processes to mirror environmental complexities. |
| Ambiguity | A lack of knowledge as to 'the basic rules of the game'; cause and effect are not understood and there is no precedent for making predictions as to what to expect. | The transition from print to digital media has been very ambiguous; companies are still learning how customers will access and experience data and entertainment given new technologies. | ***Experimentation*** is necessary for reducing ambiguity. Only through intelligent experimentation can firm leaders determine what strategies are and are not beneficial in situations where the former rules of business no longer apply. |

Figure. An attempt to define VUCA: What a difference a word makes: Understanding threats to performance in a VUCA world. Nathan Bennett and G. James Lemoine, Business Horizons (2014) 57, 311—317

## Volatility

A volatile situation can be defined as one that is unstable or unpredictable; it does not necessarily involve complex structure, a critical lack of knowledge, or doubt about what outcomes may result from key events. Rather, volatility most closely represents the general definition of VUCA commonly used in the business press: relatively unstable change. A manager facing a volatile situation seeks to address certain questions: Will the situation create a spike in prices? If so, how high? And how long will the elevated prices last?

An example is a fire in the production facility of a large computer chip production facilities. The fire introduces cost volatility, but the situation can be managed. The manager knows that the fire could cause price increases, he knows the history of price fluctuations for the production items, and he likely has a good idea of what has caused these trends. He has information on other suppliers for the production and how many other production facilities for the part exist within the key supplier. The secret to dealing with volatility, as with any component of VUCA, is understanding the opportunities and threats inherent in the situation.

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## Uncertainty

Uncertainty is a term used to describe a situation characterized by a lack of knowledge, not as to cause and effect but rather pertaining to whether a certain event is significant enough to constitute a meaningful cause. Uncertainty is not volatility. A volatile situation is one in which change is likely, but that change may come quickly and at varying magnitudes; an uncertain situation, on the other hand, is not so volatile. In fact, there may be no change inherent in it at all. For instance, a manager can be uncertain about the pending product to be offered by his competitor. There is nothing volatile here; he simply does not know enough to plan a best response.

The solution to volatility is agility and building slack resources, but there is not enough information in an uncertain situation to indicate that this would be an appropriate response. If there is not enough information to indicate that volatile change is approaching, stockpiling resources could be a costly waste of time. Because uncertainty exists in the lack of adequate information, addressing it simply involves obtaining information. Investment here entails methods of collecting, interpreting, and sharing information. Uncertainty can be solved structurally by devoting more resources to boundary-spanning activities: moving beyond existing networks, data sources, and analysis processes to gather information from new partners and look at it differently. Information networks are created from many different sources, both inside and outside the firm.

This principle is well illustrated by the aftermath of the 2001 U.S. terror attacks. Since those events, the world has lived with a greater sense of uncertainty regarding if, when, and where a next attack could occur. To again reinforce distinctions between the different components of VUCA, we note that the post-9/11 situation was not necessarily volatile: the core issue facing the world's governments was not a lack of stability or predictability. Rather, who might be behind them? This was the core of the West's uncertainty, but not necessarily a volatile situation, nor a totally ambiguous one, nor an overly complex one. Addressing the uncertainty regarding the strategies of potential terrorists has led governments around the world to collect and cull through unimaginable amounts of information. New partnerships were formed and information networks established, resulting in a relatively successful anti-terror campaign. The key to the West's success in rebuffing more attacks in the style of 9/11 has been uncertainty reduction through relentless information gathering.

## Complexity

A complex situation is characterized by many interconnected parts. Again, this is distinct from a volatile or an uncertain situation. The situation decision makers are faced with in regard to the regulatory environments and political climates in the many nations where their company does business is indeed complex, but not necessarily volatile or uncertain.

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There is no unpredictable or unstable change implied in this situation, and managers and decision makers are not faced with a lack of key information. Indeed, they have a great deal of hard information on regulations, tariffs, and the like, but are overwhelmed by the need to process it all. In complex situations, a great deal of effort is required to collect, digest, and understand the relevant information in its entirety. A complex situation calls for a uniquely distinct response that is utterly separate from those necessitated by the other components of VUCA. This highlights the danger of not properly understanding and defining firm challenges. Although effective in volatile situations, stockpiling resources is useless if a firm does not understand where best to allocate them in a complex environment.

Similarly, establishing new information networks, as a firm should do in times of uncertainty, risks an even greater degree of information overload, which can cause firms to freeze and not make any decisions at all. Instead, the most straightforward way for an organization to address complexity is to simplify the situation by adopting a structure that mirrors that of the environment.

Research has consistently shown organizations that adapt themselves to match environmental change perform at substantively higher levels, whereas firms that maintain past structures and processes in the face of a changing business environment are less effective.

Organizations should be structured to align with and take advantage of environmental complexity rather than struggle against it. In the most obvious example, as a small, informal organization grows, it is expected that formal departments will appear to address what has become too much for a single person to handle. A smaller operation dealing with a smaller group of suppliers, a smaller customer base, and fewer regulations works best within a relatively simple organizational structure, but that structure becomes obsolete as the organization grows and, consequently, the organization's operating environment becomes more complex. Finance, operations, marketing, and human resources functions are established so that each part of the organization addresses something in which it has expertise. As the organization grows larger, complexity will increase and departments may divide further: the human resources department may hire specialists in benefits, compensation administration, and other compliances.

Causes of this internal restructuration should not be limited to changes within the organization; changes in increasingly complex business environments (i.e., changes outside the organization) also indicate a need for internal change.

### Ambiguity

Ambiguity characterizes situations where there is doubt about the nature of cause-and-effect relationships. Looking at the situation when fire is loose in the chip production facilities, it is easy to see how this is distinct from the other components of VUCA. It's not volatile: there is no reason for the manager to expect quick, unpredictable, unstable change. It's not complex: there

aren't an overwhelming number of moving parts here, just a lack of understanding as to what will happen next. And that lack of understanding is distinct from uncertainty: in a merely uncertain situation, you have a good idea of what causes what.

An ambiguous situation, on the other hand, typically revolves around a wholly new product, market, innovation, or opportunity. In an uncertain situation, you can predict what may happen if you gather adequate information. An ambiguous situation is more challenging because of the newness: there is little historical precedent for determining the outcomes of certain causes or courses of action. Stockpiling resources, while appropriate for volatile situations, could be a huge waste of time and energy in an ambiguous situation. Gathering information is similarly unhelpful when a situation is ambiguous, as you likely don't know what information would be most useful to gather.

Likewise, a company restructuring could be enormously inefficient if the firm doesn't really understand what that restructuring might lead to. The fourth component of VUCA continues the overall trend: the solution that works for one part of VUCA likely won't work for the other three. Each dimension of VUCA is distinct and unique, and requires a different optimal course of action. In the case of ambiguity, we believe the key to success is experimentation, not slack resources, information gathering, or restructuration. Recall that ambiguous situations are those in which the relationship between cause-and-effect is uncertain. Such could be said of the challenge the digital revolution is presenting traditional print publishers: how news junkies will want to stay informed, how students will want to get their learning materials, and how lovers of fiction will want to discover new authors are factors that will require the industry to adopt a mindset of experimentation. Further, technology allows content providers to entirely circumvent traditional publishers. It is unclear what the revenue model that maximizes return will be. Successful publishers, small and large, have thus far responded to this ambiguity with experimentation and a willingness to take risks. In an industry not typically recognized for groundbreaking innovation, publishers have created bundled contracts for authors with both traditional publishing and e-books, offered bonus content to customers who purchase e-books through their own digital marketplaces, embedded exclusive videos within their e-books, and even offered book chapters or whole books for free (for a limited time) in order to entice new readers. What will work as a business model 10 years from now? The only way these publishers can find out is to experiment with the unprecedented.

## VUCA examples in the DAhoy partners environment

### UK EU Referendum

The result of the UK EU Referendum and the triggering of Article 50 has created some uncertainty for the Higher Education landscape in UK, e.g. regarding the eligibility to access EC funding post Brexit, so as the relationship between the EQF and the SCQF and in particular the

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current formal referencing between the two frameworks. Whilst the full implication of the Referendum and the UK's exit from Europe is not clear.

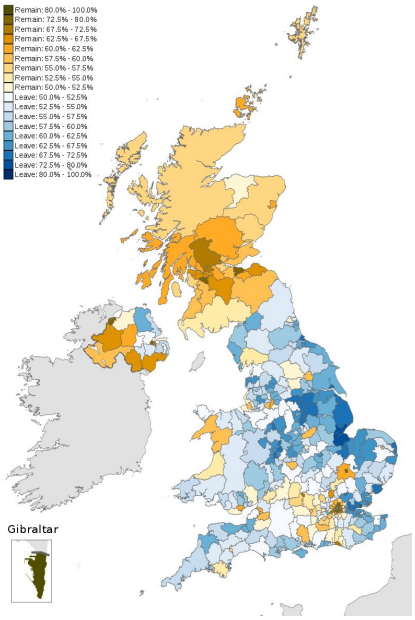



Figure. Brewit UK election map (by Mirrorme22BrythonesNilfanion,CC BY-SA 3.0).

In relation to participating in and receiving funding for European projects, the National Agency for Erasmus+ in the UK (a partnership between the British Council and Ecorys UK), remains wholly committed to the Erasmus+ programme and its benefits (https://www.erasmusplus.org.uk/brexit-update). The National Agency strongly supports continued full membership of the programme for the UK through to 2020 as planned, under the proposed Brexit implementation period. The latest guidance from them is as follows:

> *The UK Government has stated publicly that the United Kingdom is committed to continuing full participation in the Erasmus+ programme up until we leave the European Union. The Government has now agreed a fair financial settlement with the EU enabling it to move to the next stage of negotiations. With the caveat that "nothing is agreed until everything is agreed", in principle the UK will continue to benefit from all EU programmes, including Erasmus+, until the end of the current budget plan (2014-2020).*
>
> *UK organisations wishing to apply for funding in 2018 should prepare for participation as usual ahead of the 2018 application deadlines. The 2018 Call for Proposals was published on 25 October 2017 with an update on 15 December. The UK Government has made clear that it values international exchanges. In the unlikely event of a 'no deal' scenario, the Government guarantee already made still stands, and successful Erasmus+ applications which are submitted while the UK is still a Member State, even if*

> *they are not approved until after we leave, can continue beyond the point of exit. The guarantee applies to funding allocated to UK organisations, whether in applications submitted to Brussels (centralised) or to a National Agency (decentralised), whether or not the UK is the lead partner. Applications for Higher Education submitted before the exit date will include mobility in the 2018/19 and 2019/20 academic years. Practical details regarding how this would be implemented will be discussed with the Department for Education (the UK's Erasmus+ National Authority) over the coming months.*
>
> *Ecorys Website Brexit update 21 December 2017*

However under current rules, when the UK ceases to be an EU member state it will become ineligible to be part of any Erasmus+ projects and this funding stream would no longer be available. As an example, whilst SCQFP (DAhoy partner) may still be a partner of choice for other member states due to our good reputation in this area, governments in these other member states may be reluctant to approve/ recommend the Partnership due to the current uncertainty over future eligibility and status. In addition, the formal referencing of the SCQF and EQF is seen as an important contribution to student and worker mobility in Scotland and to the recognition of the SCQF across Europe and beyond and the SCQFP is keen to continue this work if possible. The current referencing was carried out some years ago and there have been many significant changes to the education system in Scotland (although not to the Framework itself). It is felt that it would be advantageous to ensure that this referencing is as up to date as it can be at the point of Brexit and discussions are ongoing as to the possibility of a new referencing process being undertaken before that. SCQFP has conducted a pilot re-referencing of the SCQF with the EQF but this has not been submitted to the EQF Advisory Group as we are in discussions with the other framework owners across the UK.

### Volcano and Bank crisis or touristic opportunities, Icelandic cases

Iceland has been severely affected by the 2008 crisis so that the university had to make severe cuts in its budget. So they were trying to build new premises at the time the crisis erupted: specifically, the university plan was shaped like a sun with rays 6 and they did that 3 (Mars, Venus and Uranus); the entrance is through the sun of the center that looks a bit like life center but in circles; This is a bright and pleasant space where the cafeteria and library, which gives the international service; it is reconfigurable for conferences; teachers offices were all open space to reduce costs - what they were obviously struggling to get used to, offices are now more and more in place.

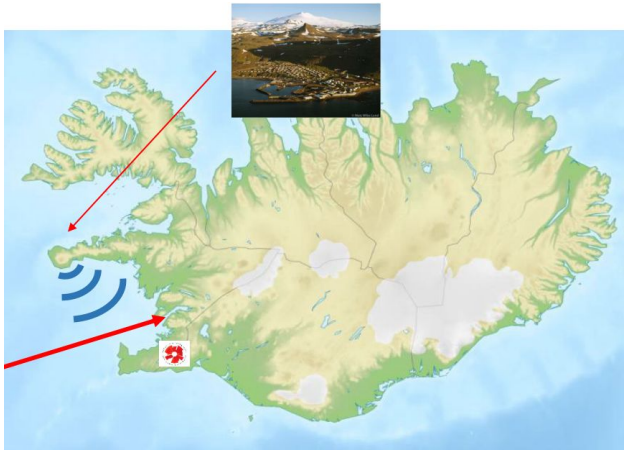


Figure. Icelandic volcano potential effects.

## Employment in regions

### Regional independence

The political situation in the Autonomous Community of Catalonia in the months of September and October of 2017 was complicated. The political and social tensions -as a result of the approval of the laws of disconnection with the Spanish State and the declaration of independence of the Republic of Catalonia for the Parliament of Catalonia- caused that the Catalan people were divided, and any companies were deciding to leave Catalonia to other Spanish regions. There was a VUCA situation, where volatility, uncertainty and ambiguity persisted. It was not known if the tension between the Spanish Government and the Catalonia Government could lead to civil confrontations, social tensions and the fall of economic production in Catalonia. Many Catalan people were worried and it was reflected in the press that there were people who had not slept for days.

A great number of citizens of the Balearic Islands studies in Catalonia. There are some university disciplines that are not offered in the Balearic Islands as superior architecture, and others like medicine have been created a few years ago. The political situation in the Autonomous Community of Catalonia also affected the students of the Balearic Islands who live and study in Catalonia, as well as those who had already obtained the degree in one of the Catalan universities. Some of the Majorcan students, supporters of Catalan independence, were mobilized and have scarcely been working and performing exams or continuous and comprehensive evaluation in their careers. Some of these students asked the university authorities that the partial exams not count in the weighting of the final grade. Other students returned to the Balearic Islands for a few days, waiting to see how events evolved. They were not clear if they were going back to the universities until they confirmed that social tension was decreasing.

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And a significant number of people who have graduated or have not yet obtained the degree in the Catalan universities were afraid of the loss of the value of the titles and their possible homologation. Several scenarios were opened. The students would have to obtain the recognition by Spain of their titles granted by the Catalan state in case of recognition of Catalonia as a new foreign country. Likewise, university degrees would have to be approved by the Spanish authorities, making it difficult for students and university graduates from Balearic Islands to integrate quickly into the Spanish labor market. The VUCA situation in Catalonia could end up generating concern on the part of those Majorcan people who study or have studied at Catalan universities.

### Repreneurs in the regions

Brittany suffers from a problem, decision centers are somehow out of its scope, Paris being the main hub. In case of economical jerk, the region can not so much help large companies. As a resounding example, SDMO (the 3rd world leader of electric generators) was created in 1966 in Brest and sold in 2005 to the US KOHLER Co. multinational. If local SDMO engineers and managers (and future ones) are to be in better capacity to decide and adapt vis-à-vis their superstructure in the US, the region will be more economically autonomous. In large companies also located in Brest (e.g. Thales Group, DCNS), the situation is somehow similar at individual level. At middle career, high technicians, middle managers and engineers are sometimes proposed to change of regional location or benefit from social plans in other companies. HEIs in Brittany, Schools and Universities, should take a position on VET and professional training on decision making for complex environments to capt adults already fixed in the territory. They are more vulnerable to career mobility in case of social plans but are anchored in the region (e.g family well being), and can then be 'repreneurs', i.e. to take over local small companies. Most HE students work in other regional or countries as first job, and are motivated for that thanks to the international dimension of the programme. Non French students tend to return to their countries or join large industrial groups, out of Brittany. Nevertheless, after at least 3 years in the Region, they like it and get inspired by its culture: Brittany has a great potential for quality of life and entrepreneurs to express in the sectors.

## Higher and Vocational Education & Training students to be skill-ready for a VUCA-world?

Globalisation imposes economic and social fluctuations (VUCA World) (1) that will entail making decisions in a complex and uncertain environment. The managers will experience unwanted periods of unemployment (corporate overhauls**,** redundancy plans, business failures, …), but they will also choose to be out of work at specific times (to set a up a business, change careers, re-train, volunteer…). Because of this ‘VUCA World’, the consequences of the options and actions that are taken must be anticipated with care and many and diverging variables need to

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be thoroughly examined, as they are the manifestations of yet unseen market trends and opportunities.




Figure. VUCA in Higher Education roundtable conducted by DAhoyers during the CDIO 2018 Conference; Whiteboard result, 1st July 2018, Kanazawa, Japan. http://www.kanazawa-it.ac.jp/cdio2018/en/program_eng.html

The VUCA context makes decisions even more strategically critical. Entrepreneurship and Leadership skills have been extensively investigated during the last decade to meet EU Modernisation Agenda strategies. Yet, decision is not only about knowledge, it is also about skills. Future Decision Makers should also be specifically prepared to making decisions in VUCA environments. This is the responsibility of HE and VET institutions: training future graduates, through a transversal skills approach so that they are able to turn knowledge. into skills, and provide the best professional answer when faced with VUCA circumstances. The first innovative aspect of DAhoy is to support the coherent inclusion of active and engaging pedagogical models. The second is to investigate Decision Making as a transversal skill, as other transversal skills the ability like to think critically, take initiatives, problem solve and work collaboratively. Decision Making is studied in DAhoy in association with three complementary dimensions: Math-based Decision Making, with rationality; Social-based Decision Making, including people's interdependencies and social identities; Career-based Decision Making, to better choose owns career path. DAhoy is grounded in a clearer understanding of the perceptions and expectations of student and fully aligned with the strategic challenges of the partners to accelerate pedagogical innovations and nucleate their HE and VET systems. Through an exchanges of best practices among Schools, in the STEM and Business fields, DAhoy seeks in the coming years:

1. to share and confront educational innovations, practices and methods, in light of professional needs;

2. to catalyse the engagement of learners with innovative courses, integrated in existing but evolving programs, through novel educational initiatives;
3. to develop and disseminate tools for assessment of such skills, via the learning outcomes approach;
4. to assesses their quality and achievements.

As such, DAhoy is to create inclusive, active and experiential pedagogies for Decision Making skills, so as to render education systems more accessible and attractive.DAhoy aims at defining and evaluating innovative Teaching and Learning activities to be integrated in educational frameworks at a systemic level, in line with the Bologna processes and quality assurance purposes, as ENQA and EQAVET recommendations for accreditation and quality enhancement.

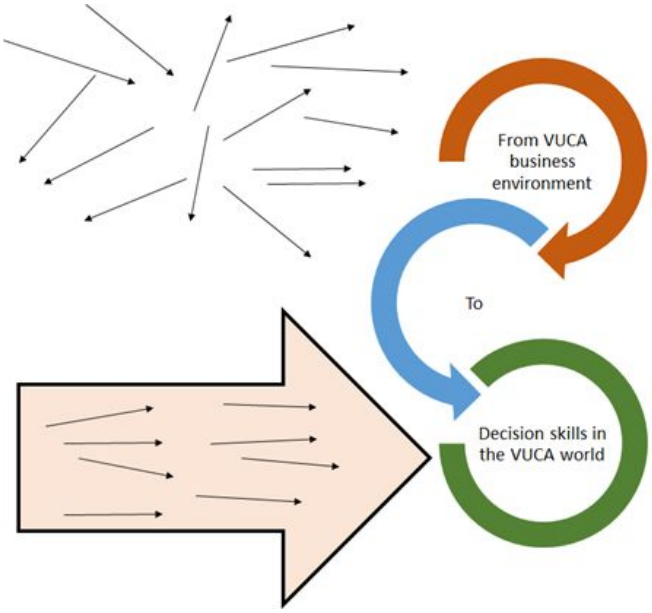



Figure. Visualization of the aim of the DAhoy project.

This leads to the theoretical question: What is VUCA and how to address it in context of the DAhoy project? There are problems that must be addressed, e.g.

1. How can we ensure that everybody understand the four VUCA terms in the same way?
2. How can we apply, adapt and invent management theories to cope with VUCA?
3. How can we teach and train our students, to reinforce their skills to make decisions in a VUCA world?

# Chapter 1: Decision Making

*"For every complex question there is a simple, and wrong, solution", A. Einstein*

According to the Financial Times lexicon, the term decision analysis "was coined in 1964 by Ronald A. Howard, professor of management science and engineering at Stanford University. Decision analysis refers to a systematic, quantitative and interactive approach to addressing and evaluating important choices confronted by organisations in the private and public sector. Decision analysis is interdisciplinary and draws on theories from the fields of psychology, economics, and management science. It utilises a variety of tools which include models for decision-making under conditions of uncertainty or multiple objectives; techniques of risk analysis and risk assessment; experimental and descriptive studies of decision-making behaviour; economic analysis of competitive and strategic decisions; techniques for facilitating decision-making by groups; and computer modeling software and expert systems for decision support" (http://lexicon.ft.com/Term?term=decision-analysis). In context of this report we investigate decision analysis theoretically from three viewpoints named:

- mathematical based approach referring to the use of data, engineering practices and logic to optimize a decision
- social based approach referring to behavioral attributes that impact the decision process
- career based approach referring to the abilities to identify and articulate motivations, skills and personality as they affect career plans and being capable to weigh up personal factors to make a sound plan

It must be stated that in many instances these viewpoints overlap each other. It is also instrumental to recognize that these three approaches should not be considered as separate entities but as pillars that support solid decision framework.

## MDM: Math-based decision making, theories and models

Decision analysis with formal methodological procedures originated in gambling where attitude toward risk is influential. Math-based decision approach and risk management are closely related as axioms of probability that are active in the solicitation. The player constantly estimates his/her chances of winning or losing.

### Background

The first scientific work on probabilities is Liber de Ludo Alae (The book on games of chance), which is reputed to have been written around 1564 by the Italian mathematician and gambler, Gerolamo Cardano. The work of Cardano explained how to calculate the probabilities of particular outcomes in an outcome space of a fixed number of possible events, outcomes and combinations. Hundred years later two Frenchmen, Pierre Fermat and Blaise Pascal took the work of Cardano further and developed the foundation for modern probability calculations.

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Probability of the occurrence of an event is the cornerstone of traditional decision analysis and risk management. The classical approach to probability is what generally is called the objective or empirical probability:

$$P(A) = \text{number of events A/total number of events.}$$

The probability of the event A occurring is the number of all possible events with the state of event, A, divided by the number of all events in the sample space. The axioms of probability will not be discussed in detail here as mathematical explanations fall outside the scope of this report. The limitation of the classical approach to probability is that the prediction of the outcome of a single event is based upon events that have already occurred, based on empirical evidence. However, the decision risk is the uncertainty of events that have not yet materialized. Many possible events with different outcomes must be considered in the assessment of the prevailing options, but the probability of occurrence varies. This is of immense importance in decision diagnosis. There are many possible outcomes in a forecast but each outcome is attached to a variance connected to the frequency of the outcome.

Abraham de Moivre provided decision analysts with perhaps the most important management tool of uncertainty management. In The Doctrine of Chances: or, a method of calculating the probabilities of events in play, de Moivre introduces the first formula to determine the normal distribution curve. The normal distribution is a means for finding the probability of the occurrence of an error of a given size when that error is expressed in terms of the variability of the distribution as a unit, and was the first definition of the probability error calculation.

Expected value (or, where appropriate, utility) is the metric for the evaluation of lotteries. Lotteries are random variable with their associated probability distributions. Each option under the management of a decision maker is considered as a lottery and is ranked according to its expected utility. The highest (or lowest if the assessment is cost related) expected value of a risk assessment is the best decision in a portfolio of options when all possible outcomes have been accounted for with weights (probabilities) indicating the chance of occurrence (uncertainty).

There are several methods for the determination of probability distributions over risky options and a popular term today is the scenario method where each option is evaluated according to predefined states of nature and probabilities. For example, government often use the scenario method in assessing public expenditure under a pessimistic or optimistic state of nature. Another method is the use of Monte-Carlo simulation or decision tree techniques whereby a probability distribution over an objective of interest, as for example the present value of a risky option, is simulated from the risk of underlying inputs such as cost or demand functions. is to call possible outcomes scenarios which are basically the same topic.

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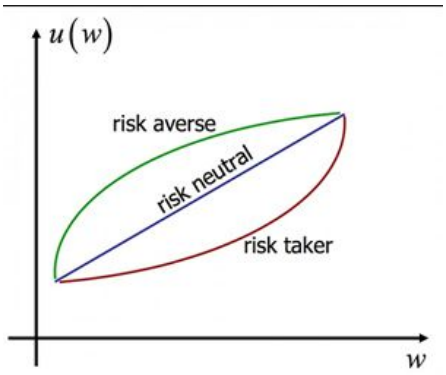
A further fundamental contribution to decision analysis is generally credited to Daniel Bernoulli. As noted earlier, a decision maker must select the option according to the highest (or lowest) expected value. Bernoulli observed that this is not always the case. People do not always behave as to maximize expected value. To demonstrate this principle, Bernoulli described a game known as the St. Petersburg paradox and is arguably one of the original fundamentals of Social-Based Decision Making Skills also accounted for in this report.

To enter this game, the player must pay an admittance fee. After the admittance fee has been accepted the game starts. A coin is tossed until the head comes up. The number of times, n, the tail side comes up before the head is used to calculate the return, R, by this function:

$$R(n) = 2n$$

Bernoulli observed that the size of the sum was related to the wealth of the player. In a contemporary context, one Euro won by a wealthy player is less significant than one Euro to a poor man. Incremental positive amounts add incrementally less value as wealth is accumulated. This leads to the assumption that expected monetary values cannot be the only criterion in decision-making. The attitude towards losses and gains must be considered and measured. This metric is called utility (plural utilities) and plays a major role in modern decision analysis and risk management.

Bernoulli concluded that the response to a change in wealth is inversely proportional to the initial wealth. The mathematical function for utility therefore frequently described as a logarithmic function with a financial value (certainty equivalent) attached to each utility. The shape of the curve describes the attitude to the risk. A function which grows with marginally lower monetary values for the attached utilities describes risk aversive attitude. The decision maker is not willing to risk more money than he expects to gain than he gains in utilities. In other word the certainty equivalent attached to the lottery is lower than the expected value of the lottery. The opposite is to be risk seeking. A utility function describing a risk seeker would have marginally smaller utilities than monetary values.




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Figure. The shapes of risk attitude in decision analysis. Utilities (u) as function of wealth (w).

The most significant use of risk based decision analysis hitherto has been in military operations, insurance and finance. An important addition to the understanding of risk and human behavior is the explanation of regression to the mean contributed by Francis Galton in the beginning of the last century. The first important work dealing strictly with risk and decision-making is Risk, Uncertainty and Profit. In his work Frank Knight makes a distinction between risk and uncertainty. Risk is defined by Knight as a 'measurable uncertainty' and he reserved uncertainty to a 'non-quantitative type'. Functionally speaking, it come essentially to make a distinction between a random variable and its probability distribution.

Uncertainty is not necessary negative. It is simply the cloud preventing us from seeing future events. Keynes (1936) published General Theory of Employment, Interest and Money an important milestone in understanding risk and uncertainty in the decision problem. Knight and Keynes primarily developed theories of economics in context of risk management in their pioneering work which largely falls outside the scope of this paper. Savage (1954) developed an axiomatic for subjective utility theory where in addition to a personal utility function a decision maker possesses a subjective assessment of a probability distribution over the states of nature i.e. a measure of a his/her degree of belief in the truth of propositions.

Prescriptive decision making supposes a careful modeling of the decision problem. The decision maker builds a model by defining assumptions and options:

- who are the decision makers and stakeholders?
- what options are there?
- what factors affect the decision process and what information do they possess?
- what are the preferences over different options?
- how do decision makers evaluate risky options?
- in case of multiple decision makers, what are the rules of the game?
- is there a voting/decision rule for a joint decision, is there a cooperative decision making process or is decision non cooperative (in the sense of game theory)?

The expected utility theory (EU), game theory and decision theory are directly relevant to the subject of this research in understanding how politicians and other stakeholders behave in terms of the conception of public projects and how decision models are constructed. Decision techniques for choices against 'nature' of a single decision maker are treated by approaches such as multi-attribute value theory and EU for risky choices.

EU theory is an axiomatic theory. Rationality of decision making relies principally on two axioms which are the independence of irrelevant alternatives and transitivity. It assumes that decision makers are rational and make decisions to maximize own interests and can distinguish between two or more options. Both axioms have been challenged in the experimental literature by psychologists and economists and have opened the way to behavioral decision making theory

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among which prospect theory and more generally ranked dependent utility theory. These are also the drawbacks of EU theory. People are not always rational and they do not always think about maximizing their own interests. Important improvements on the zero sum approach came from Nash, who introduced nonzero-games and Selten, who followed with sub-games.

It is also worth mentioning the work of Taleb (2007) on what he calls black swan events, i.e. extreme events with low probability and high impact. In fact, Taleb claims that the fundamentals of using probability distributions for estimating the impact of events on outcomes are idiosyncratic. This leads to what Taleb calls ludic fallacy for explaining the drawbacks of using the basic axioms of probability to estimate future uncertainty. Biases concerning probability perception have also been a major failure of expected utility theory which supposes linearity in probability. Experimental observations have paved the way to ranked dependent utility theory.

## Classification

It is important to keep in mind that there are two ways one can approach decision theory:

1. A normative approach aims to provide the decision maker with a good decision. A good decision simply means one which represents truly enough the decision maker preferences given its state of information. Normative theory provides tools for achieving it: modeling tools such as influence diagrams, tools for evaluation and elicitation of probability distributions and finally tools for decision taking such as multi-criteria analysis and utility theory.
2. Second, a descriptive approach aims to understand how people effectively take decision. It is important of maintaining a distinction between both approaches since the goals are different. But certainly the second can bring and has brought methods for the first. For example, methods for probability elicitation have been proposed to minimize framing effects in probability assessments.

The importance of Social-Based Decision Making Skills were cognitive biases and behavioral attributes are significant part of the training is not a coincident. Understanding the cognitive biases of decision making should certainly belong to the training of decision makers as will be addressed later. The descriptive perspective of the decision making process is about how people behave in reality. But EU should not be abandoned when the perspective becomes prescriptive that is giving tools to the decision maker for making 'good decisions'.

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Figure. Visual presentation of decision perimeters of DAhoy.

In spite of the limitations, EU theory is useful for understanding the games decision makers play in projects with objectives that are difficult to measure.

Utility theory addresses rational decision making in a risky but fixed environment. Many decisions in addition involve interactions with other individuals. Game theory deals with situations where the payoffs of each player depend not only on his/her own decision but also on the decisions taken by others players. Von Neumann and Morgenstern initial objectives was to set up for the social sciences the same rigorous scientific methodology as in physics for explaining data. They developed EU when they published Theory of Games and Economic Behavior. The Cold War provided a test bed for Game Theory with its equilibrium state. Important improvements on the zero sum approach came from Nash, who introduced nonzero-games and Selten, who followed with sub-games and equilibrium refinement. A Nash equilibrium is a situation where no player would like to change its decision and the concept is central to prediction making. It assumes that each player is maximizing its expected utility conditional on correctly anticipating the choice of other players.

Many problems however are left unresolved with the concept:

1. firstly, the theory says nothing about equilibrium selection that is with multiple equilibria a theory of equilibrium selection is missing.
2. Second, Nash equilibrium may be a loose concept in infinitely repeated games as shown by the theorems which state that, under the condition that players are patient enough, any individual rational outcomes can be attained.
3. Third, game theory is a highly stylized description supposed to grasp the essential elements of the interaction situation.

Despite these remarks, since many decisions are of game theoretical nature, the game theoretical framework is still useful: first we have learned a lot about behavior with strategic interaction with the use of the game theoretical framework. Notably, carefully controlled

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experiments may be set up, a field called experimental economics. Since we have a theory making prediction, in turn they can be tested and deviation from equilibrium may provide us with a revised a more powerful theory. A new strand of literature called behavioral economics has emerged from this approach. Second, the game theoretical framework may be improved by the use of agent based modeling. Agent based models are computational models whose aim is to simulate the interactions and actions of autonomous computational entities called 'agents'. In an empirical perspective, the modeling seeks to make a structure-preserving map between the real world and the abstract world of the model. One use of an agent-based approach is then to strengthen the realism of the modeling of social systems. Some unrealistic game theoretical assumptions are challenged by the ABM approach: most notably the rationality and knowledge of players and the structure of interactions. They are replaced by players who have access to situated information due to their position in the network, with behavior shaped by their (local) context and with bounded rationality. Social systems are complex and the corollary is that collective behavior may be difficult to predict from the knowledge of the behavior of single components. Complex systems are characterized by emergence. Emergence occurs when the properties of a system present novelty or innovations with respect to the entities in isolation. Moreover, even simple rules of behavior can provide complex phenomena as for example the one observed on cellular automata. In a VUCA environment, such modeling techniques may then be useful to provide a bottom up explanation of social phenomena.

## SDM: Social decision making, theories and models

*"To make a decision, you have to be an odd number of people, and three is already too much".*
*G. Clemenceau*

Axiomatic decisions making made by mathematical approach can be linked with what Daniel Kahneman (2011) call System 2 processing of the mind. System 2 is thinking is slow, effortful, infrequent, logical and calculative and often leads to parameter driven decision models that can be stochastic or deterministic. This type of decisions are frequently data driven and based on empirical evidences. The expected utility theory (EU) is derived from the work of Von Neumann and Morgenstern (1944). The fundamental principle is that the rational decision maker can clearly distinguish between options by combining the probability of an event and the impact of the outcome. Risk attitude is usually described by the shape of the person's utility function derived from how the person chooses between options (Weber et al., 2002). The terms of being risk averse, risk neutral and risk seeking refer to the curvature of the expected utility function.

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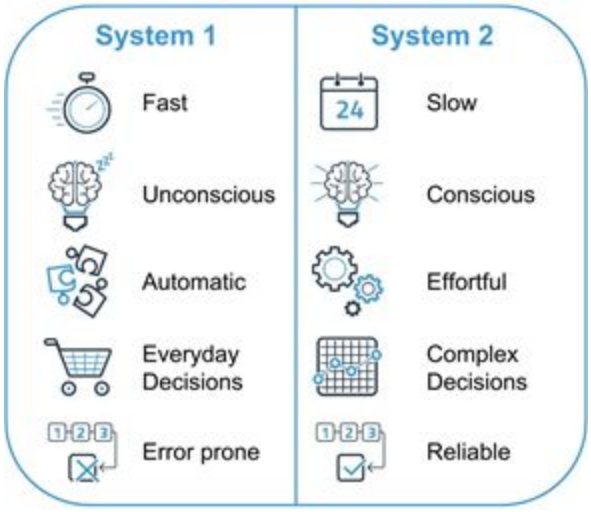



Figure. Visualization of the characteristic of System 1 and System 2 thinking.

These expected utility theories are related to standard rational choice theory (RCT), are useful normative approaches, but there is a catch. According to H. Simon (1955), RCT is based on five assumptions:

- the problem is clear and unambiguous and the decision-maker has complete information regarding the decision situation
- the decision-maker can identify all the relevant criteria, can list all the viable alternatives and is aware of all the possible consequences of each alternative
- there is no time or cost constraints for the rational decision-maker to obtain full information about criteria and alternatives;
- there are decision criteria and alternatives that can be ranked and weighted to reflect their importance and that are constant and stable over time
- the rational decision-maker will choose the alternative that gives the highest perceived value.

Yet, especially in VUCA context, decision-makers' rationality is bounded, i.e. their decisions are "as much determined by the 'inner environment' of people's minds, both their memory contents and their processes, as by the 'outer environment' of the world on which they act, and which acts on them. As shown by Simon, decisions are influenced both by internal and external factors, which has led to further studies in psychology and cognitive science (at the individual level) and in sociology and organization science (at the group and organizational levels).

First, at the individual level. The problem is the decision maker's inability to make accurate assumptions from probabilistic data and rank the options. This has for example been verified by Schoemaker (1982) and, not the least, by Kahneman and Tversky. With ingeniously arranged tests, Kahneman and Tversky (1973) demonstrated several cases where people violated the expected utility assumptions. They argued that people apply mental rules, heuristics, to simplify

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the complex task of assessing probabilities and predicting values. Decisions are made on the basis of how easily events are brought to mind rather than utilizing statistical evidence; in other words, what is typical rather than the law of small numbers or statistical independence of events and how the data are then interpreted. Although useful in practice, heuristics can lead to judgmental errors as Kahneman and Tversky noted in their work on judgment and uncertainty. According to Gilovich et al. (2002) and Kahneman et al. (1982), even when decision makers know the situation they make inferential errors. Researchers have also identified several cognitive biases (e.g. confirmation, anchoring or overconfidence biases).

It also seems that even though people realize that their earlier prediction was highly optimistic, they are convinced that their present assumption is realistic. Cognitive bias and the pattern of deviation in judgment that occurs in particular situations can lead to planning fallacies, resulting in over-optimistic forecasting which increases transaction costs in the value chain. Beyond biases, decision-making is always an issue of risk perception and behavior. Risk attitude is usually described by the shape of the person's utility function derived from how the person chooses between options. The terms of being risk averse, risk neutral and risk seeking refer to the curvature of the expected utility function.

Apart from this internal level, individuals' choices are affected by collective and organizational dimensions. First, individuals are nearly always included in groups that influence their own decisions. Secondly, most human actions are carried out in organized and often regulated context, which has a strong effect on decisions. More, in order to limit individual biases quoted above, most decisions are made collectively.

A cognitive bias is a systematic error in thinking that affects the decisions and judgments that people make. Some of these biases are related to memory. The way you remember an event may be biased for a number of reasons and that in turn can lead to biased thinking and decision-making. A cognitive bias occurs when people are processing and interpreting information in the world around them. The human brain is powerful but subject to limitations. Cognitive biases are often a result of your brain's attempt to simplify information processing. They are rules of thumb that help you make sense of the world and reach decisions with relative speed.

When you are making judgments and decisions about the world around you, you like to think that you are objective, logical, and capable of taking in and evaluating all the information that is available to you. Unfortunately, these biases sometimes trip us up, leading to poor decisions and bad judgments.

In DAhoy we will form a melting pot of two sustaining approaches to enhance the leadership qualities in context of decision making for our students.

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# CDM: Career decision making, theories and models

"Never ask your way to the one who knows, you may never lose yourself"
Dupré, Mélopée Africaine

The world is changing at a rapid pace, professional and even personal life environments are now more than ever volatile, uncertain, complex, and ambiguous. HE and VET diplomas greatly facilitate first job offers. Alumni prefer responsibilities and interest of the mission. They have the same interest for the '*climat social*' in the company. Graduate students prefer a 'useful' position according their values.

As recalled by Robin Karvo (Nokia HR Consultant) and Isabelle Leclerc (Talent Acquisition and Development Manager at Amadeus s.a.s.) in the DAhoy Youtube channel[4] early 2018, judgement and career decision making skills are a key of professional and personal development. Students are to *Learn to Be Employable and Manage their Own Career*. How can higher education institutions and educators prepare learners for an unpredictable professional future and reinforce their career decision making skills, to take good career decisions at right times? In the choice of career paths, the professional role and the transversal skills associated, DAhoy project members integrated in their study :

- decision making in planning a professional project during studies;
- decision making in building a training course (internship choices, project choices, decision to be involved in the community life of the school or not, choice of studies);
- decision making for the first job (entrepreneurship);
- decision making in career mobility throughout the professional life.

The CDM subjects study are then:

- To identify students' perception and misconceptions of profession, skills, or career paths;
- To make students actively manage their own professional path, build their future professional identity, plan proactively their future career, maybe phrase few investigations or research questions for the HE and VET community.

## EU projects

European projects on the theme were identified. The Network for Innovation in Career Guidance and Counselling in Europe (NICE) (http://www.nice-network.eu/) worked on a model developed by an academic network of 40 higher education institutions in 28 European countries, which is funded with financial support from the European Commission under the Lifelong Learning Program. It includes one Curriculum framework that is composed of 9 modules. The modules systemize numerous ideas for the definition of learning outcomes in terms of competencies and resources required (Generic Professional Competences, Career Education, Career Assessment and Information, Career Counseling, Career Service Management, Social Systems Interventions). The PREFER project (Professional Roles and Employability of Future

[4] DAhoy Youtube channel https://www.youtube.com/channel/UC06_8Z8LageKeghBH3kJfow/videos

EngineeRs, http://preferproject.eu) aims to reduce the skills mismatch in the field of engineering. Young engineering graduates often display a lack of self-awareness of who they are as an engineer. The PREFER project aims to help engineering students/graduates with identifying their strengths and weaknesses. Additionally, it will to provide them with opportunities to actively explore the wide variety of engineering roles in the labor market. The project will develop a Professional Roles Framework. The Professional Roles Framework will consist of a number of different roles that engineers can take up in industry. Each role will be clearly defined with an associated set of competencies and skills. Working group are also in the place. LA.R.I.O.S is Research and Intervention Laboratory for Choice Orientation of the University of Padua. It is a working group that offers interventions - which are the result of rigorous research - to students and workers who are interested in counseling activities (http://larios.psy.unipd.it/ze-research.php). The laboratory develops some decision making skills:

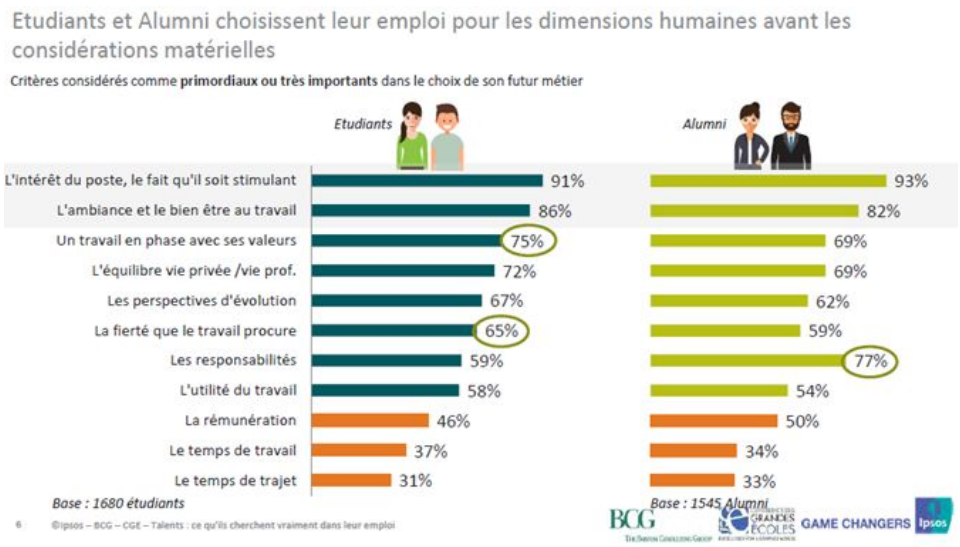
- Analyzing effects of cognitive and non cognitive variables on decisional styles
- Increase cognitive and non cognitive dimensions of decision making
- Development of the effectiveness in the career decision making

## Factors

The key motivation factors by which graduate students select and choose their first job are around:

| | |
|---|---|
| - the adequacy with a professional project<br>- the reputation of the company<br>- the activity sector of the company<br>- the location<br>- the evolution perspectives within the company<br>- the general policy of human relations in the company (social climate)<br>- the career perspectives, mobility<br>- the corporate social responsibility policy<br>- the personal and professional life balance<br>- the content of the mission / of the job (challenging)<br>- the salary<br>- the lack of alternative | - business creation in absence of other alternatives<br>- business creation by vocation<br>- hierarchical responsibilities (teams)<br>- financial responsibilities<br>- managerial responsibilities (project management, affaires management, management of transverse teams)<br>- expert responsibilities<br>- working conditions<br>- relationships with colleagues (teamwork)<br>- the management style (participative, delegative, etc)<br>- the level of autonomy<br>- the amount of responsibilities<br>- the feeling to be ‘useful’<br>- international opportunity<br>- social and solidaire economy |

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Januar 2018 - IPSOS - BCG - Barometer of graduate students from 'Grandes Ecoles' in France

The principal recruitment sourcing for graduate students are in French 'Grandes Ecoles':

- Career advisor, University information
- Alumni network
- Internship period (during the studies)
- Job forums
- Recruitment agencies
- Spontaneous applications
- Internet specialised in recruitment (linkedIn, Monster, etc)
- Film, video
- Print medias
- Teachers
- Personnel relationships (Friends, Family, …)
- Competitions

One one hand some students struggle to identify career directions and therefore need some time before being professionally operational right after their graduation. On the other hand, junior should take care of their early professional pathway as attractive offers may have sometimes bad smells.Graduate diplomas greatly facilitate first job offers and open up on broad career possibilities in many economic fields where graduate managers and engineers may often exercise their potential as leaders and future decision makers. However, uncertainty and indecision often result from student appraisal of the career kaleidoscope. Some struggle to identify career directions and therefore need some time before feeling committed and being operational within their curriculum and first jobs.



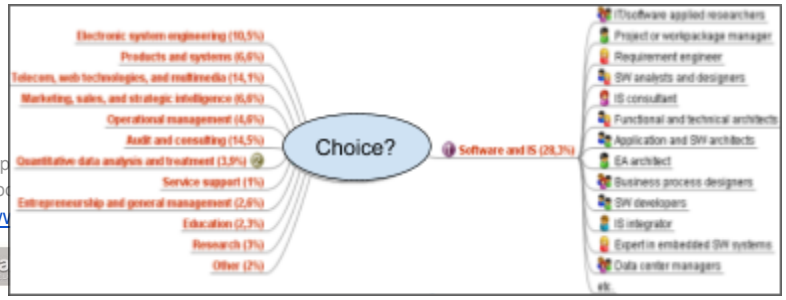
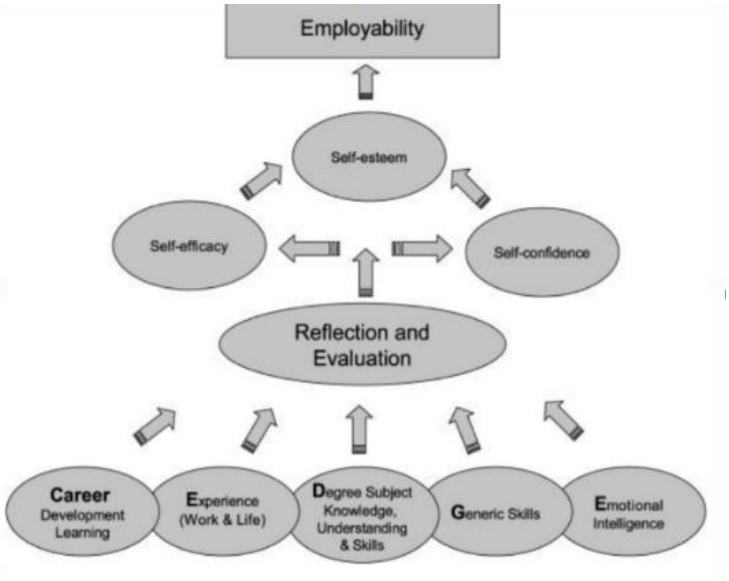



Figure i. xxx.

The European Lifelong Guidance Policy Network (www.elgpn.eu/) regards career management skills as competencies which help individuals to identify their existing skills, develop career learning goals and take action to enhance their careers. For the Life-Span Approach to Career Development (Dacre-Pool), the individual looking for a job should starts by formulating a question, examining and identifying the necessary facts in order to understand the situation, evaluating the data, identifying differents action plans, weighing the potential result of each outcome and calculating their respective probabilities. The last steps therefore consist of evaluating the alternatives in terms of value and objective, choosing the best action plan, storing the other alternatives for future reference and proceed with the chosen plan either on an exploration basis or in a definitive manner while remaining experimental. The determinants are either personal (genetic constitution of an individual modified by their experiences) or situational (geographic, historic, social and economic conditions).




Figurei. 'The key to employability : developing a practical model of graduate employability' (by Lorraine Dacre Pool and Peter Sewell Centre for Employability, University of Central Lancashire, Preston, UK)

The personal aspects rely on:

- self-confidence,

- values,
- decision-making abilities,
- stress related to subjects,
- career choices,
- personal anxiety,
- inconfort with uncertainty.

## Models

Several models addressing career decision making exist (e.g. Roger's Seven Point Plan, Holland's Matching Approach, Super – A Life Span Approach, Krumboltz et. Al. - Planned Happenstance, Hodkinson and Sparkes - Career ship). The Holland's Theory of Career Choice the RIASEC model. The Holland theory is the best known and most widely researched theory on this topic. It is widely used by professionals. Choosing a career or education program that fits Holland personality is a vital step toward career well-being and success–job satisfaction, good CDM good grades, and graduating on time. The DOTS model is a four stage model of career planning originally developed by Bill Law and Tony Watts of the National Institute for Career Education and Counselling. It has 4 stages:

- **D:** Decision Making – being able to weigh up personal factors to make a sound plan - career exploration and Decision Making
- **O:** Opportunity Awareness – Knowledge of opportunities and the ability to research these

- **D:** Decision Making – being able to weigh up personal factors to make a sound plan - career exploration and Decision Making
- **O:** Opportunity Awareness – Knowledge of opportunities and the ability to research these
- **T:** Transition Learning – Understanding of how to seek and secure opportunities - Career literature, Fairs, Work experience
- **S:** Self Awareness (self assessment and the ability to identify and articulate motivations, skills and personality as they affect career plans)




Figure. DOTS model for career management (by Liverpool university, pcwww.liv.ac.uk/~pgro/CareerResources/

Jenny Bimrose and Sally-Anne Barnes work in the Institute for Employment research at the University of Warwick and studied decision making in particular. They found 4 different styles depending on one's environment and personality.

1. **Evaluative careerists :** Individuals using this form of decision-making are undertaking a process of learning not only about themselves, but also about the consequences of their long-term decisions. Through a process of self-reflection and evaluation, individuals become more comfortable and confident in their decisions, aware of their particular skills and are able to identify preferred outcomes and goals.
    a. An example is provided by a graduate who had been employed for three years in administration with a small finance company and had become very disillusioned with his job. A process of reflection brought him to the decision that he wanted to change his career, but that there were practical issues to overcome. He had a mortgage on his house, so had financial commitments he had to meet. He wanted to remain in the same geographical area and was dependent on public transport because he did not drive. After completing a psychometric test, he started to explore his options and invested much of his holiday entitlement (20 days) in a thorough process of job search, including visiting possible employers. This became a frustrating process, as he was unable to spend the time needed in researching and applying for alternative jobs. Weighing all his constraints and options carefully, he then decided that he wanted to train for teaching. After fully researching this possibility, he concluded it was financially and practically feasible. He therefore applied for teacher training and was accepted into the course.
2. **Strategic careerists :** This is based on cognitive processing in which an individual bases their choices on a process of analysing, synthesising, weighing up advantages and disadvantages, and setting plans to achieve goals. Through this process, decisions are based on rational conditions. Individuals using this style of processing information and making decisions are competent in understanding a problem, considering and reflecting on options, and, perhaps more importantly, focusing on one particular solution.
    a. One client, for instance, had targeted various companies at a career fair for graduate employment, negotiated selection interviews and then accepted one of the three jobs offered. She then manoeuvred herself in different sections of her employing organisation at six monthly intervals, as she had worked out that exposure to varied employment contexts would provide her with the necessary preparation and skill development for realising her long-term career ambition of running her own business.
3. **Aspirational careerists :** Aspirational careerists adopt a style of career decision-making based on focused but distant career goals, and their career decisions are intertwined with personal circumstances and priorities. They take jobs that provide the necessary finance, which become a means to an end. Interim goals are not necessarily related to formal employment and achieving their ultimate career goals is definitely ‘work in progress’.
    a. A client has a degree in fine art and aspires to sell his artwork. He took a job as a media technician in a local school as he needed a source of income on which to live. After becoming bored with this job, he took a job in a pub. This lasted for only a few months before he left and spent about a year painting, but unemployed. At that stage, his father fell ill, so he took a data entry administrative job that pays well. This was to save his father from having to worry about him as it provides the financial support he needs to paint for about 30 hours a week. He is still hoping to make a living from selling his work.

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4. **Opportunistic careerists** : They exploit available opportunities rather than make active choices about work. Clients' career plans could seem vague, undecided and uncertain.
    a. One example of a client applying this style of career decision-making is that of a graduate student. Three years after her career guidance interview, she was still unsure of her career direction. After completing her degree, she had worked abroad for six months as a beauty therapist, because the opportunity presented itself. On her return home, she completed some further vocational qualifications to enhance her employability in complementary therapies. This led to her employment in a full-time job in a women's prison and in part-time employment in a health spa. Some problems emerged in her full-time employment — she was made a supervisor very quickly, which caused some problems with other members of staff — so she was thinking of leaving. She had several ideas about what she would eventually like to do, but was waiting to see if any other opportunities presented themselves. Overall, she seemed to be enjoying the challenges presented by a variety of jobs and was thriving on pressure and uncertainty.

Naturally, we do not exclude the fact that chance events may have an significant influence on career choice. (source: BrightPryor)

# Discussion: New requirements for HE and VET education

The difficulties of decision-making processes in complex or uncertain environments (Klein 1999, Lipshitz et al., 2001) can raise contradictions. The complexity associated with the need for rapid decision-making can lead to information overload and impair the decision-makers' judgment. The multiplicity of procedures, their contradictory aspects, or simply the quantity of procedures to follow in a complex situation can even lead to an inability to decide. The adapted educational answer would be to mobilize heuristics, but this requires learning time, incompatible with an emergency situation. Mathematical approaches of decision making have their limits when confronted with VUCA variables. If a procedure is not always applicable, what strategy of discernment could be adopted?

Some movement on reliability theory consider that individuals are rather a source of error than reliability (Reason, 1990). Perrow (1994) explains that the increased complexity of systems reduces the ability of individuals to understand, predict or prevent potential failures. Errors derive from the fact that "*either there are no procedures provided for the current situation, or the appropriate planned procedures cannot be implemented and constitute a problem of categorisation*" (Mendoça, Webb and Butts, 2010). The stakes of decision-making can be high: an error can have irreversible consequences. But the role that groups and individuals could play in the readjustment decision processes are underestimated. Errors can come from rigid adherence to the established plan as well as from a plan (Klein, 1999). The cumbersome nature of procedures can have an effect on the organizational performance (Brown and Eisenhardt, 1997).

## Programme outcomes on decision making

Professional life environments are more than ever Volatile, Uncertain, Complex, and Ambiguous (VUCA). The notion of VUCA is used more and more in strategic Leadership. Inspired by the Dublin descriptors, the European Qualification Framework, recalls at level 5 “competence to exercise management and supervision in contexts of work or study activities where there is unpredictable change”; and at level 6 “to manage complex technical or professional activities or projects, taking responsibility for DM in unpredictable work or study contexts”. Decision is not only about knowledge, it is also about skills. Skills relate to the “ability to apply *knowledge* to complete tasks and solve problems. Skills can be described as cognitive (use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments)”. The ENAEE, which sets Programme Outcomes for Engineering Education accreditation in EU, introduced in 2015 priority in Decision Making and Judgment abilities. From now on, in Europe, the learning process should enable Master Degree graduates to demonstrate:

- ability to manage complex technical or professional activities or projects that can require *new strategic approaches*, taking responsibility for DM;
- ability to *integrate* knowledge and handle complexity, to *formulate* judgements with incomplete or limited information, that include reflecting on social and ethical responsibilities *linked* to the application of their knowledge and judgement.

Decision models are classified as being descriptive, prescriptive, deterministic, stochastic and/or predictive.

- Descriptive models tend to have well defined relationship between the variables. Due to the established connections between the drivers of the model mathematical formulas can be applied to solve the decision problems. Uncertain variables, e.g. the ones not under control of the decision maker, are handled with management scientific techniques like simulation, queuing, three point estimates etc.
- Prescriptive models are based on the problem definition. There are little uncertainties regarding the inputs so the model calculates outcomes based on the prevailing facts.
- Deterministic models go even further and assume that all relevant inputs are known with certainty. Programming is arguably the best known type of this type of modelling.
- Stochastic or probabilistic models assume that some inputs are not known with certainty. These model types require modeling techniques such as simulation, decision trees, scenario planning and forecasting.
- Predictive models are used to obtain the functional relationship between the dependent and the independent variables. Management techniques like regression analysis, time series analysis, discriminant function analysis are uses to determine these relationships.

All models are wrong (sentence attributed to the statistician George Box) but some are useful. A model is not the 'truth' but a subjective representation that helps to answer a question relevant

to the decision maker. By building up a model a decision maker can explore the relationship between decisions and consequences. The useful skills for a prescriptive decision making process are:

- Models building techniques
- Evaluations techniques
- Decision techniques

## Leadership and teamwork

There is an increased interest in leadership above management. Management is by no means redundant or obsolete. However, Leadership with its emphasis on 'soft skills' is now being seen as the key to solve some of the encounters companies and organizations face. There are therefore good reasons to include leadership training in the DAhoy program to establish practices that can lead to better teamwork skills and less biased decision making. Some of the differences between managing and leading can be seen in the figure below.

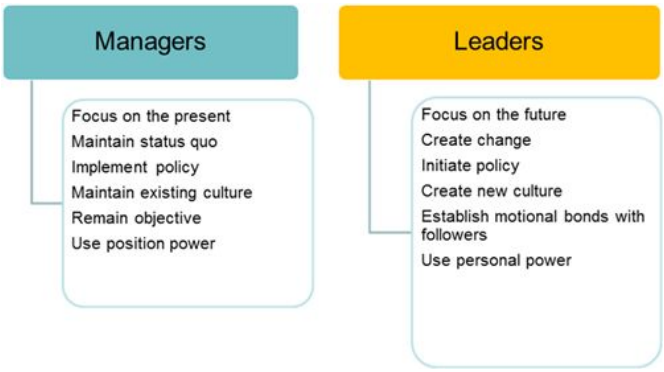



Figure. The difference between Managers and Leaders.

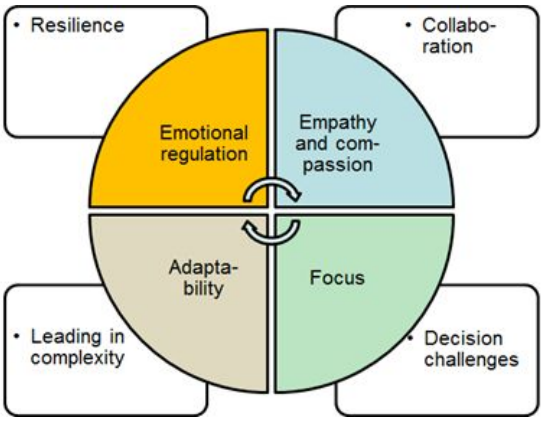



Figure. The decision challenges in context of DAhoy.

When the agility of the business environment is added to the complexity the management challenges transforms from being ordered to being unordered. From known knowns to known

unknowns and even unknown unknowns. The freedom to plan a solution to a decision problem linearly with optimization is reduced to short sprints with iterative and continuous planning. The Agile movement in project management is a worthy example of how majority of projects are now planned with the assumption of unknown solution.

## New skills

We live in times of unprecedented transformation towards a knowledge driven economy as has been stated earlier in this report. This has been named the Cognitive Capitalism. Cognitive Capitalism is the intangible assets of innovation, brand and flexibility that are becoming more and more critical for the long-term success or failure of companies and organizations. This has led to increased interest in enhancing our mental abilities that can contribute to more creative and co-operative work force. Furthermore, modern society, with its fast pace and information overflow, challenges our attention. This trend will be adapted in the DAhoy project so that future training of our students will reflect this enormous transformation.

WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD

### Top 10 skills

| in 2020 | in 2015 |
|---|---|
| 1. Complex Problem Solving | 1. Complex Problem Solving |
| 2. Critical Thinking | 2. Coordinating with Others |
| 3. Creativity | 3. People Management |
| 4. People Management | 4. Critical Thinking |
| 5. Coordinating with Others | 5. Negotiation |
| 6. Emotional Intelligence | 6. Quality Control |
| 7. Judgment and Decision Making | 7. Service Orientation |
| 8. Service Orientation | 8. Judgment and Decision Making |
| 9. Negotiation | 9. Active Listening |
| 10. Cognitive Flexibility | 10. Creativity |



Source: Future of Jobs Report, World Economic Forum

This phenomenon is sometimes named the Digital Deluge referring to how we as individuals are constantly interrupted by direct marketing signals, e-mails, social media, phone calls to name just few of the symptoms characterizing the present times. Research indicates that almost half

of the time we are disengaged and distracted which inevitably will hurt our labor productivity (what a person produces over a period/No. of persons working in the period). So, we have a paradox to deal with:

- We need more focused, engaged and creative workforce.
- We live in times when people are blasted with information overload and we face complexities making it more challenging to be focused, engaged and innovative.

Professional and personal life environnements are more than ever volatile, uncertain, complex and ambiguous because the social and economic globalisation concerns the whole planet. Everything is going faster and faster! Therefore, there is a growing concern about responsibility of decision makers, decision making skills in engineering and management education. The perception of positions for Managers, Experts, Consultants, Entrepreneurs are important to discover during the studies to make the right choice for the first job. It is essential to provide graduate students who develop a long-term aspiration for future career path the 'tools and cognitive reflex' to be proactive in their career mobility. This is critical to reinforce students ‘self-confidence, self-awareness and self-esteem to reflect and decide: this is a principle to maintain their employability in a recruitment market which is becoming more and more competitive. The leitmotiv could be for all graduate students: A good choice at the right time!

This is the VUCA world in context of modern business life were leaders and managers are tested with fresh challenges of leading innovative teams and individuals in an environment contradicting creation and focus. In teaching the Math-Based Decision Making Skills approach it must be assumed that the student has in his previous studies acquired the necessary fundamental skills in mathematics and statistics. Equally the DAhoy project will focus on the social context of decision making. This approach is at the least equally important of training and enhancing decision skills of future leaders, so as for career decision making.

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# Chapter 2: Course examples for decision making

How to prepare HE and VET students for a VUCA-world and how that can be taken into consideration in educational setting? To start to answer this questions, a survey methodology is operated, looking at some projects in the topic which approach Teaching & Learning in Decision Making, as presented in Chapter 1. Descriptive analysis of the courses including transversal Decision skills in partner institutions is also conducted. The Teaching & Learning activities to analysed and compared take their sources in the syllabus description of partner educational programs (Bachelor and Master levels for HE, VET) including Decision in specific courses or as transversal skills and competences.

## DAhoy partnership existing courses

For our study, we asked each DAhoy partner the Teaching and Learning (Teaching & Learning) activities dealing with the Decision-Making Process in their institution. This work is made on quantitative and qualitative perspectives. Each activity is detailed at the end of this document. Different activities are included in Teaching and Learning (Teaching & Learning) activities. Some institutions choose to develop activities rather with courses or with a mix composed by Courses and Practical Experiences.

### Collection method

The aims of the survey are to identify and analyse:

- which activities are set up by DAhoy partners dealing with decision-making process
- what kind of pedagogical aims they want to reach
- which skills they aim to develop
- what kind of teaching methods and tools are associated with these activities
- who is the audience and its academic level
- whether these activities can be linked with the definition of a decision tool with the VUCA parameters.

**Number of Teaching and Learning (Teaching & Learning) activities from DAhoy partners**

| Partner | Quantity |
|---|---|
| **IMT Atlantique** | 11 |
| **EN** | 9 |
| **RU** | 2 |

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| | |
|---|---|
| **FUEB** | 2 |
| **CCG** | 3 |
| **SCQF** | 2 |
| **Total** | 29 |

Some courses deal with the general culture on the decision-making process (reading books, courses) while others focus on the experience of decision-making with post-exercise reflection. Some activities offer the opportunity to reflect, implement, and change behavior through iterative learning processes.

## Collected decision-related courses or activities

The work on decision-making by DAhoy partners takes place at various periods in the training programs. The variety of activities and periods cover a broad spectrum of curriculum of a higher education institutions. DAhoy Partners organise different Teaching and Learning (Teaching & Learning) listed hereafter:

### By IMT Atlantique (IMTA)

- The 1st activity **IMTA-Activity 1** (IMTA-A1) is called **coaching career in student professional project with alumni coaching at the end of the curriculum.** The purpose of the unit is to provide support and guidance on career paths and academic training options to students of all courses. As they enrol at the school, students hardly know about engineering jobs and the actual work environment. If they are to make the most of their education and training and stay in control, they need to identify their career plans clearly. It is therefore essential to support them from enrolment, throughout tuition and until their 1st career choice.
- The 2nd activity **IMTA-Activity 2** (IMTA-A2) is called **academic and career guidance-3-year continuum of coaching.** It is focused on decision making in student professional project. When IMTA-A1 is for the end of the curriculum, IMTA-A2 is a **'YOU' continuum** that covers the 3-year curriculum organized in three dimensions (1A : '**Y**ourself' involves knowing oneself to define one's professional profile and describe one's skills properly. / 2A : '**O**penminded' open the scope of possibilities for career projects. / 3A : '**U**p to you' highlights the fact that if they want to be in control, students will have to be determined to anticipate, take action, commit themselves, make decisions and make a challenging start in work life.)
- The 3rd activity **IMTA-Activity 3** (IMTA-A3) is called **Engineer's Passport about Decision Making in student integration at school.** The Student Induction Programme is a 'walking tour' scheduled during the first two months. At each milestone, the students are trained on an approach that gets them to ponder the range of activities in their future

curriculum (notably their school projects, internships, volunteering or international projects) and encourage them to take control of their education and future life and career.

- The 4th activity **IMTA-Activity 4** (IMTA-A4) is called **Software Engineering and Object Oriented Programming.** The field of software engineering is focused on providing means of mastering the complexity of software construction, thanks to methods and tools. Software engineering consists of organizing and proposing conceptual and practical solutions to produce and maintain software with the assurance of a compromise between cost, quality and time. As part of a project where students work in pairs, students have to follow a development cycle in order to design, realize and validate an application based on the object model and the Java language. The project guideline is a gamble system with bets to design and implement, based on an informal textual client requirement.
- The 5th activity **IMTA-Activity 5** (IMTA- A5) is called **Orientation Race for Freshman newcomers.** It consists in a race where each group get a compass, a map of the campus with the different flag positions and a brief description of the mission. A professor follows the group and takes notes/observations. The race lasts 30 minutes, they have to find as many flags as possible. Each flag gives points; some of them are more valuable than others depending on the difficulty to find them. After the race, a debriefing is done with the professor and the group. That the most important part of the activity. With concrete examples, we manage to show that it is not so trivial to organize a group and to take decision in a group. Question of responsibility is also discussed. While orientation exercise is primarily an individual sport, we decided to propose the activity for a group of 8 students. It is of course a pretext in order to observe how they organize the group without any prior instructions. The time constraint (i.e. 30 min race) is very important: indeed it is because the mission is very constrained that the group needs to organize.
- The 6th activity **IMTA-Activity 6** (IMTA- A6) is called **Reliability and Decision Making in Inshore Cruising.** This one-week course is an inter-semester course and relies on a specific class of phenomenon to train students to take decisions and react in unexpected and unpredictable situations. The real experiential situations so selected reflected real-life nautical scenarios with a high level of complexity and time pressure, where specific skills were to be acquired or reinforced, such as risk and priority management, watchfulness, team management with respectful interactions, etc.
- The 7th activity **IMTA-Activity 7** (IMTA-A7) is called **Risk and Crisis Management.** This course is focused on the field of crisis and risk management and aimed to make students aware of human and organizational factors through a role-playing game that simulates a real complex high-risk system (i.e. nuclear power plant). “Sprintfield” is an active method where students experiment a degraded professional situation, aiming at showing the complexity of actions and decisions in high-risk situations and at introducing theoretical concepts. The retained context is a real and well-documented accident occurred in a nuclear power plant. Each player has a specific role with detailed

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objectives and information. In respect with creation rules of role-playing games, instructions are general and differ from a player to another and the game evolves according to random events or to actions and decisions from players Players have to work together in order to operate the nuclear power plant. Consequently, they have to organize themselves, to coordinate their actions and to communicate in an efficient way. This role-playing game has the form of a computing interface with a limited number of data and possible actions.

- The 8th activity I**MTA-Activity 8** (IMTA-A8) is called **Risks and Dangers of Mountain Activities.** This one-week course, in winter mountain environment (snow) addresses organization skills, decision skills and leadership skills for generalist engineers. In groups of 7, gather the most relevant information in order to make the right decisions in a limited time. The context of the proposed situations is more and more complex. The available time (survival time under an avalanche) is becoming weaker. The course relies on Mountain security knowledge and rescue chain, Experiential situations in mountain, Off-piste skiing**.** The main idea of this inter-semester is to put the trainees in real situation (visual observation of slope - of quality of snow at risk - of exposed corridor - committed off-piste ....) so that they are able to approach these new freeride and off-road activities in a better knowledge of what they can or should not do, so that this practice is done in full control of the potential danger.
- The 9th activity **IMTA-Activity 9** (IMTA- A9) is called **Social Decision Making.** A large part of future engineer's work activity will be to take decisions in uncertain and ambiguous context (related to scientific, technical but also economical or organizational choices). The general objective of social sciences' teaching is to go beyond common sense explanations of decision-making processes. From real experimentations and examples, we show that decisions can not be reduced to mathematical models, but are strongly influenced by group dynamics, individual characteristics and personal and professional identities. This activity is organized with small groups (around 25 students), interactive pedagogy, role-play, video, organized debates based on movie watching (bottom-up logic).
- The 10th activity **IMTA-Activity 10** (IMTA- A10) is called **socio-economic Systems Modeling.** It consists in lectures and tutorials. The course introduces the concepts of socio-economic modeling, using the framework and tools of game theory and agent-based modeling. Game theory can been applied to different fields: economics, political sciences, biology… Students will also be introduced to experimental economics where the predictions of game theory are tested in a laboratory.
- The 11th activity **IMTA-Activity 11** (IMTA- A11) is called **Normative Decision Making.** Rational or prescriptive decision-making is about taking a good decision, that is one which reflects the decision maker preferences given the information he has about all uncertain events affecting the objectives he follows. In the context of strategic decision making, three items are worse to define and constitute each a learning objective for students; techniques for modeling the problem must be defined. Without a model related to the decision problem, no clear decision can be taken.

| Number of Teaching and Learning (T&L) activities from DAHOY partners | | | | | |
|---|---|---|---|---|---|
| Partner | *Courses* | *Practical exercises* | *Coaching session* | Mixed activities | Projects |
| IMTA | Activity 4 Software Engineering and Object Oriented Programming course<br><br>Activity 9 : Social Decision Making<br><br>Activity 10 :Complex system thinking and modeling<br><br>Activity 11 : Normative Decision Making | Activity 3 : The engineer's Passport to success the integration at school<br><br>Activity 5 : Orientation race<br><br>Activity 6 : Reliability and Decision Making in Inshore Cruising<br><br>Activity 7 : Risk and Crisis Management<br><br>Acivity 8 : Risks and Dangers of Mountain Activities | Activity 1: Co-orientation or coaching career delivered by an Alumnus<br><br>Activity 2 :academic and career guidance 3 year-continuum of coaching | | |

By French naval Academy (EN)

- The 1st activity **EN-Activity 1** (EN-A1) is called **IMTA Leadership seminar.** This internship enables civil students (from IMTA) to discover the different aspects of leadership and decision-making process through many activities such as theoretical courses, practical exercises and sports activities during a 2,5-day seminar. The seminar contains experiential activities for the future decision-makers with scenarios in complete break with what the students environment, they are coached mainly by military trainers. The Naval Academy provides this training in the context of military training set up for the cadets who are the future officers of the French Navy.
- The 2nd activity **EN-Activity 2** (EN-A2) is called **HEC Leadership seminar.** This is also an internship enables civil students from an academic partner HEC to discover the different aspects of leadership and decision-making process through many activities such as theoretical courses, practical exercises and sports activities during a 5-day seminar. The seminar contains experiential activities for the future decision-makers with scenarios in complete break with what the students environment, they are coached mainly by military trainers.
- The 3rd activity **EN-Activity 3** (EN-A3) is called **executive leadership seminar**. It is rather organized for civil executives. This internship enables civil them to discover another aspects of leadership that they know and live in their jobs and help them to analyse their own decision-making process through many activities such as theoretical courses, practical exercises and sports activities during a 2,5-day seminar.
- The 4th activity **EN-Activity 4** (EN-A4) is called **Command and Convince**. It is a course intended for the cadets, future decision-makers of the French Naval Academy. The

program module includes courses dealing with leadership (Theory on traits of personality of leaders, styles of leadership, methods of command, to convince, decision in complexity, ethics and leadership decisions).

- The 5th activity **EN-Activity 5** (EN-A5) is called **pre-corvette.** It is an experiential training. The training takes place on a simulator before a navigating-period for cadets in order they learn to take references with a team, with navigating rules. During this module, they may face a 5-to-10 mn period of higher complexity in order to train them to different nautical situations and take decisions in such situations.
- The 6th activity **EN-Activity 6** (EN-A6) is called **Exmar.** It is an experiential learning activity (serious game in real condition). It consists for the cadets (organized in teams) in evacuating groups of people working on a geographical land where riots and rebellion forces try to destroy the governing structures. This training enables cadets to discover the different aspects decision-making process through an activity in real conditions creating an evacuation of refugees from a hostile territory onboard ships.
- The 7th activity **EN-Activity 7** (EN-A7) is called **Ethics and leadership**. It is a course based on ethical considerations. This training enables cadets to include ethical considerations in their decision-making process before being faced with ethical dilemma and choices to make in their future career. The courses are organized with 2 person-teams: a civilian teacher and an officer who make cadets wonder about real situations with ethical issues.
- The 8th activity **EN-Activity 8** (EN-A8) is called **Ethics and literature**. It is a course which enables cadets to analyse situations where ethical issues are raised. For this activity, a reference list is proposed to cadets: through different readings or movies they must read or watch, cadets explain what they remind mainly as far as decision-making process is concerned (effects of environment, of period, of situation, of time pressure, consequences of a decision…). They have to compare the works and explain which decision they would take in such situations and the reasons of their choice.
- The 9th activity **EN-Activity 9** (EN-A9) is called **Human science project**. This training enables cadets to study specific topics of leadership (one dealing specifically on decision-making process). They deepen a topic during one semester with one researcher-teacher in order to wonder about leadership issues. This activity may enhance knowledge about decisions and help the cadets to wonder about leadership for their future career.

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| Number of Teaching and Learning (T&L) activities from DAHOY partners | | | | | |
|---|---|---|---|---|---|
| Partner | *Courses* | *Practical exercises* | *Coaching session* | Mixed activities | Projects |
| EN | Activity 4 Leadership courses<br><br>Activity 7 : Ethical and leadership courses<br><br>Activity 8 : reading on decision-making subjects | Activity 5 : Leadership nautical exercices on simulator<br><br>Activity 6 : Leadership military exercice | | Activity 1 Leadership seminar for external actors<br><br>Activity 2 Leadership seminar with cadets and external students<br><br>Activity 3 Leadership internship for executives | Activity 9: human project |

By Reykjavik University (RU)

- The 1st activity **RU-Activity 1** (RU-A1) is called **Decision Analysis**. It is a course structured in lectures and exercise classes intended for pure academic exercises, teamwork and status exams. This course is structured around methods and disciplines used by professionals to make decisions where there exist uncertainties regarding the outcome. Uncertainties are dealt with by statistical methods and awareness of cognitive biases related to how the mind processes information.
- The 2nd activity **RU-Activity 2** (EN-A2) is called **Disaster days**. This activity is based on experiential learning. The main objective is to enhance interpersonal skills, as well as to break up a long semester and open a venue for students to become acquainted with fellow students. The context of the project is an unexpected challenge, most often a “disaster” of some sort, that has to be dealt with in teams. This event is called Disaster Days and is run early in the first semester in the students’ program at the university.

| Number of Teaching and Learning (T&L) activities from DAHOY partners | | | | | |
|---|---|---|---|---|---|
| Partner | *Courses* | *Practical exercises* | *Coaching session* | Mixed activities | Projects |
| RU | **Activity 1 : course on decision** | **Activity 2 : Crisis exercice** | | | |

From the Fundacio Universitat Embresa de les Illes Balears (FUEIB)

- The 1st activity **FUEIB-Activity 1** (FUEIB-A1) is called **Master’s Degree in Big Data Analysis in Economics and Business** (MADM) of the University of the Balearic Islands. In this training, the students analyse the data and make decisions based on the obtained data in different exercises. They have to develop a master’s job, internships in

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companies and training modules where they develop exercises in which to make decisions in real situations. They have to do exercises (problems) and make decisions based on unforeseen real or fictitious situations. The students also have to use different techniques for diagnosis, evaluation, inference and later decision-making before the real problems and situations based on the available data.

- The 2nd activity **FUEIB-Activity 2** (FUEIB-A2) is called **Decision Making**. It is a course which provides the necessary knowledge for decision-making in a financial situation (as a tool for making business decisions). The students learn to develop this capacity for the achievement of the goals, both in the workplace and in the educational field. The course offered is aimed at all professionals interested in making financial decisions in the market, seeking success in the operations carried out. It is also aimed at people who want to expand knowledge on the entrepreneurship, delving into the components involved in investment and financing.

**Number of Teaching and Learning (T&L) activities from DAHOY partners**

| Partner | *Courses* | *Practical exercises* | *Coaching session* | Mixed activities | Projects |
|---|---|---|---|---|---|
| FUEB | **Activity 1 Course Decision Making and Human Rights for Public Order Policing**<br><br>**Activity 2 : Decison Making Process** | | | | |

## By City College of Glasgow College (CoCG)

- The 1st activity **CoGC-Activity 1** (CoGC-A1) is called **Leadership Styles and Decision Making.** It is a one-day course to help introduced cadets to their course and what is going to be expected of them over the course of their cadetship. Class is divided into groups and are allocated a leadership style to research (autocratic, democratic etc.). They will then as group present to the rest of the class what each style is (advantages/disadvantages), provide examples from their sea time of any experiences of that particular style and as a class will discuss situations where that style would be appropriate when faced with making decisions. Class will also look at previous MAIB reports of which incorrect decision-making had serious safety consequences.
- The 2nd activity **CoGC-Activity 2 (**CoGC-A2) is called is **experiential learning activity on simulator** where candidates are asked to take control of a bridge and practically demonstrate their decision-making skills in a real-life, immersive environment. Students are involved with operational conduct of a vessel in various shipping situations over the course of a week. This includes entry and exit of harbours, coastal navigation, and navigation in restricted visibility, while conducting the duties of Lookout, Helmsman, or Officer of the Watch. Navigational Aids and Electronic System Training (operational

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level) is a 9-unit course covering an array of electronic equipment principles. 8 units are on individual pieces of bridge equipment and 1 unit is a simulated bridge continual assessment based on the knowledge of the students and their decision making processes in various bridge related scenarios.

- The 3rd activity **CoGC-Activity 3** (CoGC-A3) is called **Leadership Styles and Decision Making.** It is a group exercise completed during class time to review previously experienced leadership styles in the maritime industry and how these styles might impact decision-making (examples of situations, such as emergencies, and how decisions are made). Class is divided into groups and are allocated a leadership style to research (autocratic, democratic etc.). They will then as group present to the rest of the class what each style is (advantages/disadvantages), provide examples from their sea time of any experiences of that particular style and as a class will discuss situations where that style would be appropriate when faced with making decisions. Class will also look at previous MAIB reports of which incorrect decision-making had serious safety consequences.

Number of Teaching and Learning (T&L) activities from DAHOY partners

| Partner | Courses | Practical exercises | Coaching session | Mixed activities | Projects |
|---|---|---|---|---|---|
| CCG | Activity 1 : Phase 3 Deck<br><br>Activity 2 : Navigation course | Activity 3 : Practical navigation activity | | | |

From the Scottish Credit and Qualifications Framework database (SCQFP)

- The 1st activity **SCQF-Activity 1 (**SCQF-A1) is called **Decision-making processes**. It is a short CPD course for public/private and 3rd sector employees (credit rated by Edinburgh Napier University). Participants are introduced to approaches such as force field and problem tree analysis as well as pareto and fishbone diagrams.
- The 2nd activity **SCQF-Activity 2** (SCQF-A2) is called **Decision Making and Human Rights for Public Order Policing.** It consists in a short course with a programme owner: Mind over Matter (credit rated by: Edinburgh Napier University).

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| Number of Teaching and Learning (T&L) activities from DAHOY partners | | | | | |
|---|---|---|---|---|---|
| Partner | Courses | *Practical exercises* | *Coaching session* | Mixed activities | Projects |
| SCQF | Activity 1: CPD course<br><br>Activity 2: Decision Making and Human Rights for Public Order Policing | | | | |

## Career decision making examples

Traditionally, educational institutions design career preparation programs which focus on making their students more attractive to potential employers. For example, in a University context, the Department of Guidance and Professional Insertion of the Foundation University-Enterprise of the Balearic Islands has set up the Occupational Guidance and Occupational Assistance Program. This non-compulsory program aims to improve the possibilities of self-employment of the university graduates and guide students who are seeking employment. Concretely, it allows the improvement of employment opportunities by designing a personalized itinerary for job placement. This personalized itinerary consists in the realization of individualized sessions of professional orientation: how to properly make decisions to get a job, how to apply for a job interview to get an employment. Students learn the ability to make the right decisions from the individualized orientation sessions. At IMT Atlantique, a compulsory 63h career preparation course is in place since 2007, to disclose to students, via active workshops over three years, their career perspectives, enabling them to participate actively in their own learning path, to build their future professional identity, and to plan proactively their future career.

In Iceland at Reykjavik University, the goal of the Student Counselling and Career Centre is to ensure that all students at University are able to engage effectively in their academic and social environment. The service is free and confidential for students at the University, and also for all students considering further education at the University. The main focus are on coaching, wellness, and 'think outside of the box'. Seminars on controlling exam anxiety or stress are held regularly. In these seminars, students receive instructions on how to recognise the symptoms of exam anxiety or stress, and how to react to mental and physical symptoms in order to lessen the impact of anxiety on their study performance. The Student Counselling and Career Centre organises free guided meditation and relaxation sessions every Thursday throughout the semester. In addition, in January each year the Student Counselling and Career Centre organises a mental health awareness week, which helps to generate discussion about mental health difficulties and well-being.

In France, at IMT Atlantique, there is a Career center for all the students (800 students in Brest campus).The students are scientific (maths, physics) for a numeric training ('engineer' = master 2), after a competitive examination between prestigious universities. This center includes one

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permanent position only, but working with 10 external consultants in HR. The training period is a 3 years continuum:

- Y1: 'Yourself' involves knowing oneself to define one's professional profile and describe one's skills properly.
- Y2: 'Open Minded' open the scope of possibilities for career projects.
- Y3: 'Up to you' highlights the fact that if they want to be in control, students will have to be determined to anticipate, take action, commit themselves, make decisions and make a challenging start in work life.

In the Balearic Islands, Enterprise Foundation University of the Balearic Islands (FUEIB) and University of the Balearic Islands (UIB) have carried out some activities in which students and university degrees have conducted or are carrying out actions related to the Career Decision Making (CDM). We can mention the Entrepreneur's Space and Support for the new Technology Company project (RESET). In fact, the labour market is not very important and the students who are not mobile have the project to create their start-up. RESET was a UIB program for the creation of companies and the promotion of the entrepreneur spirit, managed by FUEIB. Through this program, aimed at the university community, different training, advice and support activities are carried out for entrepreneurs and university companies, incorporating the analysis of the experience accumulated to date, and the best international and national practices. The RESET program lasted 5 years (2008-2012). Different experts promoted entrepreneurship, based on a theoretical and practical training comprised of 3 programs.

1. Birth : Development of actions aimed at promoting entrepreneurial culture, through the organisation of seminars and basic courses
2. Growth: Articulation of different mechanisms for the detection of ideas and their transformation into a viable business project: training, specialized consultancy, support and advice in different aspects necessary to create a company (fiscal, accounting, financial, etc.).
3. Consolidation: Development of different actions with the aim of strengthening and stabilizing the established companies.

Students from universities and management, engineering and technological schools are taken into account in the diagnostic, the training approach and the recommendations. The successful engineers will be those who can put their 'vision' forward, perceive trends and explore new paths, for example nomadic career pattern.

## Diversities

The activities related to Teaching & Learning are courses or practical experiences or seminars (which contain courses, practical exercises or testimonials from decision makers). Teaching & Learning can take the form of coaching or more broadly social science projects. They also include readings of books related to decision-making.

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These activities are very often additional. If some modules deal with the decision making process conceptually, it is often to better introduce the practical exercises. They give meaning to the scenarios by highlighting the key concepts to remember.

In addition, Teaching & Learnings very often cover two aspects:

- the theoretical teaching which explains the bases and the works carried out on the problematic of the decision ;
- practice: whether in the form of simulation, coaching, exercise conducted on experimental means such as a simulator or in real-life situations.

The learning durations are variable: they take the form of courses spread over several weeks (IMT Atlantique, UK, EN) or highly concentrated courses over 2 to 5 days (EN) or a semester can follow the students on a longer period (IMT Atlantique, EN ..). These longer periods are required to follow the evolution of the student, to accompany his reflection on his career, his personal development; they also concern the follow-up of students in social sciences and humanities projects that must deal with a problem of leadership and decision-making based on a current real-life or historical case (EN). These learning sequences are also an opportunity to echo the theoretical and practical teachings delivered in the discipline. They intervene in M1 to follow students who have already acquired a form of maturity during their training.

For each partner, we differentiated the nature of the activities according to the contents. We identified 5 different types of activities:

- courses (face-to-face classes),
- practical exercises,
- coaching sessions,
- mixed activities involving both courses, practical activities, readings,
- and finally follow-up - projects.

In term of mandatory T&L offers:

- Number of compulsory activities : 3 (CoGC) - 7 (EN) – 5 (IMTA)
- Number of optional activities : 2 (SCQF) - 2 (EN) - 2 (FUEIB) – 7 (IMTA)

In addition to the variety of content offered and the opportunities they offer, the target audience is 2 types:

- Either students mostly at the L3, M1, M3 level, which meets a certain logic because it takes a certain degree of maturity to be able to approach decision-making and even more when the level of complexity, ambiguity, and associated risk increases,
- Or managers from a vocational education program who are looking for a structured learning environment to develop the skills already acquired.

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| **Number of Teaching and Learning (T&L) activities from DAhoy partners** | |
|---|---|
| **Partner** | Academic levels |
| **IMTA** | L3, M1 or M2 |
| **EN** | M1, M2 |
| **RU** | M1, M2 |
| **FUEB** | M1, M2 |
| **CCG** | L3 |
| **SCQF** | Vocational training |

The objectives according to the public are different and can not therefore be related to the same contents which the DAhoy project establishments respect.

The DAhoy project aims to deliver in 2019 an assessment tool for decision making in the VUCA environment. Our work is therefore to identify the activities already offered by partners offer opportunities to evaluate the decision-making environment VUCA. The main skills which are developed by DAhoy partners through all their activities dealing with decision-making focus mainly on:

- For IMT Atlantique, 6 main abilities
    - Ability to express, analyse, rephase, organize (CST 1)
    - Ability to make decisions (CST 2)
    - Ability to build up and implement a prospective vision (CST 7)
    - Ability to design, model and simulate (CST 14)
    - Ability to anticipate and weigh impacts (CST 4)
    - Ability to control and manage information (CST 5)
- For EN : 6 main abilities :
    - Analytical capacity for a problem especially with a high level of complexity and time pressure
    - Ability to delegate a task
    - Ability to integrate technical, human and environmental elements into decision-making problems
    - Ability to develop decision by consulting external opinions
    - Ability to decide under constraints (time, resources)
    - Ability to take responsibility for decision at the head of a team
- For RU:
    - Ability to understand the importance of cooperation and diversity in a group
    - Ability to recognize presenting solutions in diverse ways

    - Ability to recognize the decisions and planning are based on uncertain information
- For CoCG,
    - Ability to analyse situations and apply rules based decision-making in conflicting situations
    - Ability to analyse, reflect and evaluate decisions made in a work environment
    - Ability to identify safe ways of working and leading teamwork in different scenarios
    - Ability to decide of based-course of actions in vuca contexts
    - Ability to plan resources, budgets, teams and the decision process involved

Also, in terms of student assessment, some modules that are not mandatory are not the subject of an evaluation process. Others, which are mandatory, require the use of an evaluation tool. Thus, these evaluations take the form of oral defenses on the synthesis of readings of books, project report, oral assessment.

On the originality of the contexts to answer demanding public needs in the decision-making, the willingness of institutions to train their public gives them the opportunity to set up ambitious and attractive programs. Some schools mobilize their audience in very original environments at sea, in the mountains or from activities that have marked the minds (which is the case of the crisis pedagogical activity following the eruption of the Icelandic volcano). This real case presented to students is a real learning opportunity to develop skills and confront students in situations where decision-making is difficult.

# Collected Teaching & Learning activities VUCA categorisation

Are these activities suitable for decision making in the VUCA environment? The aim of DAhoy project is also to offer opportunity to face students with VUCA environments. Are Teaching & Learning activities suitable for testing VUCA criteria ?

| Partner | | Teaching & Learning dealing with Volatility ? | Teaching & Learning dealing with Uncertainty ? | Teaching & Learning dealing with Complexity ? | Teaching & Learning dealing with Ambiguity ? |
|---|---|---|---|---|---|
| **IMTA** | Activity 1: Co-orientation or coaching career delivered by an Alumnus | | X | | |

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| | | | | | |
|---|---|---|---|---|---|
| | Activity 2:academic and career guidance 3 year-continuum of coaching | | X | | |
| | Activity 3 : The engineer's Passport to success the integration at school | | | X | |
| | Activity 4 : Software Engineering and Object Oriented Programming course | | | X | |
| | Activity 5: Orientation race | | X | | |
| | Activity 6: Reliability and Decision Making in Inshore Cruising | X | X | X | |
| | Activity 7 Risk and Crisis Management | | | | |
| | Activity 8 Risks and Dangers of Mountain Activities | X | X | X | |
| | Activity 9: Social Decision Making | | X | X | X |
| | Activity 10:Complex system thinking and modeling | | | X | |
| | Activity 11: Normative Decision Making | | | | |

| **Partner** | | Volatility ? | Uncertainty ? | Complexity ? | Ambiguity ? |
|---|---|---|---|---|---|
| **EN** | Activity 1 : Leadership seminar for external actors | | | X | |
| | Activity 2 : Leadership seminar with cadets and external students | | | X | |

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| | | | | | |
|---|---|---|---|---|---|
| | Activity 3: Leadership internship for executives | | | X | |
| | | | | | |
| | Activity 4 :Leadership courses | | X | | |
| | Activity 5: Leadership nautical exercices on simulator | | X | X | |
| | Activity 6 Leadership military exercice | | X | X | |
| | Activity 7: Ethical and leadership courses | | X | X | X |
| | Activity 10: Human Sciences project | | X | | |

| **Partner** | | Teaching & Learning dealing with Volatility ? | Teaching & Learning dealing with Uncertainty ? | Teaching & Learning dealing with Complexity ? | Teaching & Learning dealing with Ambiguity ? |
|---|---|---|---|---|---|
| **RU** | Activity 1: course on decision | | | X | |
| | Activity 2: Crisis exercice | X | X | X | X |

| **Partner** | | **Teaching & Learning dealing with Volatility ?** | **Teaching & Learning dealing with Uncertainty ?** | **Teaching & Learning dealing with Complexity ?** | **Teaching & Learning dealing with Ambiguity ?** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **FUEIB** | Activity 1 : Course Decision Making and Human Rights for Public Order Policing | X | | X | X |
| | Activity 2 : Decision Making Process | | X | X | |
| **CoGC** | Activity 1: Phase 3 Deck | | | X | X |
| | Activity 2 : Navigation course | | X | X | X |
| | Activity 3 : Practical navigation activity | | X | X | |
| **SCQFP** | Activity 1: CPD course | | | X | |
| | Activity 2: Decision Making and Human Rights for Public Order Policing | X | | X | X |

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# Chapter 3: Analysis of three DAhoy decision making staff trainings

The main objective of the DAhoy activity 4 is to learn from the partner members and academics of the consortium, based on the activities carried out by them, and more specifically from those who have participated in 3 Joint Staff Training Events (JSTE). These 3 JSTE have been developed in the different cities, countries and dates (JSTE-1, 22nd-24th January in the Ecole Navale of Brest, JSTE-2, 16th-18th April in the City of College of Glasgow, JSTE-3, 5-7th of June in the Reykjavik University, in Iceland).

In the 3 JSTEs, people from the seven partners/members of the DAhoy project (City of College, Ecole Navale, FUEIB, IMT Atlantique, FREREF, Reykjavik University, and Scottish Credit and Qualifications Framework) have fostered their skills on leadership, teamwork and *decisionship* (in the three dimensions of Decision Making: Mathematics Decision Making or MDM, Social Decision Making or SDM and Career Decision Making or CDM) via real experiences, have developed decision pedagogical issues, and reinforced the DAhoy collaborative dimension between the participants, and the motivational factors.

The O1/A4 is not only to learn from the partners. The O1/A4 îs to inspire the DAhoy partners from their learning outcomes and *decisionship* skills in the JSTEs, analysed through the questionnaires that FUEIB has produced and designed for each JSTE. How? Identifying and capitalizing the pro and cons of the skills/non qualities in the three dimensions of Decision Pedagogical Issues (Mathematics Decision Making, Social Decision Making and Career Decision Making, specially) through a SWOT based method. In this way, a series of conclusions may be obtained that may be appropriate for the assessment models of the activities (O2/A7), including proficiency levels, for High Education (HE) and Vocational Education Training (VET) students.

## Method

FUEIB has designed three questionnaires, one for each JSTE, to know the main skills, positive and negative, of the partners. These questionnaires have been created with the idea of determining the pros and cons of decision making by each person who participates in a group and carries out activities. They are general questionnaires with qualitative and quantitative questions that have allowed us to prepare a SWOT, including the weaknesses, threats, strengths and opportunities for the 3 JSTEs.

The first questionnaire fulfilled by the partners in the JSTE1 included 15 questions (See Annex). Of the 15 questions, the questions 8 and 9 are issues related to Career Decision Making (CDM), the questions 10 and 11 with Mathematics Decision Making, and the question 12 with the Social Decision Making (SDM). The other questions are general and have allowed knowing how to act when the partners have to make decisions. In this questionnaire, there

was interest especially to know the decision making, more than the acquired skills by the partners.

The following two questionnaires, designed by JSTE2 and JSTE3, had a smaller number of questions, specifically twelve. The reduction in the number of questions, from 15 to 12, is a consequence that the partners had to take a considerable time to answer them. In addition, some questions did not provide the necessary information to have a better knowledge of the key aspects needed for this report.

The twelve questions asked for the JSTE2 and JSTE3's questionnaires are the same (See annex). Of these twelve questions, 10 are the same as those already mentioned in the JSTE1 questionnaire. These are the questions 1, 2, 3, 5, 7, 8, 10, 13, 14 and 15 and that corresponds to the questions 1, 2, 4, 6, 7, 8, 9, 10, 11 and 12 of the questionnaires JSTE2 and JSTE3. These 10 issues are key aspects to meeting the objectives set out in the report and will be analysed in the section on the skills in the JSTE's questionnaires. However, the other questions that are not present in the three questionnaires (JSTE1, JSTE2 and JSTE3) could also be analysed, since some can also provide the necessary dimensions for decision making.

# Overview of 3 DAhoy Join Staff Training Events

In order to analyze the answers provided by the partners and define the possible positive and negative skills to be taken into account for the evaluation models of the activities planned in the DAhoy project, it is necessary to briefly know what kind of activities have carried out the partners in the 3 JSTEs about the decision making. In this way, it will be easier to compare the answers provided by the partners in the questionnaires with the activities developed during the 3 JSTEs.

## JSTE1: Leadership in Land for Future Managers

The JSTE1 took place at the *Ecole Navale* de Brest (France) in the month of January as already mentioned. The title of the course was "Leadership in Land for Future Managers" and was aimed not only at the DAhoy members, but also at 20 engineering students from IMTA Atlantique, as this training is regularly offered to the French business students (HEC) and engineering students (Supelec), Adult Education employee and managers of DCNS, MBDA, EDF, Energies Nouvelles, etc.. The number of participating DAhoy members was 6.

In the course, the participants had to judge, advice, reflect on their way of leading the activities, and take responsibility as leaders from their theoretical and practical training that included real activities in land. These are fundamental skills to know how to better define your positive or negative skills when making decisions.

The course also integrated a film analysis, discussion exchanges on decision and leadership problematic, aquatic and combatant activities, formal lectures on leadership types and chief figures, several formal and informal debriefings.

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The DAhoy members attended *Ecole Navale* for two days, and on the third day, they strengthened and improved what they had learned in the previous days. During the JSTE, the participants (including the DAhoy Members) had to carry out three different activities foreseen:

### Escape Game (JSTE1-A1)

It is a well-known activity in educational environments. It's an escape game in an escape room. The participants are gamers. They locked in a room, and had to solve a series of problems to get out of the room.

The idea of this activity was try to find some decision skills to be specified as an idea of escape games for Teaching & Learning (Teaching & Learning) activities. In addition, a series of non-formalized learning outcomes can be obtained.

### Dinghy Race (JSTE1-A2)

This activity was carried out by the STEM students, while DAhoy members were observers who analyzed and visualized the decisions made and the skills demonstrated by the participants.

The participants had to move the dinghies from a shed to the pier, located at a remarkable distance, and there they had to get on the different boats and row from the dock to a distant point without any instructions on the best way to do it.

This practical exercise aims to modify and enhance its decision making (DM) learning outcome referential and proficiency scale. It also allows participants to discover their weaknesses and strengths of the team by themselves, assess and reflect on the performance of the team, and can be reorganized themselves according to their self-assessed strengths.

### Forest Workshops (JSTE1-A3)

As in the previous activity, 20 students carried out this pedagogical activity, while the DAhoy members were observers, evaluators and analysts of the work carried out and practice for the students. The activity consisted in carrying out a series of team practical exercises in the forest, initially on leadership skills and medium specification/formalization of learning outcomes. The team leader, a different one for each exercise, had to plan and manage the complex situation proposed in the exercises with the team participants in order to solve the problems planned in the forest. This activity allows having a better knowledge of the learning results in Decision Making.

## JSTE2: Take Good Decisions

This JSTE was made in the City of Glasgow College (CoGC) in the month of April. The title of the course realized was “Take Good Decisions” and was aimed at 13 DAhoy members. The course has had five activities for three days. These are activities that are usually performed by cadets during their maritime studies and they are usually done without having much knowledge, except for the second day, which are more complex, although they are usually manageable with little technical knowledge. The five activities are the following ones:

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### Table Top Tactics (JSTE2-A1)

This is a decision making task from a table top pedagogical activity, and involves a VUCA situation. The participants must solve a problem, evaluating the situation and taking different solutions according to their analysis. The activity introduces them to teamwork, identifying a problem, prioritization and decision making based on calculations. It also introduces the conflict between moral and ethical decisions and calculation based decisions.

In order to perform the activity satisfactorily, it is necessary that the team members collaborate organized, communicate in an appropriate way, and work as a team to develop a group plan.

### Design and Build (JSTE2-A2)

The DAhoy members carry out a practical task, where they had to build a structure based in the specifications provided. They had to design, budget, negotiate and decide on alternative courses of action.

This pedagogical activity implies a creative work and the contribution of the team participants to propose a satisfactory solution. It means taking the right decisions (individual and group) to properly for resolving and competing against other teams.

### Entry in Enclosed Spaces (JSTE2-A3)

This is a practical exercise where a team had to rescue a casualty form the working engine room. To carry out it, the participants have had to know the procedures to carry out safe work practices and how to enter closed spaces without oxygen.

Through this exercise, the DAhoy members planned, analyzed and worked together to solve the mission, making decisions based on what they have learned and their own experience in the career.

### Navigation Simulator (JSTE2-A4)

By using a simulator, the marine operations team has thrown emergency situations to the participants to verify how they should act as officers of a ship. The decisions made by them are based on the knowledge acquired in the classroom in a real-life environment.

**The process of reaching a judgement, coming to a conclusion or choosing an option**

The exercise allows to record the answers that the team provides to the different challenges proposed, the communications made between the team members, the body language, and to analyze in detail the decisions taken from their experience and skills.

### Escape Room (JSTE2-A5)

It's a more complex version of what we completed in JSTE1. The participants stayed in a room and had to find solutions to get out of it and to free themselves. DAhoy members had to make bigger decisions together and develop more skills to meet the test objectives.

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## JSTE3: VUCA Decisions

This JSTE was organized by the University of Reykjavik (RU) in the month of June 2018. The course was aimed at 15 DAhoy members. It has had four activities for three days. In these activities, the DAhoy members worked in VUCA situations, in 'brain training' for rational decision making with the idea of training future managers in applying disciplines of Decision and Risk Management. The four activities were the following ones:

### Mindful Leadership (JSTE3-A1)

The objective of this exercise is to carry out a series of mental skills that allow DAhoy members to be more creative and to be better focused and engaged in work. The members have had to face complexities so that they can be more innovative and cooperative, as well as involved in the work they can do.

It's a method to obtain a positive mentality, consideration self-confidence, well-being and harmony for the participants.

### Crisis simulation (JSTE3-A2)

The organizers have raised a study case of simulation in time of crisis with the idea that the participants responded and dealt with the situations raised in that simulation. This activity requires a lot of reactivity and decision taking under stressful conditions, under VUCA situations.

The simulation platform was organized in different aspects and the team members had the opportunity to apply the theory, to experience the problems (crisis in this case) and reflect finally on these experiences.

### Rescue teaming: a VUCA experience (JSTE3-A3)

The participants worked the mind to improve the taking of dimensions in critical, dramatic and dangerous situations, and not to be taken by the subjectivity in VUCA situations. The matrix used made it possible to distinguish different types of decision-makers.

The DAhoy members had to work and train intuition, putting their experience to define what a safe/a dangerous situation was.

### Cognitive biases (JSTE3-A4)

The participants were conducted a survey in which they were asked logic questions to see if their answers were determined by biased or preconceived information.

They had to apply logic and their cognitive abilities to respond adequately to the questions asked, and were not conditioned by the cognitive bias that affects the decisions and thoughts that participants make.

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## VUCA categorization of the JSTE activities

Decision oriented learning situations can now be categorised in a VUCA rubric of perturbation, where Interpersonal skills could be considered (e.g. social decision making considerations and team working abilities).

| | | | | |
|---|---|---|---|---|
| ***Magnitude / variability*** | ***Volatility*** | ***Uncertainty*** | ***Complexity*** | ***Ambiguity*** |
| **Weak** | Table top tactic, Enclosed Space entry, Escape Room | Table top tactic, Enclosed Space entry | Table top tactic , Design and Build, Enclosed Space entry, Escape Room | Simulators |
| **Medium** | | Design and Build, Simulators, Escape Room | | Table top tactic , Design and Build, Enclosed Space entry, Escape Room |
| **Strong** | Design and Build, Simulators | | Simulators | |

Figure. DAhoy JSTE activities linked to VUCA rubrik during JSTE2 debriefing in Glasgow, 2018.

# Pros and cons

The questionnaires of the three JSTEs answered by the DAhoy members have allowed to know their skills or non-abilities to make decisions when they have had to solve the activities proposed by the organizers, as a team or individually. Skills or non-abilities vary according to the activities proposed in the 3 JSTEs.

However, they show a trend that can be very useful to identify and capitalize their responses towards the constitution of the assessment models for High Education (HE) and Vocational Education Training (VET). In addition, it will allow identifying and capitalizing the pros and cons in the different pedagogical dimensions, as well as the creation of a SWOT.

For this reason, this section analyzes the global results of those similar questions formulated in the 3 JSTEs to determine the main capacities of DAhoy members in Career Decision Making, leadership and teamwork.

# Qualities

## Strengths and Qualities

For the resolution of the activities, the DAhoy members have identified their qualities in the different pedagogical activities realized in the 3 JSTE.

They have defined many qualities based on the pedagogical activities performed. Many of them are the result of their decision making in the race and their experience, and others are as a result of the social environment, the exercises they have had to perform, and the logical application to the problems that have been raised. Some others are the result of the individual's own personality.

The total number of qualitative strengths indicated is 31, a remarkable number. They are part of the three dimensions (CDM, SDM and MDM).

The main qualities defined by the participants at the time of making decisions are the following ones:

- *Teamwork* (5 answers)
- *Listening Skills to make decisions* (5 answers)
- *Understanding/Analyzing the context/activity* (4 answers)
- *Planning* (3 answers)
- *Experience for the development of the activities* (3 answers)

These results coincide with some Learning Outcomes that the participants have identified in the pedagogical activities carried out for the JSTE1 and JSTE3.

Other qualities that have been taken into account are *logical skills* (MDM), *communication and observation* (SDM), *knowing a good Decision Making* (CDM) or *Self-Awareness* (MDM).

## Weaknesses or Non Qualities

The second question involves the non-abilities or qualities of the JSTE's participants who has answered the questionnaire. These are the negative skills that hinder or prevent the resolution of the proposed exercises or activities in the JSTEs.

Unlike the first question, it was not a completely open question. The DAhoy members had to choose the different options proposed in the questionnaire. They could mark all they wanted. Only the pollster has given the option to include other weaknesses that are not included in the questionnaire, if they think so.

The main answer is the *difficulties of communicating in a different language* (17 answers). This answer was especially pointed out in JSTE3 in the exercises on VUCA situations.

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Other important weaknesses are:

- *Not explain adequately how activities could be solved* with 6 answers; indicated especially in the first exercises of the JSTE1 that required field work
- *My lack of experience of professional training* (5 answers), skill that is related to the Career Decision Making (CDM).

## Skills

### Adequate or useful decisions

This question identifies those reasons that the participants believe that are useful and adequate for the resolution of the activities proposed in the different JSTEs. Like the previous question, a number of skills has been proposed, so that the DAhoy members could choose and mark them. Some of the skills respond to logical decision making applied through mathematics (MDM), others according to the professional career (CDM), and others according to the social context (SDM). Others were general skills.

The participants have especially highlighted four useful and appropriate reasons when making decisions:

- *Good collaboration by all members* (24 answers)
- *The application of logic to the existing problem* (12 answers)
- *The experience of training of one of the members* (8 answers)
- *The leadership of a team member* (8 answers)

In the last two JSTEs, the number 2 (Take good decisions) and 3 (VUCA Decisions), the DAhoy members have indicated especially their good collaboration, a fact that does not happen in JSTE1 (Leadership in Land for Future Managers). The JSTE2 and 3 propose pedagogical activities that required principally the support and cooperation of all the participants for the resolution of activities.

*The application of the logic to the existing problem*, a MDM skill, is the second reason for the DAhoy members. Together with the previous skill, they are two learning outcomes that have been identified as relevant by the participants when carrying out pedagogical activities in the different questionnaires.

The other two relevant responses are *the experience of training of one of them and the leadership*. They are two different skills, one linked to the CDM, and the other to the SDM, but both have a common point, such as the importance of a particular individual when solving an activity.

### Attitude when the group make decisions

The respondents have had to define which has been their attitude, when the group in which they were part had to make decisions for the resolution of the exercises.

Unlike the previous questions, it was not an open and qualitative question. The DAhoy members had to score from 1 (not agree at all) to 5 (totally agree) the different options proposed in the questionnaire. If the chosen options are closer to the value 5, it is that the participants believe that they showed this attitude.

In addition, the different options proposed by the pollster were not all positive. They have also been negative, which also allows knowing the existence or not of weaknesses in the realization of the exercises.

The following results are ordered from highest to lowest score and they are the average of the 3 JSTE.

| | Average of the 3 JSTE |
|---|---|
| *Interact with the other members of the group* | 4,20 |
| *Participate in decision making* | 4,06 |
| *Assume leadership in decision making* | 3,77 |
| *Agree decisions with the other members of the group* | 3,76 |
| *Manifest their disagreement with the decisions taken by the group* | 2,79 |

Again the collaboration, the cooperation *and the interaction of other members of the group* are the keys to the resolution of the activities in the opinion of the DAhoy members. In the last two JSTEs, related to VUCA situations and Decision Making, it has been the main answer.

The interactions between the participants in the proposed games are especially promoted in JSTE3. On the other hand, in JSTE1, where they played a more role as observers in an open field, and leadership was prioritized in future managers, it was not the main answer, and more importance was given to *assuming leadership in decision making*.

Together with the collaboration in the group, *the participation in decision making* has also had a high score. In JSTE3, where VUCA problems had to be solved, it had a score equal to the collaboration option.

On the other hand, the options related to a greater role of the members in the resolution of the activities, such as *assuming leadership or agreeing on decisions*, have a score between 3 and 4.

The negative answer, manifesting their disagreement, has been the one with the worst score, lower than the average. Only in the JSTE2, which is when they have had to make more decisions in the proposed activities, has it had a score close to 3.

### Type of action when making decisions

This question defines the ability of the participants to act when they have had to make decisions, without the group intervening yet.

As in the previous question, the DAhoy members had to score from 1 (not agree at all) to 5 (totally agree) some skills proposed in the questionnaire. The skills are SDM, CDM or MDM, and are usually used by participants who must make decisions and resolve difficult situations. If the proposed options are further from the value 5, it is that these options are not the skills or qualities most used in the pedagogical activities.

The results are also ordered from highest to lowest score and they are the average of the 3 JSTE.

| | Average of the 3 JSTE |
|---|---|
| *Analyze the situation* | 4,52 |
| *Define priorities* | 4,33 |
| *Interact with other group members* | 4,23 |
| *Search for optimal solutions* | 4,21 |
| *Organize team work* | 3,84 |
| *Identify the risk factors* | 3,81 |
| *Agree decisions with other members of the group* | 3,53 |
| *Manage conflicts* | 2,81 |

The DAhoy members have mainly defined the skills related to logical thinking/*analyze the situation* (MDM), and the ability to *prioritize the most important activities* in the exercises (CDM). They are skills that involve more planning than action. The high scores of these two skills are a reality in JSTE3 and especially in JSTE 1, where they are one of the main learning outcomes in the exercises developed.

In contrast, *the search for optimal solutions* (MDM) and *interaction with other members* (SDM) that have a score between 3 and 4 are the main options chosen in JSTE2. In this JSTE, there

are exercises in which the participants must make the best decisions, which means looking for the best solution to the proposed activity, and the need to interact with the group and work in a team.

### Experience or training to solve the problems

Another question has raised the training and experience that participants have in the JSTE pedagogical activities. First, they had to indicate if the DAhoy members had used their experience or training to solve the problems or difficulties raised. 92.6% of respondents confirmed that they used the experience or training in the exercises of the 3 JSTEs.

If so, they had to indicate the skills based on their experience or training to solve the problems posed by the JSTE's organizations, a CDM question.

As in the last questions, it was not an open and qualitative question. The DAhoy members had to score from 1 (not agree at all) to 5 (totally agree) the different options proposed in the questionnaire. If the indicated options are closer to the value 5, it is that the participants believe that have used these training skills or are based on their experience.

All the results are again ordered from highest to lowest score and they are the average of the 3 JSTE.

| | Average of the 3 JSTE |
|---|---|
| *Know how to work in a team* | 4,36 |
| *Know how to organize* | 3,98 |
| *Self-Confidence* | 3,67 |
| *Leadership* | 3,63 |
| *Self-Control* | 3,28 |

The participants have cited the *knowing how to work in a team* as main CDM skill. They have evaluated with a very high score in the JSTE1, where they perceived as observers the need to work as a team to resolve the activities.

Another high score, close to 4, is to *know how to organize the activities* (CDM skill). It has had the highest score in JSTE3, where decision making VUCA demanded knowing *how to organize activities* to solve complex situations than knowing how to work as a team. In fact, *knowing how to work in a team* was the fourth option with the lowest score.

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In contrast, these two skills have had the same important score in JSTE2, where participants had to make decisions, requiring a good organization, planning a mission and design of the activities, and an ability to work as a team and making group decisions as the exercise 'Design and Build'.

The aspects most related to the individual's own personality such as *self-confidence or self-control* have had low scores. The collective aspects have been valued much more than the individual ones.

### Behavior to resolve the exercises

If in the previous question, the pollster asked about social issues such as the training or experience that DAhoy member had from previous learning, now he wants to know their reactions as a individual person. Specifically, the participants had to define their behavior when they had to make decisions to resolve the activities.

This MDM question has 5 options and the DAhoy members have had to score from 1 (not agree at all) to 5 (totally agree). If the indicated options are further from the value 5, it is that these options are the ones that have been less considered in the exercises.

The results that have been ordered from highest to lowest as in other occasions are the following ones:

| | Average of the 3 JSTE |
|---|---|
| *Apply the logic rationality* | 3,88 |
| *Reflect on the situation* | 3,81 |
| *Try to control the uncertainty* | 3,16 |
| *Be impulsive* | 2,34 |
| *Lack of control* | 2,21 |

A first aspect to emphasize is the low scores of all the options, inferior to 4 and some close to 2. Also, the options that have a more negative rating as *be impulsive or lack of control* are those that have had a lower score.

*Applying the rationality of logic to the exercises* (MDM skill) is the option most valued by DAhoy members. It has been especially well scored in JSTE2, where decision-making required the application of logic for the resolution of activities as the “Escape Room” or “Table top Tactics”.

On the other hand, the option *reflect on the situation* (MDM skill) has predominated in JSTE3. Some of the exercises proposed in this JSTE activities in VUCA situations, such as “cognitive biases” or “Mindful Leadership” require personal reflections before developing them. Personal reflection is one of the main learning outcomes detected in the activities.

## Effects

### Different decisions after completing the activities

In the next two questions, participants must answer what they would have changed in the JSTEs, once their activities finished. They want DAhoy members to reflect on what they would have done and applied, if they had the opportunity to practice or experience the JSTE’s pedagogical activities again.

In the H question, the pollster asked if the participants had made different decisions than those they had finally made, and if so, they should identify the decisions they had made to improve the resolution of the activities. These are skills that were not used in the JSTE’s pedagogical activities.

In the whole of the 3 JSTE pedagogical activities, 44.4% of the DAhoy members would have made different decisions from those that they finally took. It is particularly interesting to note how the highest percentage of the change of decisions corresponds to JSTE1 -where they acted more as observers- and the lowest to JSTE3, where VUCA decisions had to be made.

Regarding the different answers, they have indicated principally:

- *Better planning before and during activities* (3 answers)
- *Better organization of the team* (2 answers)
- *Search for a greater consensus among the participants* (2 answers)
- *Have more control and to be prepared better for complex situations* (2 answers)

*Planning before and during the activities, and better organization of the team* are aspects that would improve after having made the exercises, in special in the JSTE1.

Regarding *the consensus and a better control of the activities*, it has been highlighted especially in JSTE 2 and 3, where decision-making and volatile situations predominate respectively.

### Strengths or qualities after completing the activities

This question, which complements the previous one, asks for the qualities or strengths that DAhoy members have and would use, but that they did not apply for making decisions in the time of the activities. These are qualities or strengths that can have a logical component (MDM), social origin (SDM) or related to the career (CDM).

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The total number of qualitative strengths indicated is 21. The most important are the following ones:

- *Planning* (4 answers)
- *Listening* (4 answers)
- *Analyzing activities/risks* (4 answers)
- *Observing and Evaluating the situation* (3 answers)
- *Distribution of the tasks* (2 answers)

In opinion of the participants, the three main qualities are *planning* (CDM skill), *listening* (SDM skill) and *analyzing activities and the risks* of the exercises (MDM skill). The three strengths would have been applied during the exercises in all JSTEs, but some of the participants did not do it or could not do it. They involve three important moments that are developed continuously to solve the activities: first listening, then analyzing and finally planning.

Similar to the analysis, there is the *observation and the evaluation of the situation* (MDM skill), also necessary before developing the activities. DAhoy members have indicated it for JSTE1 (Leadership) and JSTE3 (VUCA situations).

## Pros and Cons of making decisions

In the last question of the questionnaire proposed for each JSTE, the participants had to define the skills (Pros) that they believe that have generated positive situations and the adequate decision making in the exercises, and the not skills (cons) that have favored situations and / or negative or less desirable decisions.

Positive skills are qualities to improve the exercises, while the lacks of these skills are threats for solving adequately the activities proposed by the organization.

There have been a significant number of positive skills highlighted by DAhoy members. Specifically, they have indicated 29 qualities (such as positive attitude, self-control, rationality, creativity or knowledge between others). The most skills they have commented in the JSTE's pedagogical activities are the following:

- *Communication skills* (8 answers)
- *To know how to solve the tasks and problems proposed* (4 answers)
- *Team Confidence* (3 answers)
- *Team collaboration* (3 answers)
- *Develop a clear plan* (3 answers)
- *Team work* (3 answers)
- *Commitment* (3 answers)

*Communication skills* (SDM) are the main strengths that the participants have pointed out as means to generate positive situations in the JSTEs. These skills encourage personal

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interactions and more connection between the team. The DAhoy members have cited them in the three JSTE, being one of the learning outcomes identified in the pedagogical activities.

The second skill that the participants have highlighted is *knowing how to solve the situations* (CDM skill). It has also been indicated in the questionnaires of the three JSTEs, especially in the JSTE1, where the resolution of problems as a leader is important.

The other positive skills refer mainly to personal and professional relationships, such as team confidence, collaboration, teamwork and commitment. Only, outstanding quality like *developing a clear plan* is an activity more related to the execution of the exercises.

Likewise, there have also been a very considerable number of non-skills that have been defined in the questionnaires by DAhoy members. Concretely, they have identified a total of 25 non-qualities (e.g. too quid decisions, not taking risks, not organized). As mentioned above, the absence of these skills has led to negative or undesirable situations in the proposed exercises.

The following non-skills are the main ones that the participants have cited:

- *Language difficulties* (3 answers)
- *Lack of communication to fast decision making* (3 answers)
- *Not being patient* with the team (3 answers)
- *Frustration when developing the activities* (2 answers)
- *Bad choices* (2 answers)

The first two not qualities are related to the lack of collaboration with the team, due to various causes, such as *communication, or difficulties in understanding* which have been detected in JSTE3, where there were VUCA situations.

In contrast, the third and fourth non-ability are related to the individual's own personality (SDM), such as frustration or not being patient. It has also been noted in JSTE3.

Only, the bad choice, the last not highlighted skill, is the result of making decisions at some time of the exercises. In addition, it has been indicated in JSTE1 and JSTE2.

## Discussion

### SWOT analysis

From what has been learned from the DAhoy members who have participated in the 3 JSTE, the next step is the development of a SWOT method based on the identification of the positive and non-positive CDM, MDM and SDM skills.

The answers of the different participants in the JSTE's questionnaires have allowed generating a SWOT analysis, identifying the Strengths (+ indicator), Weaknesses (- Indicator),

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Opportunities (+ Indicator) and Threats (- Indicators) that should be taken into account, being what the participants have pointed out.

The SWOT method is an adequate instrument to have a broad and objective view of those skills that have been used in the pedagogical activities of the 3 JSTE, as well as those skills that have not been used or are not available to carry out the activities proposals by the organization.

This SWOT describes the main skills used or not used by the DAhoy members in their activities, and the table also allows capitalizing the pros and cons of the main dimensions of the pedagogical methods of decision, as well as obtaining a series of results that can be useful for the assessment models on activities (O2/A7) for HE and VET students.

| SWOT METHOD | |
|---|---|
| **STRENGTHS (+)** | **WEAKNESSES (-)** |
| - Teamwork<br>- Listening skills to make decisions<br>- Analyzing the context/activity<br>- Planning adequately<br>- Experience for the development of the activities<br>- Team confidence<br>- Communication skills<br>- Observing and Evaluating correctly the situation<br>- Distribution of the tasks<br>- Commitment | - Difficulties of communicating in a different language<br>- Not explain adequately the activities<br>- The lack of experience of professional training<br>- Better planning before and during the activities<br>- Better team organization<br>- Greater consensus among the team members<br>- Have more control and to be prepared better for complex situations |

| | |
|---|---|
| **OPPORTUNITIES (+)** | **THREATS (-)** |

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| | |
|---|---|
| - Knowing how to work in a team<br>- Knowing how to organize the activities<br>- More interaction with other group members<br>- More participation in decision making<br>- Know how to solve the tasks and problems proposed<br>- Good collaboration by all members<br>- Define priorities<br>- Search for optimal solutions<br>- The application of logic rationality to the existing problem<br>- Reflect on the situation | - Lack of communication to fast decision making<br>- Not being patient with the team<br>- Frustration when developing the activities<br>- Bad choices |

# Reflection, Takeaways, and DAhoy Perspectives

HE and VET students (e.g. STEM, engineering, business, medicine, law, political fields) must constantly reinforce key skills to meet evolving graduate profiles. As a reminder, in 2014, the European Council emphasised that “fostering the Union's industrial growth requires the right skills. The European Council urged the Commission and the Member States to address shortages in the area of Science, Technology, Engineering and Maths (STEM) skills as a matter of priority” (EUCO 7/1/14 REV). But the nature and dynamics of change, in a fast changing world, creates greater uncertainty and more unpredictability in our European society (e.g. migrant and economical crisis, Brexit, recent terrorist attacks). In 2015, Andreas Schleicher, the head of education at the OECD, recalls that “in the past, education was primarily about teaching people something. But now, education should be about making sure that students develop a reliable compass and the navigations skills to find their own way through an increasingly uncertain, volatile and ambiguous world” (GEIS 2015 Transcript of dinner speech, 19 October 2015, Helsinki). In 2016, ten actions to help equip people in Europe with better skills were defined by the European Commission (i.e. Recommendation on Key Competences to help more people acquire the core set of skills necessary to work and live in the 21st century, promoting entrepreneurial and innovation-oriented mind-sets and skills, (http://europa.eu/rapid/press-release_IP-16-2039_en.htm). Opportunities in the preparation of highly skilled workforce for the industry around what is now to be called *decisionship* must be deeply considered .

In a rapidly changing world, the VUCA context requires now to rethink the vision for higher education [Kamp 2016]. As seen today in the European society, the nature and dynamics of change creates unpredictability and future HE and VET students are to manage complex situations with critical reasoning. Professional life environments are more than ever VUCA. This context makes decisions even more strategically critical. But as Le Boterf defends it [LeBoterf, 2006], a skill is only effective once it has been tested and validated thanks to its confrontation to

reality. To prepare future professionals to make more reliable decisions in VUCA environments, experiential learning models are a key, all along a curricula with a transversal skills approach. DAhoy supports the coherent inclusion of active and engaging pedagogical models, with DM as a transversal skill, in association with three complementary and unified dimensions including learning outcomes:

1. Math-based DM, with rationality;
2. Social-based DM, including people's interdependencies and social identities;
3. Career-based DM, according to own career path.

For such, the first objective of DAhoy for its first year, according to this deliverable, was (i) to conceptualize Decision learning outcomes, share and analyse good Teaching & Learning practices on Decision Making in STEM first, in order to gain experience in trans-national cooperation and strengthen DAhoy partners capacities. Next coming years will be dedicated to (ii) capitalize on the exchange of good to best practices, to assess and evaluate innovative decision making Teaching & Learning activities, to foster quality improvement in HE and VET sectors and partnerships, to support effective and innovative training events for HE and VET students, to be formalized in educational kits for transferability to other fields than STEM, (iii) to define a high-quality innovative integrated framework for Decision Teaching & Learning, supporting VUCA capacities, to be continuously integrated in partner HEI but also in other European HE and VET institutions.

## How to prepare HE and VET students for a VUCA-world?

How can we approach and overcome the educational challenges so as to prepare graduates for their future responsibilities? In the curriculum, when and how is it best to develop a student's ability to discern; and make good decisions at right times in VUCA environments?

Students must capture the multiplicity of contextual factors influencing individual and / or collective DM processes. The VUCA world is volatile, uncertain, complex and ambiguous. Teaching decision making under such conditions cannot be based exclusively on mathematical models. A large part of future work activities will be to take decisions in uncertain and ambiguous context (related to scientific, technical but also economical or organizational choices). The general objective of the teaching the 'new normal' must equally be based on social sciences and to go beyond common sense explanations of decision-making processes. Decision making skills are transversal and can be enriched by a multiplicity and variety of experiential learning situations.

DAhoy members strongly believe in the mission of DAhoy to forward the training of engineers, but also STEM and business learners to include or further extent the skills of uncertainty management which is the foundation for decision analysis. Other fields are of course considered for transferability. The future will be full of surprises, maybe more than before. Many of the events, technical developments, social circumstances we now take for granted would have been

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considered impossible only few years back. The jobs that are in top demand today did not exist few years ago. We are in fact preparing skilled students for jobs that do not exist today and educating future decision makers to solve problems we do not know yet, to manage their professional career path in the lo term, competences are transferable.

## Takeaway-1: Reinforce reliability of human-based systems

DAhoy foundations are in line with the models promoted by the Higher Reliability Organisations (HRO) and the Actionist movements. Very close to each other, they seek to identify sources of reliability where decision-maker roles are crucial. HRO movement focuses on the factors that contribute to maintaining reliability, it links observable factors with the absence of disaster by highlighting the ability of individuals to adapt to unforeseen situations and develop a collective mind (Roberts et al., 1994). HROs are strongly characterised by many rules (e.g. nuclear, medical sector). Cognitive saturation can come from an accumulation of written procedures. The Actionist movement (Weick, 2001) deals with the concept of sense making through the theory of enactment, it analyses the way people act in organizations. Weick considers that strict compliance with rules can compromise reliability. In dynamic environments, there is a link between the number of rules to be followed and the level of organisational performance (Davis et al, 2009): too many procedures reduce the level of performance, as well as too few rules.

VUCA contexts are characterized by dynamicity and emergency. Mechanisms to detect early signs of crisis and react at time are required. This point is a key element of High Reliable Organizations (HRO) [8] which seeks to understand the normal functioning of human-based decision systems by identifying the characteristics of HRO and explaining their exceptional performance. To reach a higher level of reliability, Roberts recommends flexibility in the decision-making process. Weick [1] identifies three characteristics of HRO in contexts where the error is unforgivable: information overload, constant turbulence, and increasing complexity. Unlike other theoretical frameworks on reliability (e.g. Theory of Normal Accidents), the HRO and Actionnist currents have even the specificity to consider human behaviours as a source of reliability rather than of failure. These organizations are able to create and maintain a state of collective watchfulness thanks to the quality of the interactions between their members [9]. Weick mentioned that respectful interactions, a system of roles, improvisation, and watchfulness are the four sources of reliability.

## Takeaway-2: Transversal and transferable skills

Decision making skills are transversal. Some studies forecast that 75% of long-term job will rely on soft skills, and decision making echoes with soft skills. To name an example of 'soft skills' it is worth mentioning an interesting leadership called mindful leadership. Large companies, such as Google, Aetna and General Mills, have been implementing large-scale mindfulness programs

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over the past few years. Thousands of employees have gone through their programs with data now showing that there is a definite impact on leadership skills and quality of decision making. This approach can have direct impact on the development of emotional intelligence. To enhance our emotional intelligence with mindful leadership is arguably the way forward to improve our decision skills and strengthen our attention and focus in the VUCA world.

DAhoy future results are to trigger modernisation and reinforce the response of HE and VET training systems to the main challenges of today's world echoed in Decision Making: employment, economic stability and growth, with the need to promote these transversal competences in several dimensions (MDM, SDM, CDM).



Figure. Interleaving 3 ropes of CDM, SDM, and CDM skills for lifelong learning ((c) H. Audunsson).

This report showed that the concept of decision has multiple dimensions. Decision making skills are also transversal (i.e. “skills acquired in one context that, with adaptation, may be applied in another context”), as for ability to think critically, take initiatives, problem solve and work. Decisions rely on many factors, context-dependant. A dedicated decision framework is to provide support for faculty staff to improve student competence in decision skills, interwoven with the learning of disciplinary knowledge and its application in professional environments. Mastering of these skills is to be assessed by various stages of complexity, e.g. from partial application, realisation, adaptation, to anticipation in various VUCA situations. Societal responsibilities are elements of DM and included in the three aforementioned dimensions. The DM learning outcomes are to be indicated to provide a pragmatic guide to deal with the pressing ethical and social considerations. The aim is to ensure that students are educated, trained, and empowered to include ethical and social considerations in their decisions, diminishing negative consequences in their future work, professional itinerary, and personal life.

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## Takeaway-3: Employment & lifelong career preparation

DAhoy will allow that HE & VET institutions that realize tasks of guidance and labour advice help the students to develop their professional capacities so that they can accede more easily to the labour market.

Higher education and VET curricula meant to train skills that allow to solve uncertain and changeable situations at work, while developing future job projects and patterns. Such projects may be tested all through the student's curriculum as part of a well-thought process that will eventually lead to getting one's 1st job. Working toward the school's students' employability should be deemed as a sustainable, life-long process through which they acquire the agility they will need to go through unexpected events in their careers.

It is thus critical to emphasise on students' self-confidence, especially when considering that the recruitment market is becoming more and more demanding and competitive for newly graduates. Students' perception of a profession can strongly influence their career choices. Yet many students who have had only limited exposure to a profession may base their decisions on limited or distorted perspectives, for example a single internship or co-op experience, both positive and negative.
It is essential to provide students with the means which will enable them to participate actively in their own learning and develop a long-term aspiration for future career paths. As learning outcomes, the learning process should enable graduates :

- to know themselves and analyse their set of skills;
- to gather information, identify options, and explore career options;
- to recognize and define their choices;
- to define career paths, to plan and evaluate them, to select options;
- to gain flexibility and propose a coherent professional project including career orientation, and to combine personal development therewith.

There may be challenges for students wishing to enter their first job. The concept of a professional, and what precisely the job in itself entails, may be overwhelming: there are often several different factors that contribute to the selection of the first job. Career preparation courses may be included so as to prepare students adequately for their first job, future nomadic careers, and to reinforce career decision-making skills.

## Takeaway-4: Territorial level first

Located at the crossroads of the Bologna process and Education & Training 2020 strategies, DAhoy is designed to meet the latest European key priorities for competencies in HE and VET. It is now crucial to identify also skills mismatches at territorial levels for better train students and VET professionals, to foster more skilled individuals to stay at local levels, in the city or region of their studies. E.g. in France, for engineer students selected at national level, the situation is critic. Many good engineers and high level technicians tend to move to Ile de France or internationally. As a priority scope, the territorial careers and employability is to be reinforced thanks to DAhoy career decision making dimension but also decision skills in relation with

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entrepreneurship, as a core competence for it! In startups, the decision power is included with the entrepreneur individual. Communes and Regions need that young professionals create locally their companies. If DAhoy is to better identify key students and better train them to decide and hold forth to small companies, the territorial environment is ready to support them. Local incubators, as 'lieux d'élevages' of startups, have to learn from DAhoy methods and can support its outcomes for its territorial logics and strategies (instruments supported e.g. by Metropoles, affected on economical aspects). A *lieu d'élevage* is to be complemented by a training 'lieu' of top transverse skills.



DAhoy project results ate to have a positive impact on the persons directly or indirectly involved in the activities, including improved levels of skills for employability and of opportunities for professional development, and increased motivation and satisfaction of learners thanks to innovative pedagogical models around decision making. The territorial careers and employability is to be reinforced thanks to DAhoy career decision making dimension in Regions. If DAhoy gives some keys to concentrate competencies in HE and VET education and training on *decisionship*, chances will be multiplied to have decision makers to stay in their territories.

DAhoy activities aims also to support territorial and national policy reforms in higher education (e.g. building communal or regional networks and coalitions of interested groups, better HEIs employers links, labor & career mobility, modernisation of national to European HE & VET systems). Thus, DAhoy is ultimately to stimulate and improve the efficiency of learning outcomes in HE and VET across the EU countries. DAhoy partners will work on raising awareness campaigns promoting the benefits of their innovative learning models and reinforcing decision skills for individuals, economy, and society.

# Future work

## VUCAlity semantic and rubricization

We made a first work by identifying which activity include VUCA criteria. As this work is based in a subjective way, it needs to be deepened and experimented by actors (students, executives) who will qualify with a more precise approach to the level of Volatility, Uncertainty, Complexity and Ambiguity in each activity.

So, the next step in DAhoy project will be then to define precisely the levels of Volatility, Uncertainty, Complexity and Ambiguity per each exercise or activity and the corresponding skills. To reach this aim, the DAhoy members will have first to define what VUCA criteria represent? They will have also to differentiate different levels for each VUCA criteria and test if

the previous fulfilled grid corresponds exactly to what actors test in reality. Maybe an interpersonal dimension is to be added to the VUCA categorization as it impacts the activities, learning outcomes, and proficiency achievements.

| Magnitude variability | Interpersonal | Volatility | Uncertainty | Complexity | Ambiguity |
|---|---|---|---|---|---|
| Low | JSTE2 – A2<br>JSTE3 – A1<br>JSTE3 – A2<br>JSTE3 – A4 | JSTE1 – A1<br>JSTE2 – A5<br>JSTE1 – A2<br>JSTE2 – A3<br>JSTE3 – A1<br>JSTE3 – A4 | JSTE1 – A2<br>JSTE2 – A2<br>JSTE2 – A3<br>JSTE3 – A4 | JSTE1 – A1<br>JSTE2 – A5<br>JSTE1 – A2<br>JSTE2 – A2<br>JSTE2 – A2<br>JSTE2 – A3 | JSTE1 – A2<br>JSTE2 – A2<br>JSTE2 – A4<br>JSTE3 – A4 |
| Medium | JSTE1 – A1<br>JSTE2 – A5<br>JSTE2 – A2<br>JSTE2 – A3 | JSTE1 – A3<br>JSTE2 – A2<br>JSTE3 – A2<br>JSTE3 – A3 | JSTE1 – A1<br>JSTE2 – A5<br>JSTE1 – A3<br>JSTE2 – A2<br>JSTE3 – A1 | JSTE1 – A3<br>JSTE3 – A1<br>JSTE3 – A2<br>JSTE3 – A4 | JSTE1 – A1<br>JSTE2 – A5<br>JSTE1 – A3<br>JSTE2 – A2<br>JSTE2 – A3<br>JSTE3 – A3 |
| High | JSTE1 – A2<br>JSTE1 – A3<br>JSTE2 – A4<br>JSTE3 – A3 | JSTE2 – A4<br>JSTE2 – A2 | JSTE2 – A4<br>JSTE3 – A2<br>JSTE3 – A3 | JSTE2 – A4<br>JSTE3 – A3 | JSTE3 – A1<br>JSTE3 – A2 |

Figure. DAhoy JSTE activities possible categorization.

## A design-based research for Teaching & Learning innovations

To reinforce decision making skills in HE and VET education, several conceptual and methodological questions remain to be answered. As such, for student's competency development in; and for; VUCA contexts, DAhoy project proposes a Design Based Research (DBR), to analyse; design, evaluate and refine iteratively; the collective behaviour variables of student teams, when facing perturbations in complex and unexpected situations.

Design-based research (DBR) focuses on real educational situations (Anderson & Shattuck, 2012), which are potentially more complex than simulated environments. Inspired by the system engineering principles and agile methods implying clients in iterative cycles, DBR aims to continuously enhance practices (Collins et al., 2004; Mc Kenney & Reeves, 2014). Iterative in essence, the approach is ultimately oriented toward creating, rather than testing, theories. In DBR, regular interactions are in place between researchers, practitioners and trainees. Learners

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are also responsible for the learnings they experience in the Teaching & Learning Activities (TLAs) enhancement loop.

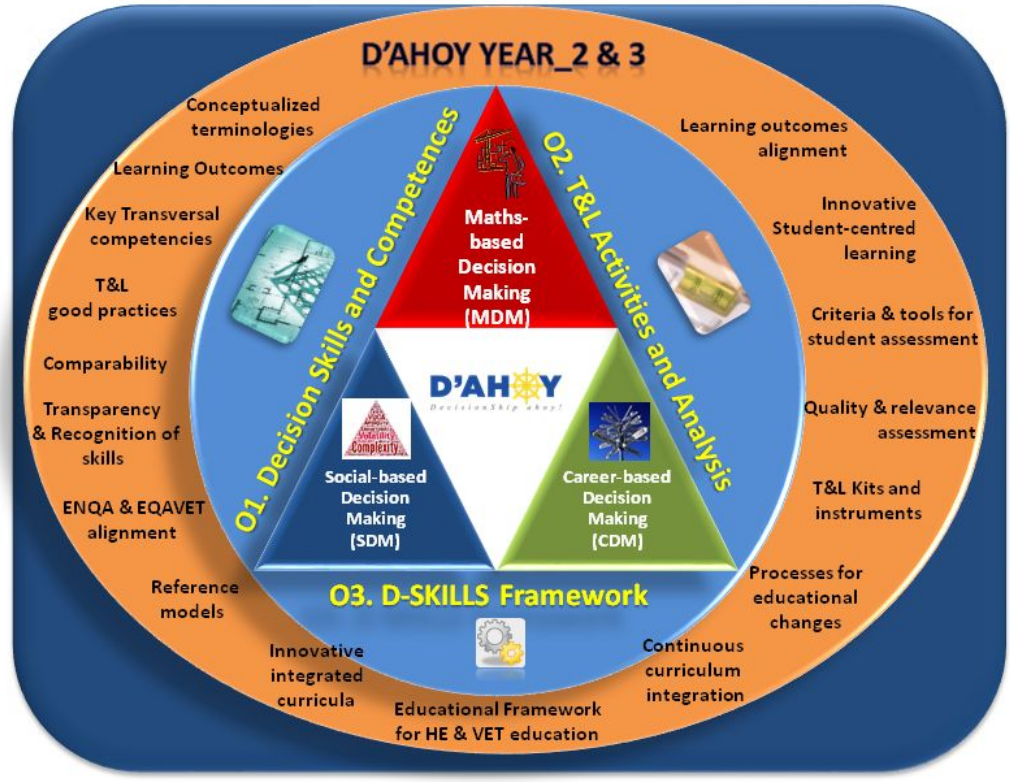
This first year DAhoy activities contain limitations: the way to control and measure learning variables must be defined and calibrated, as the prototype Teaching & Learning design. For transferability, we should also choose other learning contexts for the quantitative and quantitative analysis. Nevertheless, the flexible and iterative DBR method we will put in place to re-formalize decision-making learning outcomes and assessment criteria, in line with the proposed VUCA rubric. DAhoy project is carefully structured to produce theoretical understanding that can serve the work of others. The VUCA concepts are to be clarified to link them with learning outcomes and reliability theories. Phenomena classes and complexity experiential variables are to be classified to be linked with reliability. As theoretical contribution, the approach will allow to propose and make operational a sub-syllabus of decision-making skills for higher and VET education. An assessment rubric of the skills associated with decision-making in VUCA situations will ultimately be inferred and validated in real settings. To obtain a realistic view on students´ reactions to working in a volatile, uncertain, complex and ambiguous environment, it would probably make sense to monitor and assess VUCA factors at various stages of Teaching & Learning activities, not only at the end.

This DBR for the second year of the DAhoy project is initiated with questions such as: what are the theories of reliability? What are the learner's motivational factors? What are the so called *decisionship* learning outcomes? How do we characterise the VUCAlity of learning situations to continuously reinforce learner proficiency throughout a curriculum?

## An integrative D-SKILLS educational framework

The next steps in DAhoy will therefore be both reflect prescriptive and cognitive approaches in forming the suitable curriculum. At systemic level, the integrative D-SKILLS educational framework to be produce by DAhoy partners will result in the development, implementation, and transfer of innovative practices at local, regional, national or European level HE & VET organisations.

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DAhoy Outputs are to be exploited in various HE and VET institutions, for several fields, ranging from STEM education to others (e.g. business, medicine, politics). It results in:

- education and research mutual reinforcement on Decision methods and processes, with surveyed adequate Teaching & Learning approaches, promoting more student-centred and engaging learning approaches;
- a systematic integration of the European and accreditation requirements for Decision skills;
- innovative Teaching & Learning methods and new learning opportunities that effectively support the relevance and development of students' knowledge and skills in Decision making in three dimensions, as transversal key competences for HE and VET students;
- unified D-SKILLS learning outcomes, with recognition of these skills through the SCQFP personal profile; The Erasmus+ Agencies are promoting initiatives such as Mobility of Apprentices and skills needs identification, sector skills alliances for design and delivery of VET and alliances for implementing new strategic approach.
- transferable learner assessment practices and continuous evaluation methods to improve the quality of Teaching & Learning in Decision, through transdisciplinary approaches

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- more attractive education and training courses defined and assessed, to be coherently integrated in existing programs of various HE & VET fields;
- key Decision competences reinforcement in HE and VET training, including reference models and methods for introducing those competences in curricula, as well as for acquiring, delivering and assessing the learning outcomes of those curricula around Decision making with maturity models of processes for programme enhancements, via the D-SKILLS framework;
- feedback loops to adapt HE and VET provision based on outcomes for *decisionship*, as part of quality assurance systems in line with ENQA and EQAVET recommendation, including institutional-level governance improvements, with continuous quality enhancement approaches.

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- Risk perception and representation (R. Kouabenan, P. Slovic)
- Human error and human reliability (J. Rasmussen, J. Reason)
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- DUSUCA: https://tinyurl.com/jsbltdm
- CoCoRICo-CoDec: https://tinyurl.com/h4tqzhx
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- LA.R.I.O.S is Research and Intervention Laboratory for Choice Orientation http://larios.psy.unipd.it/ze-research.php

# Glossary

- **CEDEFOP:** European Centre for the Development of Vocational Training
- **CDIO:** Conceive, Design, Implement, and Operate http://www.cdio.org/
- **CDM:** Career-based Decision Making, to choose owns career path and manage his/her competence development
- **COGC:** City of Glasgow College https://www.cityofglasgowcollege.ac.uk/
- **DAhoy:** Decisionship Ahoy!
- **DM:** Decision Making
- **DOIP:** *Departament d'Orientació i Inserció Professional*
- **EQF:** European Qualification Framework
- **EN:** Ecole Navale https://www.ecole-navale.fr
- **ENAEE:** European Network of Accreditation of Engineering Education, http://www.enaee.eu/
- **ET**: Education & Training
- **FREREF:** Fondation des Régions Européennes pour la Recherche, l'Éducation et la Formation www.freref.eu
- **FUEIB:** *Fundació Universitat-Empresa de les Illes Balears* https://fueib.org
- **HE:** Higher Education
- **IMTA:** Institut Mines Telecom Atlantique https://www.imt-atlantique.fr/
- **IO:** Intellectual Output
- **JSTE:** Join Staff Training Event
- **MDM:** Maths-based Decision Making, with rationality for large project including models and processes as found in multi-criteria and risk analysis;
- **OECD:** Organisation for Economic Co-operation and Development
- **RU:** Reykjavik University https://en.ru.is/
- **SCQFP:** Scottish Credit and Qualifications Framework Partnership http://scqf.org.uk/
- **SDM:** Social-based Decision Making, for VUCA contexts, including people's interdependencies and social identities;
- **SDMO:** Société de distribution des moteurs de l'Ouest www.sdmo.com
- **SEFI:** European Society for Engineering Education http://www.sefi.be/
- **STEM:** Science, Technology, Engineering, and Mathematics
- **SWOT:** Strengths, Weaknesses, Opportunities, and Threats
- **TG:** Target Group
- **T&L**: Teaching and Learning
- **UIB:** University of the Balearic Islands www.uib.eu/
- **UK:** United Kingdom
- **VET:** Vocational Education & Training
- **VUCA:** *Volatility, Uncertainty, Complexity, and Ambiguity*
- **WBL:** Work-based Learning

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# Annexes

## Annex DAhoy partnership course portfolio (cf. Chapter 2)

- File Annex-O1A3-DAhoyCourseSamples.zip
  - 29 docx files, July 2018
  - 11 courses by IMTA, 9 courses by EN, 3 courses by CoGC, 2 courses by RU, 2 courses by FUEIB, 2 courses identified from SCQF database



# Annex FUEIB questionnaires (cf. Chapter 3)

- DAhoy Decision Making Skills, JSTE1 questionnaire
  - File Annex-O1A4-DAhoyQuestionnaireFUEIB-1.pdf
  - 4 pages,January 2018
  - by L. Tudela, FUEIB
- DAhoy Decision Making Skills, JSTE3 questionnaire
  - File Annex-O1A4-DAhoyQuestionnaireFUEIB-2.pdf
  - 5 pages, June 2018
  - by L. Tudela, FUEIB

# Annex DAhoy JSTE reports (cf. Chapter 3)

1. Report “DAhoy Joint Staff Training Event 1 (JSTE1) Learn & Inspire analysis”, 22-24 January 2018, Ecole Navale
   - File Annex-O1A4-DAhoyJSTE1report.pdf
   - 48 pages, February 2018
   - By Liliane Esnault, Siegfried Rouvrais, Matthew Stewart, and Luis Tudela, with kind help of Mari Agredano, Haraldur Auðunsson, Thordur Friðgeirsson, Yvon Kermarrec, and Sophie Lebris
2. Report “DAhoy Joint Staff Training Event 2 (JSTE2) Learn & Inspire analysis”, 16-18 April 2018, City of Glasgow College
   - File Annex-O1A4-DAhoyJSTE2report.pdf
   - 45 pages, April 2018
   - By Liliane Esnault, Thordur Friðgeirsson, Siegfried Rouvrais, Matthew Stewart, and Luis Tudela, with kind help of Manhal Alnasser, Haraldur Auðunsson, Lluc Bono, Sven Breitenbuecher, Katie Jordan, Sophie Lebris, Nathalie Marshall, Mathieu Simonnet, and Philipp Taylor.
3. Report “DAhoy Joint Staff Training Event 3 (JSTE3) Learn & Inspire analysis”, 5-7 June 2018, Reykjavik University
   - File Annex-O1A4-DAhoyJSTE3report.pdf
   - 61 pages, June 2018
   - By Liliane Esnault, Thordur Friðgeirsson, Siegfried Rouvrais, and Luis Tudela, with kind help of Manhal Alnasser, Haraldur Auðunsson, LLuc Bono, Sandra Cook, Bryan Flannagan, Sarah Ghaffari, Sophie Lebris, Nathalie Marschal, Matthew Stewart, Roger Waldeck, Claire Wiseman.

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# Contributors

DAhoy project is an inter-institutional collaboration which includes a process in which parties (individuals or institutions) work together to achieve project goals. DAhoy knowledge is shared through regular open discussion during plenary project and skype meetings. All DAhoy partners share the same values and ideologies around the project objectives. This DAhoy report, as project year one deliverable, is a joint authorship: several authors have participated and whose contributions cannot be separated one from the other. The property of this document content is the one of all the corresponding authors.

More precisely, there is generally a 'leader' of the collaboration for this report:

- At IMT Atlantique
  - Siegfried Rouvrais is responsible of this report writing process, as DAhoy project leader;
- At Reykjavik University (in forward RU)
  - Þórður Víkingur Friðgeirsson is responsible of the O1/A2 activity, reported in chapter 1: Analyse decision perimeter
- At Ecole Navale (in forward EN)
  - Sophie Gaultier Lebris is responsible of the O1/A3 activity, reported in chapter 2: survey and compare Teaching & Learning offers;
- At the Foundation University-Enterprise of the Balearic Islands (in forward FUEIB)
  - Lluis Tudela is responsible of the O1/A4 activity, reported in chapter 3: Learn from and inspire the DAhoy participants.

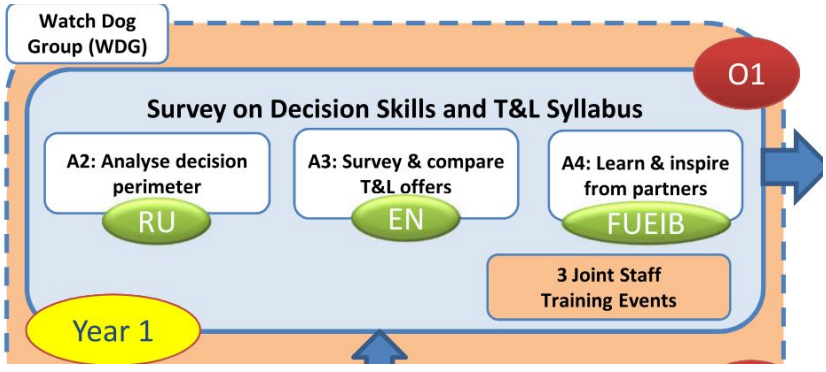



Figure. DAhoy Year-1 activities and institution leadings.

A collaborative project can not exist without the active implication on several stakeholders in the partnership. Several DAhoyers actively collaborated for this first DAhoy report, formally as subsection producers or during informal discussion during project meetings or join staff training events. They include in alphabetical order:

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