

Smart safety shoes

The next step in preventing occupational incidents



Introduction

The construction and logistics sectors in the Netherlands are rapidly increasing in size, but unfortunately are also part of the most hazardous industries. One part of safety which needs to be addressed is manual handling related incidents. The moving of objects around a worksite through utilization of an employee's body increases the exposure of the employees to hazards, especially if done incorrectly. Next to hazards, this will also increase costs for both employee and employer. In collaboration with Allshoes, market leader of protective footwear (safety shoes) in the Netherlands, the possibility was explored of transforming the passive and reactive role of safety shoes into safety shoes that are capable of proactive (manual handling related) incident prevention, through utilization of smart technology.

Research insights

An extensive research phase led to some critical insights, which are presented on the right. Research results show that the human factor plays a major role in the causation of occupational incidents and can be divided into three categories: the individual, the task and the organisation. As this human factor is either the leading cause or part of the cause for around 80% of all incidents, it is vital for incident prevention.

Furthermore, current methods for detection and prevention (e.g. manual handling training and safety programs) have serious shortcomings which make them less effective tools for the reduction or elimination of manual handling related incidents. More than a dozen studies indicate that manual handling training has no positive relation with improvement of manual handling technique or decrease in musculoskeletal disorders (back disorders). Next to this, traditional safety programs lack the implementation of leading indicators and supporting programs like behaviour-based safety programs result in superficial insights on leading indicators. In addition to this, studies indicate the opportunity for (smart) technology to aid in overcoming these shortcomings.

Figure 1: Research insights

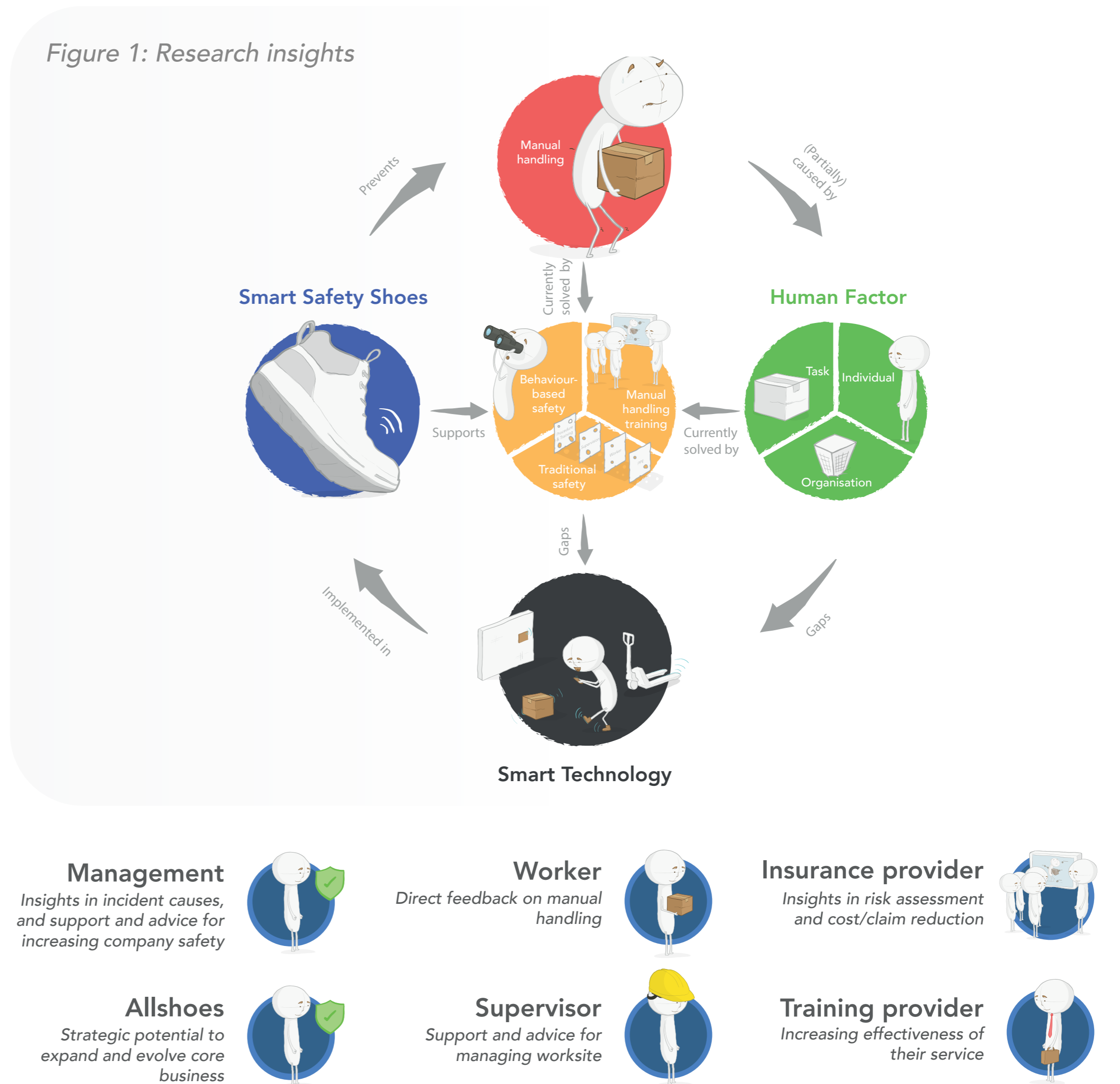


Figure 2: Core values for key stakeholders

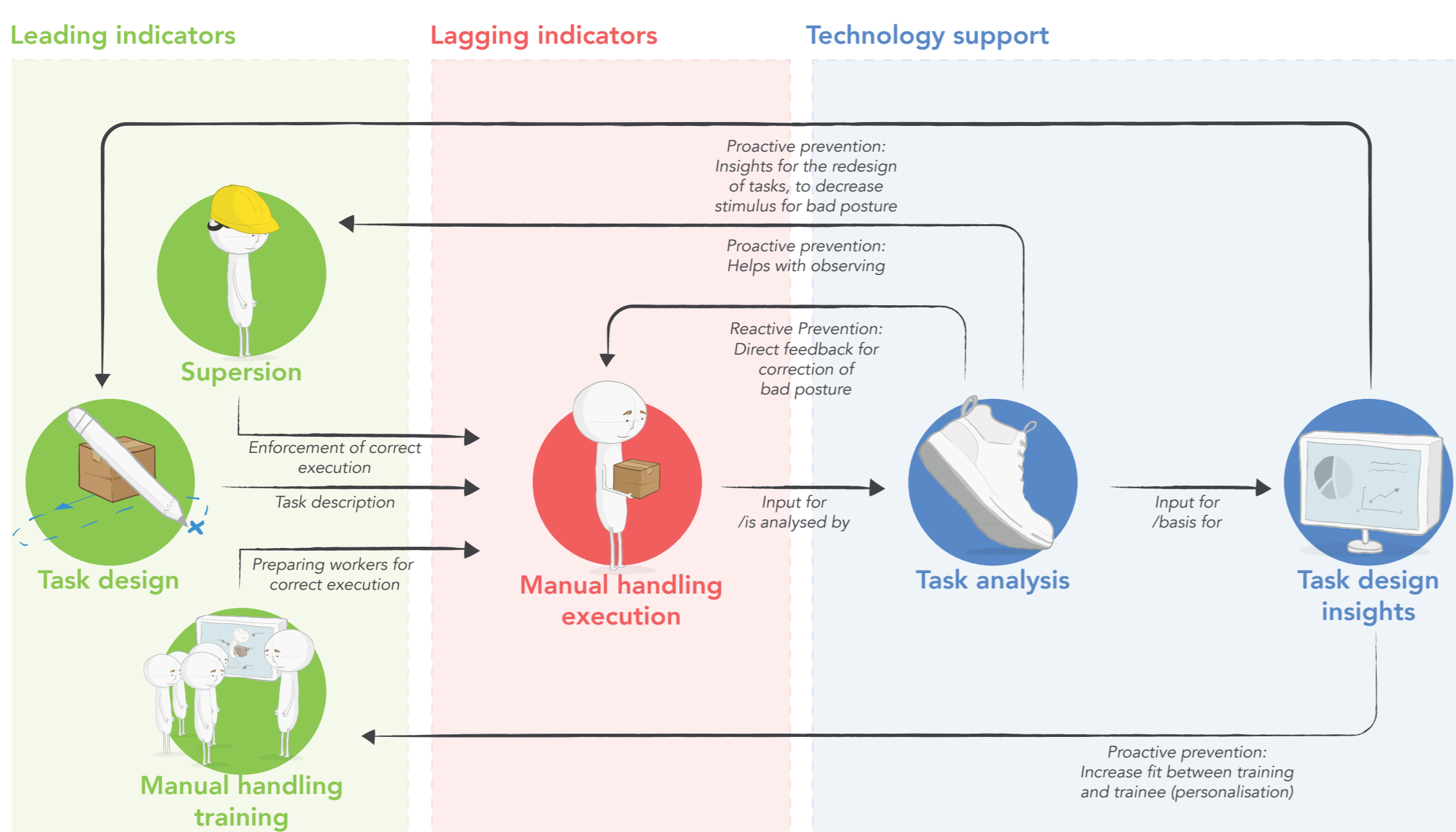


Figure 3: Working principles of final design

Results

The final design concept are smart safety shoes, which uses sensors and data analysis tools (e.g. machine learning) to identify and detect leading and lagging indicators for manual handling related incidents and subsequently are able to effectively communicate those insights to different parties: employees, employers, supervisors and training providers. The smart safety shoes can, in this manner, support current detection and prevention methods in their shortcomings. The before mentioned parties deploy the insights through a hybrid system: reactive incident prevention (improve the individual) and proactive prevention (improve task design and organization), which both increase incident prevention. This working principle of where data is measured and how it is implemented is visualised on the left. Furthermore, the core values that can be provided by this system to the different key stakeholders is summarized in figure 2.

Smart safety shoes are the next step towards occupational incident prevention and potentially the first step towards smart, ubiquitous, occupational safety. However, further research is needed for the development of the smart safety shoes and the exploration of further possibilities. In addition to this, the principles behind the smart safety shoes could serve as a basis for further design research, to address other occupational safety issues and other industries.

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