

Assessing Human Factors Maturity[®]

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Human factors is an integral part of achieving successful organisational and health and safety performance. It is a discipline which focuses on the human element to understand and improve the interaction between people and complex systems. In the process industries, human factors is concerned with human behaviour and performance, particularly in relation to reducing the risk of incidents and accidents.

Many factors influence health and safety performance and behaviour and there are recurring themes related to how people have contributed to major accidents in the past. Applying human factors requires consideration of the depth of the different topic areas, whilst recognising the breadth of coverage and the need to approach the subject from a holistic perspective. Typically, it is challenging to know where to start, and to know which specific Human factors areas should be prioritised.

The Human Factors Maturity[®] Model (HFM[®]M) was developed by the Keil Centre to enable organisations to assess their own level of Human Factors Maturity[®] (Human Factors Maturity[®] is a registered trademark of The Keil Centre Ltd). The model presents an opportunity for organisations to assess how mature they are in managing human factors, but importantly, to pinpoint where to focus future efforts. The HFM[®]M uses a 5-level scale to determine an organisation's level of maturity. It includes 12 key human factors elements which have been identified from empirical research and from mining human factors literature. The model was developed using the combined expertise of seven human factors specialists at the Keil Centre and tested with the cooperation of an industry partner.

The model was further developed into an interactive tool for application in a workshop format. A cross-section of organisational representatives is invited to participate to assess their current level of Human Factors Maturity[®] for each of the 12 elements using a card-sort methodology. Once the level for each element has been determined, the current arrangements are described and the requirements to improve maturity to the next level for each element are identified. At this point, the priorities for action are defined based on their importance to the organisation, taking account of the elements most in need of development. This assessment supports the development of a human factors strategy and an action plan. The HFM[®]M has been tested in the energy and chemical production sectors.

1. Introduction

The Keil Centre Limited started the development of the HFM[®]M in 2014 in response to a specific requirement from one of its client, Duke Energy International (DEI), which was at the time a subsidiary of Duke Energy and the largest electric utility in the United States. DEI had previously worked with the Keil Centre to develop their safety culture and enhance their safety performance (Mitchell, Bernard & Villagran, 2014). As part of their continuous safety improvement, DEI decided to define a strategy for the broader human factors issues within the company. DEI acknowledged 'human factors' was a new concept to most people within the organisation, and felt it was necessary to educate the workforce but also to assess their current arrangements and management of human factors issues. The Keil Centre, a firm of chartered psychologists and human factors and ergonomics specialists, was asked to support the development of the assessment tool, which then became known as the HFM[®]M. The initial development journey of the tool was published by DEI and the Keil Centre (Mitchell, Bernard & Villagran, 2016).

Since the initial development, the HFM[®]M has been significantly refined and used in a global chemical production company to assess their current arrangements and management of human factors. In addition, a

comprehensive training course (known as ‘human factors essentials’) is being developed to support and improve the capabilities of those in an organisation who are tasked with implementing the human factors strategy, informed by the results of the HFM[®]M assessment. This paper describes the current version of the model, and its application at the global chemical production company.

2. Structure of the Model

The HFM[®]M uses 5 levels to describe an organisation’s level of maturity. It reflects the notion that human factors capability requires key aspects to be in place (as defined by Nickleby 2002, on behalf of the UK Health and Safety Executive). These aspects include: a focused process which includes policy development; effective organisation and planning; implementation of methods to identify and reduce human factors risks; measurement of the success of the implementation; and reinforcement, maintenance and development through audit and review. In the 5-level HFM[®]M, the lower levels of human factors provision are typified by an ad-hoc approach that is not planned and where no set policies or procedures are in place. At the higher levels best practice approaches are applied in a planned and systematic way and are monitored for their impact. Human Factors Maturity[®] ranges from ‘Emerging’ to ‘Leading’, as shown in Figure 1.

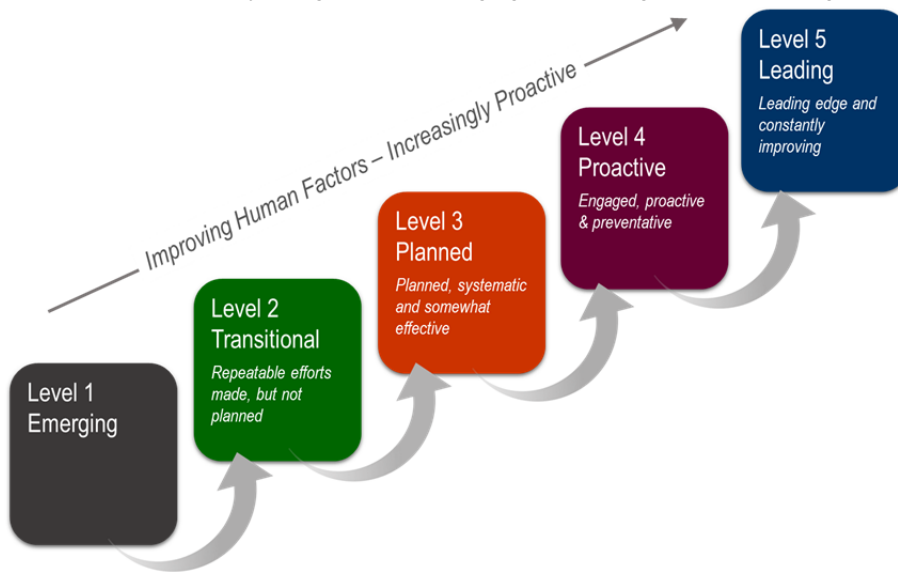


Figure 1 – The 5 Levels of HFM[®]M

The model incorporates specific human factors elements, each of which is assessed for its degree of maturity relating to the 5 levels. The HFM[®]M includes 12 key elements of human factors identified from empirical research and from mining human factors literature which outlines their relevance to major accidents. The 12 key elements are shown in Figure 2.



Figure 2 – The 12 Key Elements of the HFM[®]M

Various institutions have concluded that there are recurring human factors themes related to major accidents, such as the UK Health and Safety Executive (HSE) and the Energy Institute. The HSE refers to the 'top ten' human and organisational factors, which are further sub-divided into a total of 16 categories. The HSE's 'top ten' is shown in Table 1 alongside the HFM[®]M key elements.

Table 1 – HSE's Top Ten and the HFM[®]M 12 Key Elements

HSE's Top 10 Human Factors topics	12 Human Factors Maturity [®] Model Elements
1. Managing Human Failure	1. Managing Human Failure (including maintenance)
2. Procedures	2. Human Factors in Incident Investigation
3. Training and Competence	3. Design and Development of Procedures
4. Staffing	4. Training and Competence
5. Organisational Change	5. Staffing and Workload
6. Safety-Critical Communication	6. Managing Organisational Change
7. Human Factors in Design	7. Safety-Critical Communications
8. Fatigue and Shift work	8. Human Factors in Design
9. Organisational Culture	9. Fatigue and Shift work
10. Maintenance, Inspection and Testing	10. Safety Culture and Behaviour
	11. Contractor Management
	12. Managing Performance under Pressure

The 12 elements are described in Table 2.

Table 2 – Definition of the HFM[®]M 12 Key Elements (continue)

HFM [®] M Elements	Description
1. Managing Human Failure (including maintenance)	This is a structured analysis of the potential for human failure, including both errors and intentional behaviours. Potential human failures can then be addressed to prevent the error in the first place, improve detection and recovery and / or mitigate it if it does occur.
2. Human Factors in Incident Investigation	Human failure is symptomatic of a deeper failure and systematically linked to the tools, tasks and working environment and therefore requires thorough investigation as part of the overall investigation process.
3. Design and Development of Procedures	Procedures are agreed safe and correct ways of performing tasks; they include work instructions, method statements and other task-based job-aids. They guard against error and non-compliance if they are well designed and include user involvement during their development.
4. Training and Competence	Employees are the last line of defence. Therefore, effective training and competence development are fundamental for achieving the desired standard of task and safety performance.
5. Staffing and Workload	Staffing must be optimised to ensure the right people are in the right place at the right time, with suitable knowledge, skill and experience to operate safely. It includes having enough staff, and an even allocation of tasks, as well as the required competence to operate safely.
6. Managing Organisational Change	Organisational change can be defined as any change to business processes, structures, staffing levels or culture within an organisation. It requires consideration and anticipation of the human factors perspective across both planning and implementation stages.
7. Safety-Critical Communications	Critical tasks and activities involve within-team and inter-team communications which vary by form and operational scenario. Control of work systems and shift handovers require critical information to be communicated and must be adequately designed.
8. Human Factors in Design	The design of work systems and equipment directly influences how people behave and perform at work. Human Factors needs to be integrated with the engineering management system which follows a structured user centred design approach to reduce the potential for human error, accidents and ill-health, and to increase productivity.

Table 2 – Definition of the HFM[®]M 12 Key Elements

9. Fatigue and Shift work	Fatigue is caused by insufficient quality or quantity of sleep, or an excessive time awake. It can increase the likelihood of error and risk-taking behaviour and the risk of fatigue therefore needs to be managed.
10. Safety Culture and Behaviour	Culture is defined as shared attitudes, beliefs and ways of behaving. Safety culture is concerned with the way people in a given culture think and behave in relation to personal, process, product and third-party safety.
11. Contractor Management	Any organisation employing contractors must adopt the principles of an 'intelligent customer' in contractor management. This means understanding and being knowledgeable about the product or service being supplied, so that contractor performance can be effectively managed.
12. Managing Performance under Pressure	Chronic and acute stress have the potential to affect safe performance and health. Effective pressure management relates to implementing a structured programme for prevention, management and treatment.

For each of the 12 elements, the 5 levels of Human Factors Maturity[®] have been defined using the 5-level framework. Within the framework, there is a description of what could be expected to be in place at each level in relation to human factors tools and techniques, knowledge, expertise and resources, and human factors processes. The framework enables an organisation to assess its own level of Human Factors Maturity[®] for each element.

3. Process of Implementing the Assessment Tool

The HFM[®]M assessment is facilitated by a human factors practitioner with a designated group of participants who have knowledge of the practices and processes used by the organisation in relation to human factors. This may include in-house human factors coordinators, Environment, Health and Safety (EHS) managers, engineering, operations, or project managers.

Human Factors Maturity[®] is less about perception, and more about what is physically in place in terms of procedures and best practice. This differs from other diagnostics, such as 'safety culture maturity[®]', which is dependent on the perceptions of those within the organisation.

Participants are given a brief introduction to the HFM[®]M and how the workshop is conducted. Each of the 12 HFM[®]M elements are assessed in turn using a card-sort activity. The cards provide the description of each element across the 5 levels and participants review each of 12 sets of cards (e.g. Managing Human Failure, Safety-Critical Communications) together as a group. For each set of cards, they discuss and select which of the 5 cards in the set best describes the status quo.

It is common for organisations to have existing practices and processes which relate to human factors, such as competency frameworks, management of change procedures, and end user involvement in design. However, these practices and processes may not be recognised as being linked to the human factors remit. In addition, while some human factors issues may already be addressed, they may require a deeper or broader focus to attain a standard that is sufficiently comprehensive.

Once all the card sets have been reviewed, a chart of the scores is revealed and the facilitator then explains the 12 elements and levels. The group's rationale for choosing the individual cards is discussed and three elements are selected as the organisation's current highest priorities. Just because 'human factors in design' is rated at level 2 and 'safety culture and behaviour' at level 3, for example, it does not necessarily mean that tackling issues related to 'human factors in design' is more important than improving 'safety culture'.

The tool provides a broad set of recommended actions according to the level of maturity achieved. At lower levels of maturity, smaller incremental steps are presented to enable a path to improvement, rather than expecting an organisation to 'jump' to a 'leading' standard.

4. Case Study at a Chemical Process Site

A HFM[®]M assessment was conducted by two Keil Centre consultants (the authors of this paper) and the EHS professionals and operational managers of a chemical processing site.

The levels selected by participants for each of the 12 key elements are presented in Figure 3. This shows that the elements of greatest maturity were 'safety culture and behaviour' and 'contractor management'. However, the elements of least maturity were 'human factors in design' and 'managing organisational change'.



Figure 3 - Selected Levels of Maturity by Element

Human factors in design was rated at level 1 as there is no formal process and engineering design does not incorporate human factors. There are the beginnings of considerations but very little formal inclusion. The issues 'caught' are neither formalised nor comprehensive and there is no 'structure'. It is intuitively applied and there is no formal training or expertise/ qualified human factors specialists involved at the early or review stages. Engineering training does not cover human factors and it is picked up through experience. Despite this element being scored at a low level it was not selected as a priority for the company as few design projects were under way at that time or for the foreseeable future.

The elements selected for action were:

- managing organisational change (level 1);
- staffing & workload (level 2);
- managing performance under pressure (level 2).

Specific actions were identified for each of these areas to improve the level of maturity. These related to:

- formalising a structured approach for implementation, planning and monitoring. For managing performance under pressure, this included a strategy and programme to cover prevention, management and treatment;
- implementing element-specific risk assessment tools and identifying triggers for their use. For management of organisational change this included a screening checklist accompanied by a more detailed assessment format if the human factors 'flags' are identified for a given change situation;
- developing internal capability to use the relevant tools and techniques. This included specific training, for example, in the use of staffing and workload tools and developing an open dialogue with jobholders to assess workload;
- improving general awareness, workforce engagement and consultation. This included general education programmes for all element areas, as well as targeted training for specific occupational groups and 'self-help' tools to support changes in approach.

5. Conclusions

Many organisations are recognising the need to consider human factors as an integral part of achieving successful organisational and health and safety performance, but do not necessarily know how to achieve a sufficiently holistic approach.

The HFM®M and methodology provides the opportunity for organisations to baseline how 'mature' they are in managing human factors and to identify where to focus future efforts in realising an effective human factors strategy.

The model defines 5 levels of 'maturity' for 12 human factors elements which are relevant to reducing the risk of major accidents. The lower levels are typified by an ad-hoc approach that is not planned and has no set policies or procedures. At the higher levels best practice approaches are applied in a planned and systematic way and are monitored for their impact.

The HFM®M assessment is undertaken in a workshop format with different representatives from within the organisation. Participants undertake a card-sort activity to determine their level of maturity for each element and define the existing practices in place for each of them. The group then decide the top 3 priorities for action and these are agreed, using the guidance within the tool. The case study review showed that it is not necessarily the lowest scoring element that needs to be selected as the priority for action.

The assessment can be used to build support, understanding and commitment from managers towards improving the integration of human factors within the existing organisation. It also represents an opportunity for organisations who are tackling human factors to benchmark their activity and communicate about human factors topics using recognised terminology and concepts.

It is common that organisations have existing practices and processes in different areas of the organisation which relate to human factors, but they are not be sufficiently comprehensive or recognised as being part of a human factors strategy. The HFM[®]M intends to support organisations in developing a management framework to acknowledge what they already do, and to highlight gaps and improvements that need to be addressed.

References

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