Human Factors Integration. The beginning is a good place to start.

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Progress is the natural evolution of human beings and, subsequently, so is the nature of the industries that we govern. First came the drive to make money. Second, came the necessity to make money safely. Now there is the strive to make money safely AND sustainably.

However, no matter the advancements in technology, one constant will always remain, the ability to achieve 'safe and sustainable' systems still relies on human beings. A fully automated process may remove the Human-Machine Interface during production, but the process is designed, commissioned, maintained and decommissioned by a human.

Human Factors and the potential for human error has been studied and understood for many decades but the importance of Human Factors (HF) and User Experience (UX) is only recently being integrated into some design projects to the extent it should be, with ample opportunity for improvement.

The integration of HF and UX to design projects is fundamental to achieving that 'safe and sustainable' goal. The usability of a system will have a direct correlation with the potential for human error.

In a time of global change and adjustment after the COVID pandemic and the necessity for safety and sustainability, the opportunity to embrace the full potential of Human Factors Integration is one that shouldn't be ignored.

The Goal - Safe and Sustainable

Legislative changes over the last century have forced employers to "ensure, so far as is reasonably practicable, the health, safety and welfare at work of all … employees" [Health and Safety at Work etc. Act 1974]. The once acceptable culture for employees to work with the 'dangers of the job', is no more.

Employers have had to assess their risks and implement control measures to reduce the residual risks to As Low As is Reasonably Practicable (ALARP). The preferred hierarchy of controls follows the 'ERIC PD' structure. First 'Eliminate', if the hazard cannot be eliminated, then 'Reduce' the quantity of the hazardous substance or reduce the time the employee is exposed to the hazard. If there is no potential to Eliminate or Reduce the hazard, can the hazard be 'Isolated' from the employee? If none of these are achievable, or the residual risk is not ALARP, then 'Control' measures are used to reduce that risk further. These control measures can vary from safe systems of work to passive and active engineered controls.

Eliminate, Reduce, Isolate and Control are all best implemented during the early design stages, as any changes are difficult and costly once the design is frozen, or once construction is underway. If these 'ERIC' risk reduction measures were not implemented or leave a residual risk which is not ALARP, there are two further protective measures, measures which employers, largely speaking, still rely too heavily on.

Personal Protective Equipment (PPE) is designed to protect employees from hazardous materials or situations, e.g. chemical resistant gloves or welding helmets. The PPE acts as a barrier between the human and the hazard. That leaves 'Discipline', which is not the means of teaching through punishment, but rather applying disciplined regimes to the controls in place, ensuring that controls are robust and reliable.

The Problem – Too Little, Too Late

This is all well and good, Process Safety 101. But what doesn't always spring to light is that all six of those risk reduction measures have one common cause of failure, Humans! The latter three (Control, PPE and Discipline) more so than the former three (Eliminate, Reduce and Isolate).

Engineered controls are exactly that, engineered, defined as being "Skilfully and deliberately arranged rather than arising naturally" [Oxford Dictionary]. A human or combination of humans must design, manufacture, commission, operate, maintain and dispose of each control measure: leading to the opportunity for single, multiple and combined human error (s).

PPE is also designed, manufactured, purchased, used, maintained and disposed of by humans. The potential for error in selecting, using, maintaining and disposing of PPE can be fatal.

Discipline in ensuring the controls in place are robust and reliable must be both set and maintained by humans. Control degradation is a common cause of process incidents, through lack of communication, lost information and budgets, etc.

Eliminate, Reduce and Isolate rely on a human's ability to make decisions and interpret legislative requirements. The United Kingdom (UK) has a goal setting approach to legislation compliance, in that the goal is prescribed but the method to reach it is not; in comparison to the likes of the United States of America (USA) which has a very prescriptive legislation compliance approach, the goal is set and the method to get there is set. In the UK, this allows space for interpretation and space for human error.

Human and organisational errors can be found to be the root cause, immediate cause or escalation factor in nearly all major accidents – whether that be through lapses in judgement during design, risk assessment, construction and operation, or

through negligence in maintaining the robustness of the controls put in place. These human and organisational errors were all too prevalent in the cause and escalation of the catastrophic Bhopal disaster 1984, Piper Alpha in 1998 and the more recent Deep Water Horizon of 2010 and Port of Beirut Explosion in 2020.

The Barriers

Upon discussion with ten HF Consultants and UX Consultants from across the Aerospace, Defence, Security and Technology (ADST) and the Energy sectors, three attitudes towards HF/UX emerged: Reactive, Resentment and Ignorance.

Reactive

Reactive organisations only call upon HF and UX in response to an incident where human error has been identified as the root cause or a notice from the Health and Safety Executive (HSE). This usually occurs in industries where Human Factors is less regulated.

Resentment

Common in highly regulated sectors e.g. the Nuclear, Defence and COMAH industries, resentment is often expressed at the level of detail, time and resource required for the HF/UX Assessments. Although proportionality should always be considered to ensure that the appropriate level of rigour is applied, the potential for HF/UX to impact design and project progression, can sometimes be resented.

Ignorance

More common in less regulated industries is simply the lack of understanding of what HF and UX are and how they can benefit a design or project. This has the potential to progress in one of two ways: continue in that ignorance until external factors bring it to your attention – i.e. all is done and you're ready to hit 'go', until you realise that the 'go' button is too high to reach, is in the wrong language, and is too small to press without pressing all the other buttons. Alternatively, consultants are contracted to integrate HF/UX into the design/process.

These three themes are largely split between highly regulated industries and less regulated industries, leading to the same barrier, HF/UX Integration that is too little, too late. So what can be done? The solution is appropriate and timely integration of Human Factors (HF) and User eXperience (UX) into design projects.

The Solution - Human Factors and User Experience

"Human Factors Engineering applies scientific knowledge about human capabilities and limitations to design, whereas User Experience focuses on designing everything the user comes into contact with, even emotionally. Together, these produce products that are useful, usable, desirable and safe." [Research Collective].

At each stage: concept, design, manufacture, commissioning, operation, maintenance and disposal, lies the potential for human error. Human Error which can be predicted, assessed and managed if given the opportunity. Just like Process Safety, Human Factors Engineering is essential to achieving that 'Safe and Sustainable' goal, with the best potential for meaningful impact in the early design and concept stages.

HF and UX are core disciplines in multi-discipline project teams. As one would reach out to Chemical, Electrical, Process and Mechanical Engineering disciplines for input to early project stages, HF and UX need to be included. That isn't to say HF and UX will start work right away, some time may be needed to establish project parameters before the heavy lifting starts. But including HF/UX in the initial conversations, whether that be concept or bid preparation, will allow for the correct HF/UX expertise to be mustered and at the right time, reducing the potential for oversight and retrofitting.

With the drive for profit ever at the forefront, taking the time to properly assess the risks posed by ourselves, both intentionally and unintentionally, has the potential to save lives, the environment, time and money. So why wouldn't we?

References

Health and Safety at Work etc. Act 1974.

Oxford Learners Dictionaries, 2022 Oxford University Press, https://languages.oup.com/google-dictionary-en/.

Research Collective, Healthcare HF & UX Services, HUMAN FACTORS & USER EXPERIENCE, 2022. Human Factors & UX - Human Factors and User Experience - Research Collective Home (research-collective.com).