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Integrating Health, Safety, and Environment (HSE) Principles in Small Office Architecture Lessons Learned from Entrepreneurial Workspaces, Accidents, and Spatial Adaptation

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A B S T R A C T

Many global entrepreneurs began their businesses in small workspaces, where strong motivation often outweighed attention to Health, Safety, and Environment (HSE) risks. This study examines the importance of implementing HSE standards in small office spaces by analyzing entrepreneurial success stories, workplace accidents, and adaptive reuse office practices. The findings highlight that neglecting HSE can lead to serious incidents, even in small-scale environments, while proper HSE integration supports safety and business continuity. From an architectural perspective, the study concludes that HSE should be viewed not only as a regulatory requirement but also as a strategic design approach that promotes human well-being, sustainable growth, and long-term business success

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INTRODUCTION

Workplace takes major part of financial cost of a company. This necessity puts small or start-up companies into a dilemma situation as it demands significant budget for capital dan operational expenditures to fulfil a decency of employees' HSE in workplace. Entrepreneurial success stories are often narrated through the lens of perseverance, innovation, and risk-taking. Iconic companies such as Apple, Hewlett-Packard (HP), Microsoft, Amazon, and YouTube originated in garages, dormitory rooms, or modest rented offices. These narratives have shaped a global mindset that associates business success with the ability to thrive under spatial and financial constraints. Moreover, the COVID-19 pandemic has provided companies with the opportunity to implement remote working, making the physical office arguably important.

However, a workplace is needed not only to gather employees in a space (IWFM, 2018), but it plays a crucial role in building the company's image and becoming a place for employees to work productively in a comfortable, safe and efficient environment (Wustemann & Booty, 2009). In addition, there are intangible assets that crucially need to put into account, particularly in regards to employees' well-being.

From an architectural viewpoint, however, these early workspaces present a different narrative—one of informality, improvisation, and limited attention to Health, Safety, and Environment (HSE). Garages and warehouses were never designed to accommodate prolonged office activities, high electrical loads, or increasing numbers of workers. While innovation flourished, latent safety risks accumulated unnoticed.

In many contemporary cities, especially in developing economies, this pattern continues. Startups and small enterprises frequently operate in converted residential buildings, shop houses, or compact office units. HSE considerations are often postponed until incidents occur. This reactive approach not only endangers workers but also threatens business sustainability.

This paper was initiated as a reaction of the tragic fire accident eventuated in Terra Drone office building in Kemayoran, Jakarta, resulted 22 of the employees died. Reported by Jakarta Regional Government, there are at least 600 office buildings that do not meet the standard of fire protection system. Accordingly, this study analyses risk factors of workplace that crucially needs to be mitigated and seeks to reposition HSE as an integral part of small office architectural design and business strategy. Through expanded real-world case studies and architectural analysis, it aims to provide practical lessons for entrepreneurs, designers, and policymakers.

THEORETICAL REVIEW

Small Office Architecture and Entrepreneurial Culture

Modern office building was initially popularized due to massive growth of economy post Second World War (van Meel, 2000). Though the office trend changed overtime, the invent of modular furniture system in 1960s is still commonly used today in small or open area office. Enclosed office, on the other hand, is symbol of high-quality work-life standard spread by Northern Europe and Northern America (Worthington, 2006).

Small office spaces are defined by spatial efficiency, flexibility, and multifunctionality. According to Neufert and Neufert (2012), spatial standards in offices are often compromised in small enterprises to maximize occupancy and productivity. Entrepreneurial culture further reinforces this compromise by prioritizing output over comfort and safety.

While such environments support creativity and collaboration, studies have shown that overcrowding, poor ventilation, and inadequate lighting negatively affect worker health and cognitive performance (Ching, 2014).

Although efficient and effective office design have always been the main concerns, employers often neglect employees' satisfaction factor of workplace. Nowadays, it is commonly applied that office design has shifted to a more open and collaborative open plan. However, have employers ever found out how exactly their working culture and employees' expectation of their workplace? Extensive quantitative observation of work process analysis revealed the findings that mismatch frequently occurred between spatial configuration and organisation working culture as a consequence of lack of evidence-based office design (Adelea, 2023).

In terms of employee's satisfaction, studies reported that employees dissatisfied to migrate from enclosed office to open workstation due to privacy and noise distraction (Vischer, 2003 and Kim and de Dear, 2013). Regardless the trend, dissatisfied employees may lead to psychological stress and results the decline of productivity (WHO, 2010).

Health, Safety, and Environment (HSE) as a Design Framework

HSE encompasses preventive measures aimed at protecting human life, reducing occupational hazards, and minimizing environmental impact. The International Labour Organization (2019) emphasizes that HSE should be embedded in organizational culture rather than treated as a compliance checklist.

In the Indonesian business context, HSE (Health, Safety, and Environment) and K3 (Occupational Health and Safety) are often considered the same thing, but they actually differ in scope and origin. Here is a comparative explanation to help you understand their role in the business world:

1. Scope

The main difference lies in the "Environment" in HSE:

- K3 (Occupational Health and Safety): Focuses primarily on people/workers. The goal is to prevent workplace accidents and occupational diseases to keep workers safe and healthy.
- HSE (Health, Safety, and Environment): Has a broader scope because it adds an environmental aspect. In addition to protecting workers, HSE is also responsible for managing the impact of company activities on the environment (e.g., waste management, carbon emissions, and nature conservation).

2. Context of Use in Indonesia

- K3: This is the official term used in government regulations (such as Law No. 1 of 1970 or Government Regulation No. 50 of 2012 concerning SMK3). If you

are dealing with the Manpower Agency (Dinas Tenaga Kerja), the term "K3" must be used.

- HSE: This is a term more popular in corporate environments, multinational companies (MNCs), and the oil, gas, and mining sectors. This term refers to international standards (such as ISO 45001 for K3 and ISO 14001 for Environment).

In practice, if a company has an HSE department, it automatically carries out OHS functions. Conversely, companies that only use the term OHS sometimes, but it is not always, separate waste/environmental management into a separate department or simply focus solely on personnel safety. However, in today's modern business era, the trend is to combine the two into a single entity for the sake of efficient corporate risk management.

Brief Comparison

Occupational Health & Safety (K3) and Health, Safety, and Environment (HSE) aspects are opposed as follows:

Aspects	**Occupational Health & Safety (K3)**	**Safety, and Environment (HSE)**
Main Focus	Workforce Protection	Workforce + Environmental Sustainability
Main References	Indonesian Laws & Government Regulations	International Standards (ISO) & Global Best Practices
Mandatory Implementation	All companies in Indonesia	Common in high-risk industries or global standards
Job Titles	General K3 Expert, Safety Officer	HSE Officer, HSE Manager

In architectural practice, HSE principles translate into:

- Fire safety and compartmentalization
- Structural integrity
- Indoor environmental quality
- Ergonomic spatial design
- Emergency accessibility

Failure in any of these aspects increases the likelihood of accidents, especially in small office environments. This study then attempts to find out the legal source that regulates the workplace standard in Indonesia. However, the workplace code and guidance not firmly regulated yet in the country. Rather, the workplace standards are regulated for governmental internal affairs only, e.g. office facilities standard in Ministry of Finance or Ministry of Women's Empowerment and Child Protection.

In contrast. developed countries have set the standard HSE of workplace, for instance the UK government that implements the minimum standard of workplace health, safety and welfare code and guidance (1992). The minimum standard size of workplace per person in the UK is 11 cubic metres. That means if the height of ceiling is 2.5 square metres, the size of workplace per person should be at minimum 4.4 square metres. It also defines details guidance regarding ventilation, temperature, lighting, cleanliness, workstations and seating, floor conditions, falls or falling objects, transparent and translucent doors, gates and walls, windows, skylights and ventilators, traffic routes, escalators, sanitary conveniences and washing facilities. The implementation of this standard is not compulsory in this country, yet by following the standard means that a company or organization has fulfilled minimal requirement of a workplace.

Employees Well-being in Workplace Design

To be able to perform well and increase productivity, WHO encourages employers' commitment to support physical, mental and wellness of their employees (Burton, 2010). Apparently, to measure user comfort in environmental and behavioral terms, the concept of comfort is promoted (Vischer, 2004), includes physical, psychological and functional comfort. While physical aspect of HSE has been continuously deliberated which is to make sure the compliance of health and safety legal standard, psychological and functional aspects are comparably important to be further realized.

Psychological comfort involves sense of privacy (open office for collaboration and enclosed office for focused work), status (enclosed office as reward) and control (share or not to share information). Whereas, functional comfort is provided to help and improve task performance, by providing spatial comfort, visual, noise control and security. A study found that employees work facing window perform more productive to the ones sit next to walls (Sailer, Koutsolampros, Pachilova, 2021). To this matter, employees' satisfaction plays important role in both psychological and functional comfort to ensure higher productivity.

Architecture, Risk, and Business Continuity

Reason's (1997) "Swiss Cheese Model" of accident causation illustrates how multiple small failures align to create catastrophic events. Architecture often forms the first layer of defence. Poor spatial layout, inadequate escape routes, or substandard materials create conditions where human error becomes fatal.

For businesses, architectural failure directly impacts operational continuity, legal liability, and brand reputation. As finance aspect of workplace investment might be the greatest burden for a company, work process crucially needs to be analyzed in office design to produce the most efficient use and guarantee health and safety requirement at the same time (Bielefeld, 2018).

METHODOLOGY

This study employs a qualitative, exploratory research method consisting of:

1. Document and literature review
2. Case study analysis of entrepreneurial and accident-related workplaces
3. Architectural interpretation focusing on spatial planning, materials, and systems

The selected cases represent both success and failure, allowing for comparative lesson extraction relevant to the business realm.

RESEARCH RESULTS

Expanded Case Studies and Architectural Lessons

Case Study 1: Terra Drone Office Fire, Jakarta

The Terra Drone office fire in Kemayoran highlights vulnerabilities in modern office environments. The Central Jakarta Police stated that the PT Terra Drone Indonesia office building that caught fire did not have emergency exit, smoke detector, or a fire protection system. Investigation discovered the chronology of this event triggered by damaged batteries that exploded and ignited new batteries. It became lethal as these hazardous substances were not stored appropriately within workplace as lithium batteries are not only flammable, but also dangerously contain toxic materials (Kang et al., 2013). In legal term, Terra Drone does not hold the storage permit rights within this office building,

In accordance to HSE best practice scheme proposed by Federal Institute for Occupational Safety and Health (BAuA, 2023), minimum standards of hazardous substance storage are outlined as follows:

- Hazardous substance is kept in original packaging, if possible.
- Depends on the property and quantity, hazardous item is stored in storage room, safety cabinet or container.
- Only small and specific amount of hazardous substance needed during working hours is allowed within workplace

To compare to the standards mentioned above, architectural investigations of this fatal case study emphasized:

- Misuse of workspace as hazardous substance storage
- Electrical system overload: genset is placed within workplace
- Fire compartment failure: hazardous substance stored without SOP and fire protection.
- Evacuation challenges: absence of emergency exit and smoke detector

Lesson Learned:

Terra Drone negligence of HSE standard is contradictive to their organizational and cultural background; it is an industrial and originated Japan company. Japan culture that strictly demands higher performance, expert says, does not match the inadequate office standards discovered within this case. Modern appearance does not also guarantee safety. HSE must be verified through architectural performance, not aesthetics.

Case Study 2: Apple and HP Garages – Romanticized Origins and Hidden Risks

Apple's founding garage and HP's Palo Alto workspace symbolize innovation under constraint. Architecturally, these spaces lacked:

- Fire-rated walls
- Proper electrical zoning
- Office-grade ventilation

While the businesses succeeded, these spaces would be classified today as high-risk work environments.

Architectural Lesson:

Temporary innovation spaces must evolve architecturally as business operations expand.

Business Lesson:

Early success should trigger reinvestment into safer, more resilient workspaces.

Case Study 3: Microsoft and Dormitory-Based Startups

Microsoft began in a small office with a dense workstation layout. Early photographs show minimal separation between work areas and equipment.

Architectural Risk Factors:

- Overcrowding
- Poor cable management
- Lack of emergency planning

Lesson Learned:

High-density workspaces increase productivity only when supported by proper spatial planning and safety systems.

Case Study 4: Amazon Warehouses – Learning Through Scale

Amazon's early warehouses were criticized for worker fatigue and safety incidents. Over time, architectural interventions included:

- Wider circulation aisles
- Improved fire suppression
- Better lighting and ventilation

Architectural Lesson:

HSE must scale with business growth.

Business Lesson:

Investment in safety reduces long-term operational risk and labor disputes.

Case Study 5: Startups in Converted Residential Buildings

In Indonesia and many Asian cities, startups operate from houses adapted into offices. Common issues include:

- Single staircases
- Inadequate exit widths
- Non-fire-rated partitions

Architectural Lesson:

Adaptive reuse requires re-evaluation of spatial risk.

Business Lesson:

Cost-saving through reuse should not compromise worker safety.

Case Study 6: WeWork and Flexible Office Models

WeWork's co-working spaces illustrate a proactive approach to HSE integration through:

- Clear zoning
- Redundant exits
- Building code compliance

Lesson Learned:
Even high-density, flexible spaces can remain safe with proper architectural planning.

Case Study 7: Oil and Gas Companies in Indonesia

Oil and gas in Indonesia are a mature industry since 19th century. As both producer and consumer, Indonesian oil and gas contributes to state revenue prominently and set a high work-life standard of premium corporate. In a study of oil and gas workplaces (Adelea, 2023), an expert revealed that workplace size in oil and gas is spacious (12-16 m2) compared to banking industry (8-10 m2). It also specifically noted that health and safety benchmark of this sector is generally excellent. Not only the standard is high, oil and gas take serious action in implementing zero accident as successful parameter. Through a massive quantitatively qualitative observation, this study performed HSE checklist during office time and found out that this industry was risk-free of HSE hazard during the activities of their task.
However, the question then rises in regard to cost efficient. Is it necessary to provide such a high standard of HSE in workplace? How oil and gas workplace provide three virtues of comfort? The investigation concluded HSE standards of the industry, as follows:

- Physical comfort: HSE company policies aligned with government regulation, occupy grade A office building with full glass façade allows sufficient day-lighting, ergonomic furniture, central air-conditioned, and noise absorbed partition.
- Psychological comfort: open cubicle with low partition for staff and enclosed office for managerial level, provides meeting and communal area for group work, older office display premium standard as corporate high status and workplace can be accessed only by authorized persons.
- Functional comfort: spacious (12 m2) with low occupancy rate (40%), mostly managerial level entitled window view, new renovated office interior highlights a more vibrant color scheme that matches corporate brand and convinced activity-based working.

Based on observation above, this paper admits that oil and gas companies strict in performing HSE standard as regulated by company policies and government regulation. Nevertheless, it is interesting to emphasize specifically on equality comfort in oil and gas. In this matter, managerial level dominates the privilege of window view while staff workspace lies in the middle of office core. This design decision commonly to reward manager as higher status of hierarchy,

without realizing the impact of stressful staff as the biggest population within organisation that potentially leads to unproductivity.
Regarding size and occupancy rate, oil and gas typically spares vacant office to be prepared with potential company growth in the future. This strategy, however, is uneconomical and by far deviated from the design purpose as the occupancy rate during office hour significantly low (40%) compared to expected percentage of productive workplace (minimum 80%).

DISCUSSION

Synthesizing Architecture and Business Perspectives

The case studies reveal a consistent pattern:

1. Early-stage businesses accept high spatial risk
2. Accidents or growth force architectural reconsideration
3. HSE becomes a corrective rather than preventive measure

This reactive approach is costly. From a business standpoint, accidents result in downtime, legal penalties, and reputational damage. In addition, trauma post-accident of affected employees will become the biggest threat for company's productivity which results even a longer time and extra effort to recover. From an architectural standpoint, retrofitting is more expensive than early integration.
It is important to note that it is not architecture who shapes organization culture nor vice versa. Instead, relationship between space and organization needs to be in-depth analyzed before design decision is being made.

CONCLUSIONS AND RECOMMENDATIONS

This expanded study demonstrates that Health, Safety, and Environment (HSE) principles are inseparable from sustainable entrepreneurship. While many iconic companies began in unsafe, informal spaces, their success should not justify the replication of such conditions today. Small workspaces generally lack clear workspace usage procedures. Users are not fully aware of access points in and out of the small workspace, including evacuation routes in the event of a natural disaster or fire. Not all employees get a view of the exterior, so they could not understand the location of their small workspace floor, where is executive floor, assembly point floor, and hazardous floor areas. The officer's management responsible for HSE and OHS may not yet worked effectively. Even some of them may not have the Standard Operating Procedures and emergency management training. Similarly, the availability of required HSE and OHS equipment is minimal, and safety and security networks with cities/regions have not been effectively implemented.

The layout of small workspaces pattern is not easy for employees to read and follow. They did not know who the scheduled HSE and OHS on duty, who is assigned by office management to sound the alarm, to provide the announcements, warnings, and train employees in self-rescue if emergencies happened. Indeed, HSE is not an obstacle to innovation; it is the architectural foundation upon which sustainable innovation is built. Architecture plays a critical role in transforming small offices into safe, resilient, and productive environments. By embedding HSE into spatial design and business strategy, entrepreneurs can

protect their most valuable asset—human capital—while ensuring long-term business continuity.

The research suggests that circulation routes for people and goods in small workspaces should be free and safe, particularly evacuation routes and disabled routes. Similarly, mechanical, electrical, and plumbing routes should be easy to be maintained, especially in rooms where the storage of explosives or similar materials is prohibited. The research proposes that circulation routes for people and goods in small workspaces should be free and safe, particularly evacuation routes and disabled routes. Similarly, mechanical, electrical, and plumbing routes should be easy to maintain, especially in rooms where the storage of explosives or similar materials is prohibited.

Despite the fact, this paper admits that investment of workplace is substantial within company's financial budget. A study of HSE in oil and gas companies is a lesson learned that to be able to fulfil HSE standards is not necessarily to be extravagant. Instead, this research advises companies to have comprehensive understandings of HSE and incorporate their business culture within their workplace design decision to avoid inefficient and false investment.

FURTHER STUDY

For Architects

- Integrate HSE from concept design: examine three virtues of HSE comfort, i.e., physical, psychological and functional within design consideration.
- Educate clients on safety as value creation: build HSE awareness on clients since the early phase of design. Architects urgently need to convince clients through their design proposal that HSE should not only be acknowledged to fulfil the standards of company policies and government regulation. Rather, design should be purposeful in terms of HSE and its association to clients' company value and culture.

For Entrepreneurs

- View HSE as investment, not expense: perceive the mindset of HSE as preventive rather than corrective action. Comprehensive understanding that correction in HSE does not only demand the fulfilment of the standard; it disrupts the process of work during renovation and recovery time barely measurable which causes a potential continuous loss and damage in the future.
- Align workspace evolution with business growth: employs agile methods to anticipate the assumption of future changes. This should not be misunderstood by providing a surplus capacity of workplace that leads to inefficiency. Instead, stable processes of execution in the future is encouraged (Hofstadler&Motzko, 2021).

For Policymakers

- Simplify HSE guidelines for SMEs: formulate particular mindful standard of small-medium size companies with the key concept of sufficiency. It allows

companies to guarantee the safety of their employees with great relevance to their workplace and dismisses the burden of massive cost of investment at the same time.

- Encourage architectural audits for small offices: physical controls must be conducted periodically and demanded a corrective follow-up to fulfil the standard if necessary.

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