



A Learning, Training & Mentoring Framework (LTM) & the Role of Serious Games to Facilitate Sustainable Change in the Aviation Industry

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EXECUTIVE SUMMARY

A Learning, Training & Mentoring Framework (LTM) & the Role of Serious Games to Facilitate Sustainable Change in the Aviation Industry



Main Objective

Airport management and management of airport based companies are continuously required to deal with various, often complicated, changes. These organizations need well-trained change managers to facilitate the implementation of these changes. The main objective of the MAnaging System Change in Aviation (MASCA)¹ project is, therefore, to develop a dedicated Change Management System that will facilitate the transfer of an effective change management capability for the aviation industry.

¹ For more details about the MASCA project and the Change Management Systems that MASCA develops the reader is referred to <http://www.masca-project.eu/>

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MASCA's Learning, Training and Mentoring framework provides an environment in which future change managers are educated and trained. One of the main tools within this framework is the Serious Game Skyboard.

Description of Work

A core component for effectively supporting change initiatives involves training and competence development for change management skills and to facilitate the implementation of these skills in practice. The development of these competencies will be supported by the MASCA Learning, Training and Mentoring framework, which comprises two key elements: (i) a Masters Programme; (ii) a collaborative and operationally embedded learning framework. All elements are supported by the development and implementation of a serious game. The Masters Programme aims to develop crucial competencies to lead strategic change initiatives in the area of: system resilience; management of risk; innovation & sustainable change management. The overall collaborative and operationally embedded framework will provide ongoing support for the competencies and skills required for individual leaders, which will be incorporated in the Masters level. Furthermore, activities and support with shorter focus on collaborative and knowledge transformation will be executed during

development of the MASCA Learning, Training, and Mentoring framework.

One of the products within the Learning, Training and Mentoring framework will be a tool for training competencies important for change management. This tool will be a serious game aimed at training competencies identified in the competency profile for airport change managers. The game will enable players to learn and experiment with the training materials and will serve two main purposes. It will allow operational staff and change managers to sharpen their skills with respect to introductions of changes. This can be done in scenarios that focus upon changes in the turnaround process. It will also support the introduction of Collaborative Decision Making in particular.

Applicability

Many applications for the serious game have been identified among which the use of the game in trainings provided by Eurocontrol at airports dealing with the introduction of Airport Collaborative Decision Making. Change managers do not only work at airports and the competencies required from change managers do not vary much between domains. Therefore, the game could be transformed to other domains and be used to train the same competencies, but in other environments.



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Abstract

The main objective of the MANaging System Change in Aviation (MASCA)² project is to develop a dedicated Change Management System that will facilitate the transfer of an effective change management capability for the aviation industry.

In order to effectively support the change initiatives a core component involves training and competence development for change management skills and to facilitate the implementation of these skills in practice. The development of this overall competence will be supported by the MASCA Learning, Training and Mentoring framework. The Learning, Training and Mentoring comprises two key elements: (i) a Masters Programme; and (ii) a collaborative and operationally embedded learning framework, all of which is supported by the development and implementation of a serious game. The Masters Programme aims to develop crucial competencies to lead strategic change initiatives in the area of: system resilience; management of risk; innovation and sustainable change management. The overall collaborative and operationally embedded framework will provide ongoing support for the competence and skills required for individual leaders, which will be incorporated in the Masters level and in the shorter focused collaborative and knowledge transformation activities and support.

The serious game is being developed based upon the competency profile that was identified in the Learning Training and Mentoring framework. A selection of training requirements, stemming from the competency profile, that can be trained by means of a serious game was made. The game will enable players to learn and experiment with the training material. It will allow operational staff and change managers to sharpen their skills with respect to changes. This can be done in scenarios that focus upon changes in the turnaround process, in particular the introduction of Collaborative Decision Making.

This paper presents the current progress on the development of the Learning Training and Mentoring framework and the application of the serious game in supporting the development and implementation of the overall Change Management System.

² For more details about the MASCA project and the Change Management Systems that MASCA develops the reader is referred to <http://www.masca-project.eu/> and the four other MASCA papers that are presented at PSAM-11 - ESREL 2012.

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Abbreviations

Abbreviation	Description
CDM	Collaborative Decision Making
CMS	Change Management System
EASA	European Aviation Safety Authority
ICAO	International Civil Aviation Organisation
LTM	Learning, Training and Mentoring framework
MASCA	MANaging System Change in Aviation
NLR	National Aerospace Laboratory NLR
TNA	Training Needs Analysis

1 Introduction

Organisations of all kinds are facing extraordinary demands for innovation and change to improve their performance. They need to understand and manage the risks this involves. Transport, manufacturing and services are changing not only because of relentless commercial and budgetary pressures but also because the deployment of new technologies creates unprecedented opportunities to reorganize. New business models and new regulations call for leaner processes, system integration, joined-up management systems, system performance measurement, managing system change – in order to develop resilient, adaptable socio-technical systems. Research and development in process innovation and the application of new technologies are essential to transforming productivity and competitiveness in both public and private sectors. Design for future operations, managing people in changing organisations, creating new standards of practice, implementing regulatory systems that actually work – all of these bring human systems to the centre of a smart, competitive economy in which safety, quality, cost and environmental impact are reconciled.

The literature on organizational change demonstrates that, against different criteria and outcomes, only a minority of major change initiatives (typically between 30% and 50%) have a positive outcome (Dent and Powley, 2001, Porras and Robertson, 1983, Kotter, 1995, Pascale, Millemann and Gioia, 1997, Maurer, 1996). From some of the few longitudinal studies of change, Pettigrew (1985) shows how change is complex, frequently opportunistic, and depends on the balance of capacity within the organization (Pettigrew, 1985, Pettigrew and Whipp, 1991). In the aviation system, a series of European projects (ADAMS, ADAMS 2, AMPOS) have analyzed the difficulties that organizations have in achieving effective change even in response to serious safety incidents.

Change is necessary, but it is risky. It is vital therefore that the reasons for organizational change failure are understood by those responsible for its enactment. Where change involves people in organizational processes it becomes primarily a ‘human factors issue’ and involves complex, multidimensional solutions. This is made difficult by the fact that change often results in “organisational inertia” or “resistance” by employees and this requires careful management in terms of hearts and minds. It is necessary that managers who are tasked with implementing change initiatives understand clearly the complex individual, social and cultural dynamics that underlie the compliance or resistance to change on the part of personnel affected.

Designing for, and managing, the human factor in order to support the acquisition and retention of skills and knowledge is central to the safe, commercial and environmental sustainability of the

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current and future aviation system. Building on previous EU funded projects (most notably HILAS) MASCA has the clear objective of developing a new platform of knowledge through training and education on organisational processes for implementing effective change throughout the aviation lifecycle. All of these create a huge and urgent demand for high-level competence-building for those who will lead these developments:

- The ICAO (International Civil Aviation Organisation) has mandated EASA (European Aviation Safety Authority), along with all other national and regional aviation authorities, to produce new regulations requiring all aviation organisations to have a Safety Management System as from 2009. Existing regulations for the certification of new aircraft technologies also require a thorough assessment of the human aspects of the operation of these technologies. The HILAS project has developed best practice models for how these regulations can be effectively implemented.
- There is a general industrial need for the development and deployment of integrated management systems linking all people management functions to meet competitive requirements.
- Major manufacturing organisations require new capabilities to enable ‘design for operability’, particularly in complex ‘system of systems’ like aviation. This is a strategic goal of major manufacturing organisations like THALES, EADS/Airbus and their networks of suppliers. It is an essential capability to enable the next generation of integrated systems (for example, for European air traffic management) to be developed so that they actually deliver their operational and social goals.
- New forms of regulation are emerging – light and cost-effective (because they are based on transparent oversight of internal management systems), global (because the world system is globally integrated), and integrated across the system lifecycle (safety at the design phase must be integrated with safety in the operational phase).

In relation to the research carried out in MASCA to date, the change interventions have emerged around the following themes:

- Helping introduce Collaborative Decision Making in a competitive airport environment
- Linking risk & performance across flight ops, maintenance & a/c turnaround
- Assessing preparedness & facilitating change

All of which will be supported by the ongoing development of tools & methods to support & evaluate management of change and the implementation of a Learning, Training and Mentoring (LTM) framework and a serious game.



This paper presents the current progress on the development of the LTM framework and the application of the serious game in supporting the development and implementation of the overall MASCA Change Management System in supporting the emerging change case-studies.

2 MASCA Learning, Training and Mentoring Framework (LTM)

The overall MASCA work program has a primary focus on the transfer of change management capability into the organisations that are responsible for and involved in change. In order to effectively support the change initiatives a core component of the MASCA Change Management System is a framework for Learning, Training and Mentoring. The key elements of the LTM include:

- Masters Programme (developing the leadership and mentoring capability to implement and evaluate change and innovation)
- Collaborative & Operationally Embedded Learning

These two key elements will work together in establishing the required levels of competence and linking that competence to supporting the overall change programme. The philosophy guiding the LTM programme can be summarised as follows:

- While training and education needs to empower people to think in a different way and provide them with the skills and knowledge to do so – this is not sufficient if the learning from them is not accompanied by changes in the operational system.
- The LTM needs to engage with the current culture - focus more seriously on the cultural role of training and to articulate clearer goals for cultural impact.

2.1 MASCA Masters Programme – Managing Change and Innovation

The proposed Masters Programme offers an integrated approach to the human side of operations, manufacturing and services. The curriculum has a core focus on people in processes in organisations. This provides the context for managing and developing people, the design and integration of technology and the management of risk. It supports a strategic capability to meet current challenges in a coherent way: achieving value from people; recognising their value; realising the benefits from technical and organisational change; meeting ever more exacting performance standards driven by regulation, the customer and the consumer. The main target is the further education and training of personnel who have a role across key organisational functions - human resources, planning, managing operations, quality, safety, regulation, system design – providing the knowledge and skill to innovate in designing, managing and changing productive human systems.

The normal duration of the course will be two years part-time. An innovative, practice-based and flexible delivery structure (hybrid learning), combining a dynamic online learning environment

and face-to-face delivery will focus on two key elements: (i) directed study (taught element); (ii) substantial programme of research (dissertation & on-going industrial based portfolios targeting individual organisational strategic priorities). It is expected that the majority of students will be sponsored by their companies. It will deploy cutting-edge knowledge to foster advanced standards of professional practice and world class research in pursuit of the programme’s objectives. The initial focus is the global aviation system. Over time this will be progressively broadened to other complex high risk systems in both public and private sectors.

Based on state-of-the-art collaborative research and ongoing development with industry, the program will comprise the following modules.

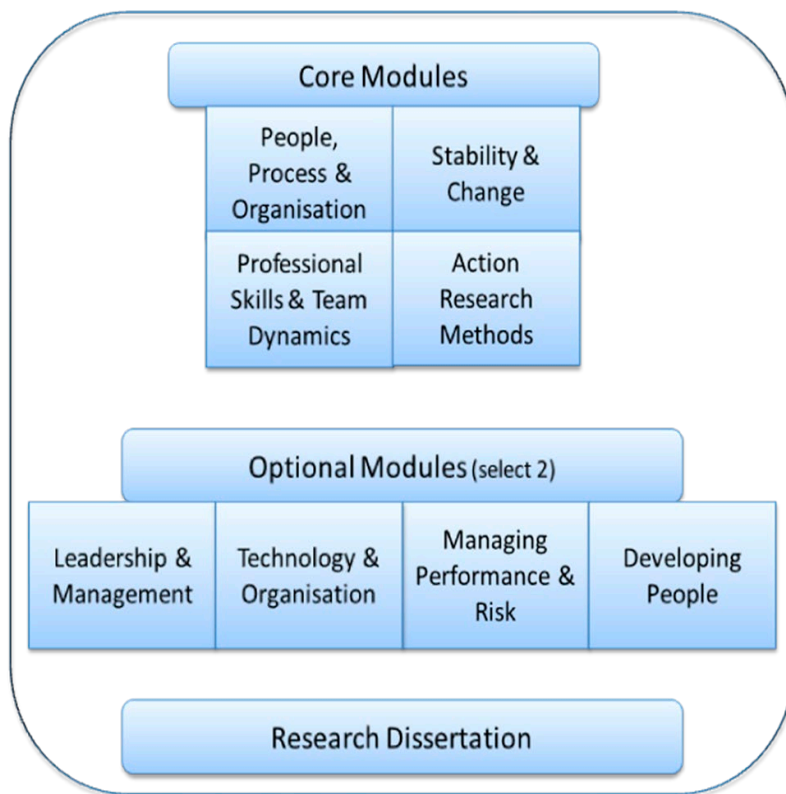


Figure 1 Overview of Modules

This highly integrated programme will focus on contemporary theory and practice about human factors, socio-technical systems, management and organisation; it will develop and mentor skills for working with people, and will deliver effective methods for conducting industrial based research that has relevance and real impact.

2.2 Collaborative & Operationally Embedded Learning

The overall MASCA Learning Model is based on a progressive collaborative process, with each stage involving preparation, collaborative learning and a particular mode of consolidation of that learning. It is particularly informed by Nonaka's model of the transformation of operational knowledge from tacit to explicit to tacit and his overall process of knowledge transformation in innovation (Nonaka, 2008).

In applying a practical human factors learning framework to support the implementation of change - a collaborative process (involving all stakeholders in the various change case-studies of defining current and future processes) will begin to populate this learning environment with an emerging consensus view of how the future process should operate in order to fulfil its goals, taking into account resources and diverse influences and organising principles. This will draw in all the comments, issues, problems and challenges that define the human factors agenda in a socio-technical system. This sets the requirements for what needs to be implemented and how it needs to be resourced and managed. At the implementation stage (both in 'serious games' as well as in full scale implementation trials), this collaborative environment will actively support the implementation with a strong focus on solving problems and collaboratively achieving operational goals. Thus this framework provides a direct operational support together with facilitating learning from practice.

3 Serious Games

To support the education and training framework, a serious game is being developed within the MASCA programme. Serious games [...] have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement.” (Abt, C., 1970). They are games that aim to teach the players competencies that are important and relevant for their professional development. Serious games are often used in parallel with other learning tools and environments, such as lectures, e-learning forums, and simulators. They enable a student to ‘play’ with course material and to see for him/herself how actions that he/she takes may work out without resulting in the consequences that may result from experimenting in real life. They range from very detailed, for part-task training, to very global, to provide students with a good understanding of the coursework. Serious games can even be used as an ‘umbrella’ for a complete course.

The advantage of using serious games over other learning tools is that when serious games are well-developed, they enhance students’ motivation (Garris, Ahlers, and Driskell, 2002). This increased motivation can lead to students spending more time on the training-task and therefore to better results (Mautone et al., 2010). In fact the game elicits them to play, and therefore learn, over and over again. A serious game is considered well-developed when the correct balance between entertainment and education was found. Therefore, the development of a serious game is a flexible process with many interactions between developers and potential users to ensure the correct balance. In other words, it is a game that is both entertaining and ensures real impact (i.e. transfer of learning back into the work-place).

3.1 Game design

Figure 2 visually displays the development process of the MASCA game. It starts with gathering information necessary for the initial design. Most of this information results from the training needs analysis (TNA), such as the composition of the target population, the available play time and the competencies that need to be trained. The rest of the required information comes from the user requirements analysis. This information answers questions regarding four entities: the knowledge domain, the game principles, the simulation model and the didactical principles.

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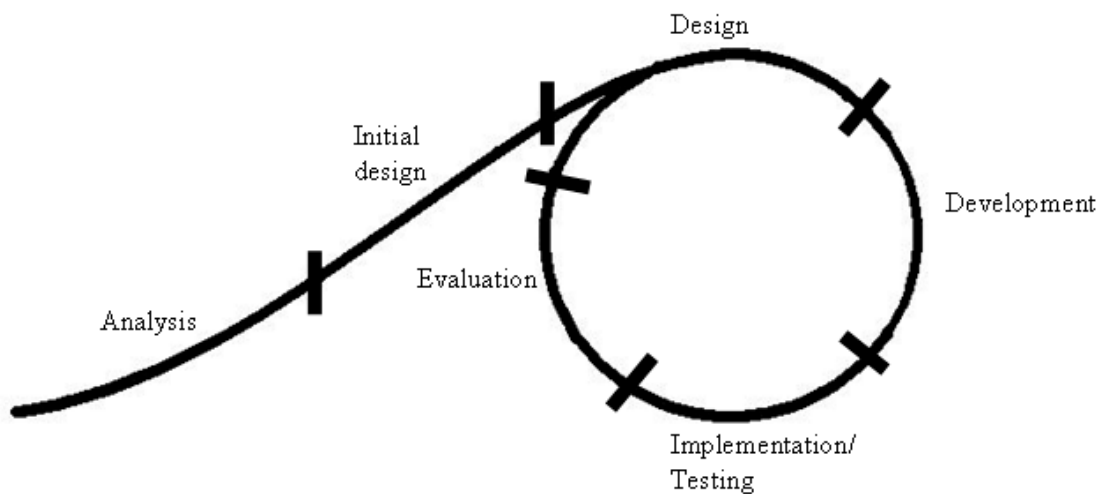


Figure 2 Development Process of MASCA Game

At this moment the TNA is completed and a competency profile (see Appendix A) is deduced from that. The transfer from competency profile to game mechanics is being made. Game mechanics form the framework of the game. They determine the complexity of the game, the ways how players interact, what kind of behaviour is rewarded and as such stimulated to display, etc. An example can be the ways that chess pieces are allowed to move over the board, or rolling a dice to determine the likelihood that something happens.

Each competency from the competency profile will be linked with one or more game mechanics to design a serious game. For example, deciding collaboratively with other players is rewarded higher than deciding on one's own what to do next, if the game aims to teach CDM. Some game mechanics can cover multiple competencies, so competencies that are similar or fit into the same mechanics can be chunked. These links ensure that the players will be rewarded for demonstrating the behaviour that matches with the competency profile and 'punished' for non-compliant behaviour.

In parallel to this, scenarios that are relevant for the potential players of the game are selected. Since most players work at airports or airlines the turnaround process, and in particular the change of applying CDM during that process, is selected as the main scenario in which the game will be played. Note that the game is not a complete simulation of a particular airport. The scenario demonstrates the generic process of CDM during the turnaround process. Since the game is supposed to be played by different stakeholders with different tasks in the turnaround process, the scenario is deliberately kept at a high level.

The game can be played in a mode during which sharing information and intentions that each player has is hindered or in a mode during which it is encouraged. These two modes represent respectively playing without and with CDM. Sharing of information will enable the group of players to collaboratively come to better and more effective results. As such the players will in a gaming environment will see for themselves that applying CDM gives better performance. They will also be able to experiment with their own behaviour with respect to CDM and see how that influences others and the performance in general. They will gain hands-on experience that they would not be able to retrieve from more traditional training methods.

Since the game is about change management, changes that can be introduced within the scenarios are needed. New technologies, procedures of working or deviations from existing schedules are options that may be applied. During game balancing sessions a number of these possible events will be tested and their relevance with respect to the aim of the game will be validated. Based upon this validation a selection of events, that will actually be incorporated in the game, will be made.

One of the labour intensive parts of the game development that is yet to come is balancing and test-playing the game. During this process it will be ensured that the behaviour that the game plans to teach is indeed most rewarding. It will also ensure that it is not too easy for players to determine a winning strategy that never fails. Hence the game will always teach what it is supposed to teach and will always be challenging and attractive to play again.

4 Conclusion

For this type of learning model to succeed people need to have the leadership and management of change skills and the confidence to successfully implement new initiatives and approaches to working. The learning, training and mentoring framework that is proposed as part of the MASCA project provides the basis for an integrated learning and management framework that moderates the learning in both design and implementation, identifies and addresses associated cultural challenges, and defines, implements and monitors key performance targets.

The Masters Programme aims to be a key building block in developing the necessary competence-in-depth to lead strategic change initiatives. As the proposed framework is not just about training but also about having the skills and knowledge to lead and manage real and effective change, the focus will be on ensuring ongoing collaboration and consolidation of learning that can actively support operational practice.

The serious game will be developed to support the learning process by enabling students to play and experiment with the lessons that were learned in the LTM. This will be done in an environment that is more 'forgiving' than the actual working environment. As such students can afford to make mistakes without the possible negative consequences that these mistake would have had in real life. The game framework will take the turnaround process with CDM as starting point for the game development to ensure that players will recognise the game as something that is tailored to their needs, while at the same time it is not a full blown highly detailed simulation of the airport where they normally work.



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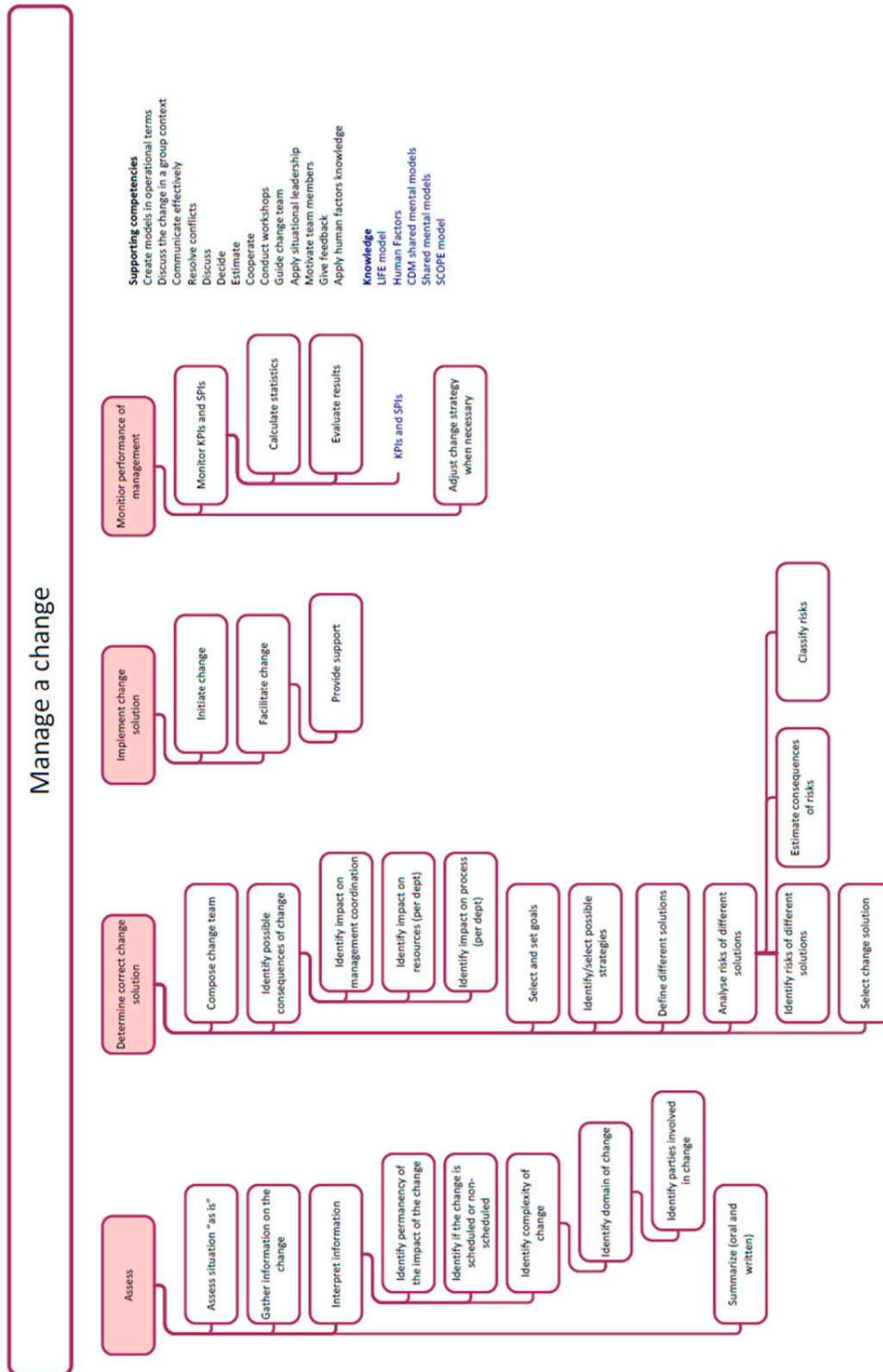


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Appendix A Competency Profile



Supporting competencies
 Create models in operational terms
 Discuss the change in a group context
 Communicate effectively
 Resolve conflicts
 Discuss
 Decide
 Estimate
 Cooperate
 Conduct workshops
 Guide change team
 Apply situational leadership
 Motivate team members
 Give feedback
 Apply human factors knowledge

Knowledge
 LIFE model
 Human Factors
 CDM shared mental models
 Shared mental models
 SCOPE model

WHAT IS NLR?

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