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Rescuing High-Tech Sectors from Imminent Disaster, Using Isomorphic Lessons & Organisational Learning Strategies as Prerequisite Tools to Manage Safety

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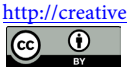

Abstract

Within high-risk industries, efficient management of safety is an important element of organisational efforts to reduce accidents. Most organisations such as nuclear, aviation and oil and gas sectors have a safety management system (SMS) which provides sequence of organisational procedure to identify hazards, mitigation of risk, measure performance, investigate incidents and maintain an on-going continuous improvement. However, experts believe that when such complex organisations complement safety management system with isomorphic lessons and organisational learning strategies to manage safety, there will be a high propensity to aggressively reduce risk and save cost. Undoubtedly, learning from accidents/incidents is one of many ways to manage safely in any given organisation. As a result, this paper is intended to ascertain if organisations use isomorphic lessons and organisational learning as strong feature of organisation's practice capable of promoting stronger safety culture; and if lessons learned from other high-risk sectors can help inform risk-based decisions in organisations. Risk experts and by extension the nuclear sector, could have learned from past accident such as the Three Mile Island of 1979 and employ lessons learned to forestall future occurrences. Primary data was gathered via online, and research population are health and safety professionals from aviation, nuclear, and the oil and gas sectors. The sample size recruited are aviation (n = 59, 25%); nuclear (n = 124, 54%); and oil and gas (n = 49, 21%). Statistical Package for the Social Sciences (SPSS) software was used to analyse 232 responses used for this paper.

Keywords

Isomorphic, Organisation, Learning, Risk, Hazard, Nuclear

1. Background

Evidence abounds from accident examples which indicate there are links between organisational change and accidents [1]. If organisations should be safe as reasonably practicable, there is need to learn (change) from their own experiences, and where suitable learn experience from others through isomorphic lessons and organisational learning [2]. But accidents are unique, this could be the reason why lesson learned from such accidents are somehow not implemented in most organisations. Analysis of the outcome of events could indicate that the same lessons and recommendations keep re-occurring [2] [3] [4].

However, accidents sometimes seem to have similar features at some point or levels of analysis [2]. This empirical observation when linked to Von Bertalanfy's hypothesis on the nature of system incites questions about how far organisational learning can happen through the isomorphic features of an accident [2]. However, this paper takes a cue from what has been discussed in a previous paper, "Reviewing Non-Technical Skills and Organizational Learning: A Comparative Analysis of Critical Safety Factors within the UK's High-Risk Industries" [5] to effectively manage organisations safely and to advance some of the arguments [5].

Because organisations are dynamic [6], there is need to understand and always re-interpret the world in which organisations operate by means of the organisational experience which they are exposed, and as environment are constantly evolving [6]. Therefore, organisational learning is essential for organisations functional in unpredictable environments to respond to unexpected circumstances more quickly than their competitors [1].

But lapses of organisational learning have led to accidents in some high-risk industries. In 2005, there was an explosion at BP's Texas City refinery which killed 15 people and wounded more than 170. BP would have learnt from other accidents that happened earlier, but did not [7]. A year after the Texas City refinery explosion accident, the Chemical Safety Board reported that BP had another major industrial accident. It was revealed that its network of pipelines in Prudhoe Bay, Alaska released 212,252 gallons of oil into the delicate tundra environment. This was regarded as the worst spill ever recorded on the North Slope. The leak went unnoticed for five days. After analysis, the pipes were discovered to have been ill maintained and examined [8]; human factor causation [9]; and lapses of NTS [5].

2. Literature Review

2.1. Isomorphic Lesson

Isomorphic lesson is a form of naturalistic genres applied to an accident with regards to organisation and management practice [2]. Moore (2009) stressed that a lesson could have been learnt when there is a corrective measure put in place to prevent future re-occurrence of the same event [10]. According to Bowerman (2002), organisations should take initiative to pattern themselves after

an organisation sometimes during a period of uncertainty or when achieving goals seems to be unclear [11]; as isomorphic is a responsive procedure which comprised of analysis of past understanding to shape a "hazard model" of what is expected to happen in the foreseeable future [12].

However, other similar views that uncertain situations are main circumstance that stimulates organisations to learn from others [13]. When organisational machineries are not well understood; when it is confusing to achieve goals or possibly the environment creating some kinds of uncertainties, then an organisations may change pattern to be like other organisations [13]. While DiMaggio and Powell (1983) argued that sometimes organisations appears not to understand how to deal with new challenges, instead search for organisations to learn from [14].

Therefore, isomorphism is a compelling development which enforces an organisation in a given population to look like other organisations which may face almost the same type of environmental challenges [15]. However, DiMaggio and Powell (1983) observed that some organisations have a habit of modelling themselves after the same type of organisations they noticed to be more successful [14].

Support for this proposition are Hannan and Freeman (1977), that isomorphism can result due to selection of non-optimal forms from a number of organisations or possibly because those that make decision in an organisation learn suitable remarks and regulate their conduct appropriately [16]. The duo therefore identified three methods in which organisational isomorphic transformation can happen, each linking to a common background. The methods are coercive isomorphism which comes from political impact and the problem of legality. The second is mimetic isomorphism, which results from normal replies to unclear issues; and lastly the normative isomorphism which is related to professionalisation [16].

Isomorphic lesson (IL) is understood as sharing information on what went wrong in either offshore or other industry operations, irrespective of the location [17]; as it is crucial to stop repeating similar mistakes [2]. Somehow, it is believed that what is learned will help to make adequate progress in safety. This progress is applicable to designing new and maintaining or upgrading of current plants [17]. And when there is interchange of information on past events and accidents, it will be important to avoiding of similar accidents reoccurring [17].

According Gordon (1998), managers have a role to play in promoting isomorphic lessens, increase safety by promoting learning from previous mistakes or experience [18]. He stated that managers should also provide safe environment suitable to work; and commitment to safety by senior management must be seen at strategic and policy levels in communication, training, promoting positive safety policy and learning from other organisations and past experience [18].

Toft and Reynold (2006) said there are four ways in which organisations can be seen as demonstrating similar isomorphic properties; as care must be taken to ensure that the situation which is to be learned from is genuinely isomorphic with that in which the lesson are to be applied, so that the lesson learned can be safely transferred to other organisations [2]. Kletz (2009) suggests that accident reports should be made public to allow other organisations learn from such incidents [19]. Toft and Reynolds (2006) agreed that if strong isomorphic similarities are found, it may be possible to utilise the lessons learnt in those other organisations to help prevent recurrence of a similar incident [2].

One example of cross industrial isomorphic learning can be considered for the nuclear industry. Sellafield limited could have learned from Piper Alpha incident when employee's nitrogen oxides (NO_x) monitor went into alarm within the Thermal Denitration plant due to a small NO_x release from an "off gas line" flange which is external to the building [20]. The incident occurred after a maintenance work was carried out during an outage in the plant, as there was no sign to show that the flange that was leaking had been reviewed during the outage [20] (Sellafield 2017). The incident was an underlying similarity to Piper Alpha as the organisation could have addressed the event in advance had there been an organisational learning culture put in place. Similarly, there were notices of contractor failures at Sellafield [21].

Another example of isomorphism was the loss of coolant water at the Crystal River Nuclear Power Plant (NPP) in Florida USA. An identical valve to that which malfunctioned at Three Mile Island (TMI) in 1979 stuck open and water-logged the reactor basement with 19,000 litres of very high radioactive water [2]. In this case the Nuclear Regulatory Commission which had conducted the inquiry into TMI incident had permitted the plant operators two exemptions from the recommendations which they themselves had suggested. According to some nuclear scientists, those two examples allowed the Crystal River incident to develop into emergency [2].

2.2. Isomorphic Pressures

To conform to an institutional environment is largely controlled by adoption of structures [22]; behaviours and practices similar to leading or prosperous organisations and can greatly influence the development of structures within an organisation [23]. As a result, industries may then be prompted to make decisions based on the following: 1) pressure they may experience from other groups which they rely upon. 2) To imitate characteristics from groups they see to be successful. 3) From professional associations that exerts pressure on the organisations by establishing cognitive base and the legitimisation of for autonomy [22]. **Figure 1** below illustrates the attributes of institutional isomorphism lessons.

2.2.1. Coercive Pressures

Coercive pressures manifest from both formal and informal ways and due to

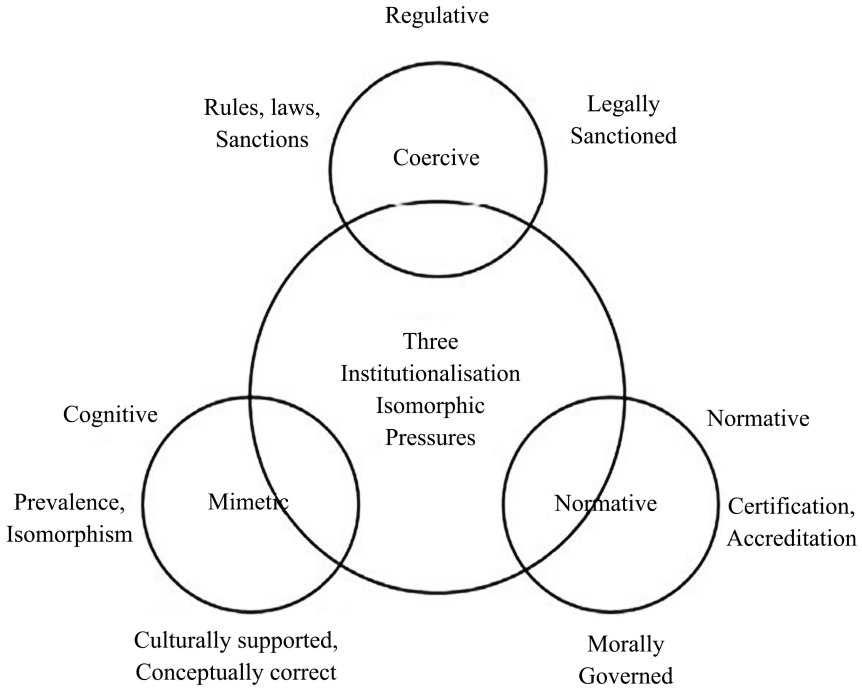

Figure 1. Illustrates attributes of institutional isomorphism.

external environment applied on the organisation [22], which is observed by imposition of standards and operating procedures from leading organisations which an organisation depends (formal) on and cultural expectations in the society (informal) within which the organisation operate [24]. There are pressures faced by organisations to adapt to professional expectations and government regulations including the leadership set by key organisational players in an industry are crucial factors [22].

2.2.2. Normative Pressures

Normative pressures involves embracing of techniques considered to be effective by organisations and associated with professional standardisation, which could be formally socialised practices spread by medium of training in a profession or learning informally through associations, conferences, publications [22].

2.2.3. Mimetic Pressures

This describes mirroring attributes of organisations as they respond to uncertainty in their environment. Organisations being copied are sometimes observed as one with higher standard and success and the search for best practices in public and private sectors [22].

2.3. Organisational Learning

Organisational learning (OL) is a collective, reflective and saturating process through which all personnel within an organisation learning [6]. A process by which organisations change or amend their mental models, processes or knowledge, rules of maintaining or improving their performance [25]. OL is believed

to be an efficient procedure to process, interpret and respond to internal and external information of a largely clear nature [26].

Maybey and Salaman (1995) said OL is concerned with the extension of new knowledge which organisation have the likelihood to influence staff behaviour; it occurs within the wide institutional setting of inter-organisational relationships [27] [28]. OL refers largely to an organisation's gaining of understanding, know-how, techniques and practices of any kind and by any means [29].

Duarte and Austin (2017) further noted that if organisations should be safe as reasonably practicable, there is need to learn from their own experiences, and where suitable, the experience from others [6]. And due to its nature as a process of developing new perspectives, OL is a source for the improvement of new organisational knowledge [30] [31].

Effective organisational learning requires not only innovations and new processes but also their adoption and diffusion to other parts of the organisation [1]. Toft and Reynolds (2006) suggests that active foresight should be the goal of organisational learning process that should combine foresight of the possible causes of disaster, with action to remove or reduce the risk of those causes taking place [2], as disasters must not be seen like meteorite that falls out of the sky on an innocent world; disaster, most often, is expected on multiple occasions [2].

If different elements of the organisation cannot communicate positively, then successful organisational learning will incline to short-run adaptive learning or, if they are unpretentious improvements, they tend to be secluded and eventually undermined and abandoned [1]. Alonso and Austin (2017) cited in Cohen and Levinthal (1990) underline the importance for organisations to exploit other sources of knowledge and positively affect internal innovation processes [6]. The duo stated that any failure that occurs in the system will have the tendency to repeat in another similar system for similar reasons [6].

Argyris (1977) and Senge (1990) noted that an important aspect of organisational change is the ability of an organisation to learn; as both authors maintained that organisational learning is sometimes recognised as an organisation that is adjusting to environmental change [32] [33]. However, Senge (1990) and US DoE (2009) recognised that OL is a crucial shift or change of mind by seeing the environment in a different way, while perceiving organisation actions as generating problems and resolutions [33] [34].

Support for the suggestions are Probst and Buchel (2000). Both noted that OL gives different pattern for systems to cause change by allowing people to interpret the economy and society in a different way [35]. Where organisations refuse to change, there is the tendency of going into bankruptcy. Though organisations should learn due to increase demand on organisations to change; and the fact that change accelerates quickly, therefore, organisations are supposed to find their footings in an environment that is becoming more complex [35] [36]; as learning is certain the only enduring solution to achieving possible advantage [36].

Learning empowers people to determine choosing from different variables or choice in whether to change, such action may not lead in any noticeable changes in attitudes [37]. Nevis *et al.* (1995) stated that procedure of how organisations learn could be very complex and does not happen in a linear progression, somehow could occur intentionally, unintentionally, informal and formal [38]. Stata (1989) basically informed that learning is bringing everyone in the same organisation to change [39].

Countering suggestions postulated by some authors, Vicker (2013) noted that organisational learning is contradictory [40]. If organisational learning means anything, it is rather on the side of the individuals that functions in that organisation [40]. This opinion is supported by Wang and Ahmed (2002) that learning commences from individuals [41]. However, OL is said to be important as it improves safety culture and recognises that individual working in an organisation learn new ways of reasoning through diverse understanding for a long period of time [42].

Organisational Learning Theory

According to [32], they are two types of organisational theories organisations should be conversant with to achieve success, vis-a-vis safety practices. These are single- and double-loop learning and single-loop and double-loop learning [32], as explained in **Figure 2**.

Single-loop learning: Single-loop learning theory is instrumental learning which changes strategies of action or assumptions of underlying strategies in ways that leave the values of a theory of action unaffected [32]. An instance is the identification and subsequent correction of a production defect. Engineers changed the respective product specification to avoid the flaw in the future. Single-loop learning compares existing problems and organisational values and norms to develop an adequate solution [32].

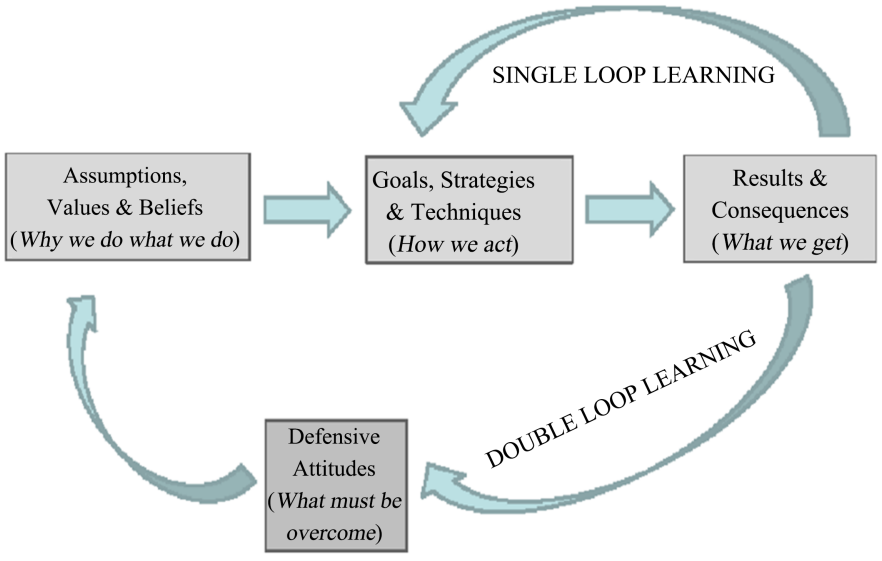

Figure 2. Single-loop and double-loop learning (Argyris & Schön, 1996: 22).

Double-loop learning: In this case, if defect correction requires adaptations of organisational values and norms, then double-loop learning is required. It is a learning that results and focuses in value change of theory which is being used both in strategies and assumptions [32]. This theory refers to two feedback loops that connect observed effects with strategies and values served by those strategies. Possibly, divergent organisational performance requirements could cause conflicts among different people in the organisation. Nonetheless, double-loop learning could be executed by persons, when it is obvious that inquiry could lead to change in the values of the theory used by organisations [29].

Overall, the three-pronged survey was conducted with the view to finding out if high-risk industries such as nuclear, aviation and the oil and gas sectors are disposed to using isomorphic lessons and organisational learning as essential tools to manage safely and maintain critical safety systems. First hand data was gathered via Bristol Online Survey (BOS) which was anonymous, with industry specific health and safety experts (managers, operators and supervisors) in the nuclear and the oil and gas sectors; and (pilots, air traffic controllers, health and safety managers and trainers) in the aviation sector.

3 Method

3.1. Design

A quantitative design, via an online survey [43] was used as the primary data collection tool [44]. Quantitative data is mostly used as a substitute for data collection to complement findings. Technique, using either questionnaire, or data analysis procedure using graphs or statistics which produces or uses numerical data to analyses information gathered [45], in comparison to other methods, it is easier to analyse [45]. This method was used to gauge respondents' views on the use of isomorphic lesson and organisational learning in the nuclear, aviation, and oil and gas sectors. Online surveys give first-hand information and are reasonably convenient in data gathering [46], although response rates are usually low which affects the sample size [47].

Questions that relate to the seven elements of NTS were assessed. Example questions are indicated in **Table 1**.

3.2. Sample Population and Size

The population researched [43] in this paper were health and safety experts from the oil and gas, aviation and nuclear sectors within the UK. The sample size are oil and gas (n = 49, 21%); nuclear (n = 124, 54%); and aviation (n = 59, 25%). Basically, some of the respondents were recruited during the World Nuclear Association Symposium in London UK. Furthermore, LinkedIn was used to recruit responses from the aviation and oil and gas, equally to the nuclear sector. The same sets of questions were asked across the three sectors [45].

3.3. Data Collection

Data was collected through an online questionnaire hosted on Bristol Online

Table 1. Online questions administered to nuclear, aviation, and oil and gas experts.

Experience and position	Practice
Q1: Which industry do you currently work with?	Q5: Isomorphic Lesson is a strong feature of my organisation's practice.
Q2: What position do you hold within your organisation?	Q6: Organisational learning is a strong feature of my organisation's practice.
Q3: Have you encountered any of the following within your working environment – isomorphic lessons and organisational learning.	Q7: Lessons learned from other high-risk sectors (nuclear, aviation and oil and gas) can help inform risk-based decisions in your organisation.
Q4a and b: Using a scale of 1 – 10 (1 = lowest; 10 = highest), rate the following in their ability to promote a stronger safety culture, specifically within your organisation – isomorphic lessons and organisational learning.	

Survey (BOS). The survey was conducted anonymously, with industry-specific health and safety experts (managers, operators and supervisors) in the nuclear and the oil and gas sectors, and pilots, air traffic controllers, health and safety managers and trainers in the aviation sector. Data received from respondents outside of the UK was not analysed. Overall, 232 responses were analysed.

3.4. Data Analysis

SPSS software was used to analyse online data. Descriptive statistics were produced, and chi-square tests used to analyse categorical responses and then Kruskal-Wallis (KW) non-parametric one-way ANOVA tests were used to analyse ordinal responses to test if responses from the three different sectors had any statistically significant difference. (See Table 2 for further illustration on KW). Non-parametric statistics (Kruskal Wallis) test is appropriate for data which are ordinal, such as the responses to the online questionnaire. The null hypothesis was no difference between the responses from the three industry sectors. The threshold for statistical significance was taken as $p = 0.05$ as the null hypothesis was rejected when $p < 0.05$.

To further ascertain the veracity of responses provided, this research organised a focus group discussion across the three sectors to elicit wider information on if isomorphic lessons and organisational learning are common factors in their domain. (See Table 3 on responses).

4. Results

The analysis from the online survey produced findings as summarised below.

Responses are detailed in Figure 3 on how each sector responded to the questionnaire.

Table 2. Kruskal Wallis test on the questions asked to respondents was used to analyse ordinal responses on if responses from the three different sectors had any statistically significant difference.

		Mean			Kruskal Wallis	
	Scale	Nuclear	Aviation	Oil and Gas	H	P
Q2: What position do you hold within your company?	1 - n	3.19	3.56	3.86	4.841	0.089
Q3: Isomorphic learning	1 - 3	1.55	1.47	1.70	4.253	0.119
Organisational learning	1 - 3	1.27	1.18	1.24	1.239	0.538
Q4: Isomorphic learning	1 - 10	8.19	8.23	7.60	2.930	0.231
Organisational learning	1 - 10	8.42	8.25	7.82	3.583	0.167
Q5: Isomorphic learning is a strong feature of my organisation's practice.	1 - 5	2.43	2.15	2.27	5.280	0.071
Q6: Organisational learning is a strong feature of my organisation's practice.	1 - 5	2.09	1.80	2.00	3.714	0.156
Q7: Lessons learned from other high-risk sectors (e.g. aviation, nuclear, oil and gas) can help inform risk-based decisions in my organisation.	1 - 5	1.60	1.37	1.78	6.624	0.036

Table 3. Responses from focus group discussion across the three sectors.

Focus Group Discussion to Determine Validity of Results			
Pillars	**Nuclear**	**Aviation**	**Oil & Gas**
Isomorphic Learning	1) Lexicons and language may be different in/across sectors. 2) I cannot say the sector applies isomorphic learning in safety management.	1) Isomorphic lessons are not relatively common.	1) Isomorphic learning is a new terminology which is unthinkably known to the sector.
Organisational Learning	1) The sector somehow learn from another organisation. 2) But there is formal organisational learning strategy in the sector. But if organisations can learn from each other, perhaps accidents will reduce across industries.	1) The whole organisation has changed a lot and organisations are working to learning skills which is more generic skills. 2) Every year standard of operating procedures has become common in aviation. The sector learns from other organisations on other skill sets.	1) The sector cannot be said to be learning a lot from others if not some accidents that happened in the sector would not have occurred.

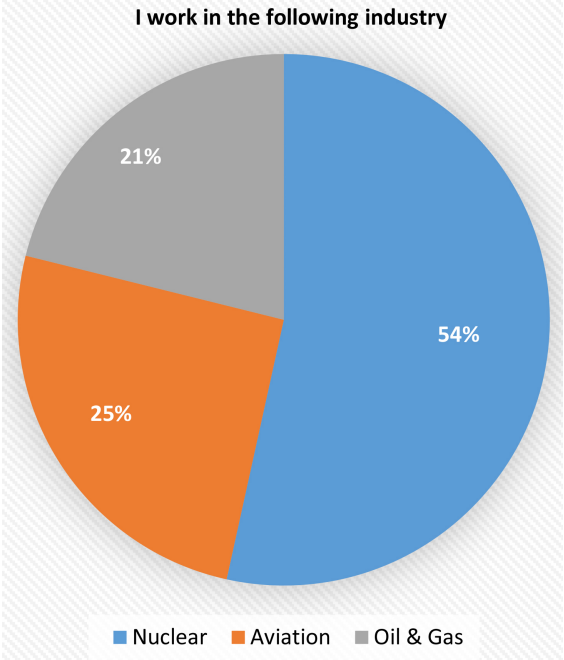

Figure 3. How each sector responded.

Identify the sector you work for

The origin of respondents was n = 124 (54%) from nuclear; n = 59 (25%) oil and gas and n = 49 (21%) aviation sector.

What position do you hold within your organisation

Responses are detailed in **Table 4**.

Have you encountered any of the following (Isomorphic lessons and Organisational learning) within your working environment?

Responses are detailed in **Figure 4** and **Figure 5**.

Using a Scale of 1 - 10 (1 = Lowest; 10 = Highest), Rate Isomorphic lessons and Organisational learning in their ability to promote a stronger safety culture, specifically within your organisation

Responses are detailed in **Table 5**.

Isomorphic lessons

Organisational learning

Using a scale of 1 - 10 (1 = Lowest; 10 = Highest), Rate Isomorphic lessons and Organisational learning in their ability to promote a stronger safety culture, specifically within your organisation

Responses are detailed in **Table 6**.

Isomorphic lesson is a strong feature of my organisation's practice

Responses are detailed in **Figure 6**.

Organisational learning is a strong feature of my organisation's practice

Responses are detailed in **Figure 7**.

Lessons learned from other high-risk sectors (Nuclear, Aviation and Oil and Gas) can help inform risk-based decisions in your organisation

Responses are detailed in **Figure 8**.

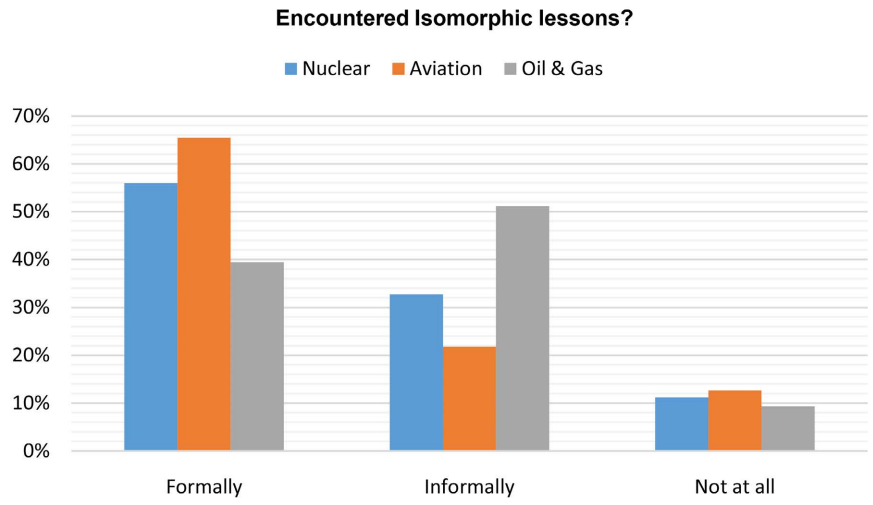

Figure 4. Sectors response on isomorphic lessons.

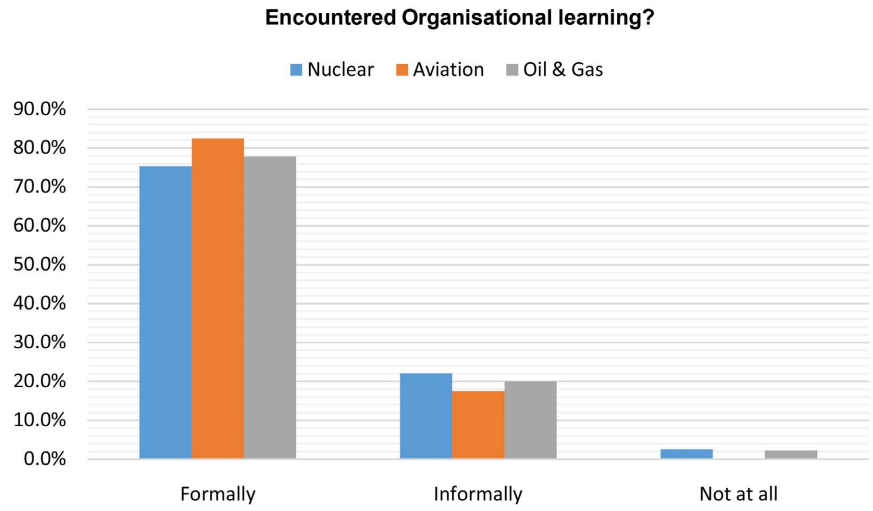

Figure 5. Sectors response on organisational learning.

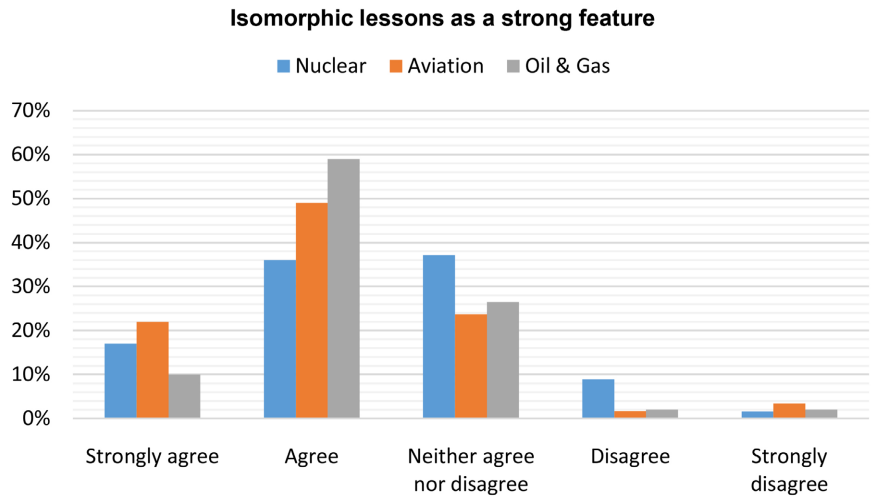

Figure 6. Response on if isomorphic lesson is a strong feature of organisation's practice.

Table 4. Indicating positions staff hold in their various organisations.

		Senior Manager	Manager	Supervisor	Operator	Technical	Non-technical	Others	Total
Nuclear	**Count**	45	**23**	4	1	**32**	4	15	124
	[%] of Total	**36**	19	3	1	**26**	3	12	100
Aviation	**Count**	11	12	3	18	5	1	9	59
	[%] of Total	19	**20**	5	**31**	9	2	15	100
Oil & Gas	**Count**	7	10	9	2	10	0	11	49
	[%] of Total	14	**20**	**18**	4	20	0	22	100
Total	**Count**	63	45	16	21	47	5	35	232
	[%] of Total	27	19	7	9	20	2	15	100

Table 5. Rating on isomorphic lessons on its ability to promote a stronger safety culture.

	Count (Rating)										Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Nuclear	1	0	3	1	9	7	12	15	28	36	112
[%]	1	0	3	1	8	6	11	14	25	**32**	100
Aviation	2	0	0	1	2	2	4	16	8	18	53
[%]	4	0	0	2	4	4	8	30	15	**34**	100
Oil & Gas	1	2	1	1	2	2	5	11	10	8	43
[%]	2	5	2	2	5	5	12	26	**23**	19	100
Total	4	2	4	3	13	11	21	42	46	62	208
[%]	2	1	2	1	6	5	10	20	22	30	100

Table 6. Rating organisational learning on its ability to promote a stronger safety culture.

	Count (Rating)										Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Nuclear	1	0	1	2	3	8	14	24	25	42	120
[%]	1	0	1	2	3	7	12	20	21	**35**	100
Aviation	0	1	1	0	1	3	7	20	10	16	59
[%]	0	2	2	0	2	5	12	34	17	**27**	100
Oil & Gas	1	1	1	0	2	2	6	14	8	9	44
[%]	2	2	2	0	5	5	14	32	18	**21**	100
Total	2	2	3	2	6	13	27	58	43	67	223
[%]	1	1	1	1	3	6	12	20	19	30	100

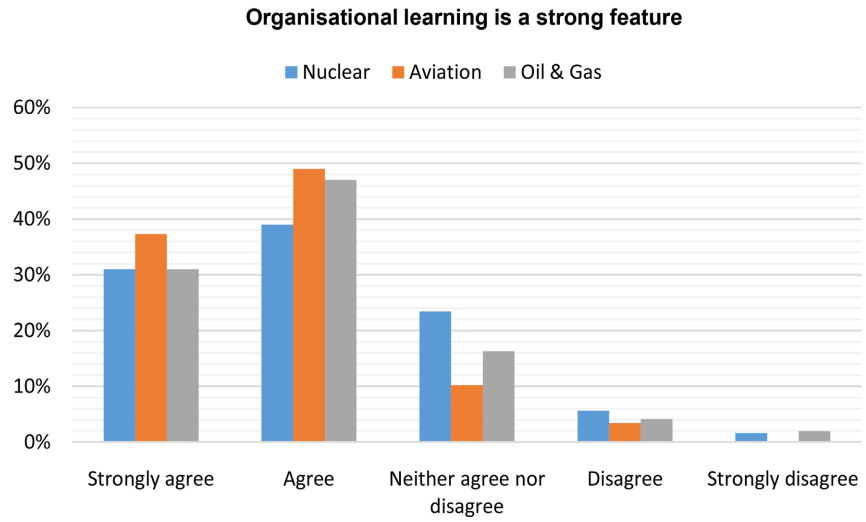

Figure 7. Sectors response on organisational learning.

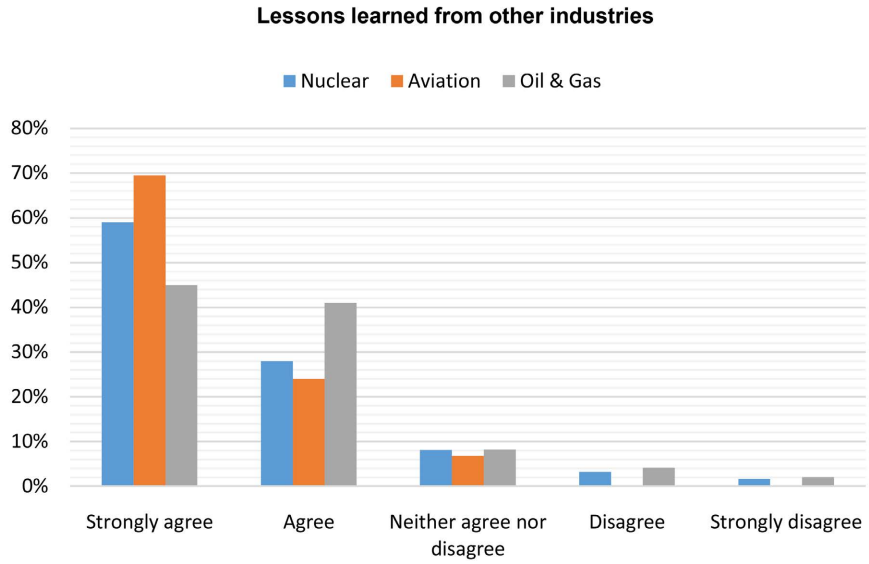

Figure 8. Sectors response on if lessons learned can be transferred.

5. Discussion

Discussion on this paper focused on seven results completed from online survey across the three sectors. The first question determined the number of respondents that attended the online survey. The result indicates that the nuclear sector was more inclined to the survey and produced more responses, compared to aviation and the oil and gas sectors (see Figure 3). Positions each respondent hold across the three sectors were similarly considered. The importance of the question gave reliability to the results as long service could translate to possessing vast experience and taking wider decisions in any critical situation. The result showed that the nuclear sector had more of senior managers, followed by aviation and the oil and gas sectors. On managers, aviation respondents were higher, compared to the oil and gas and nuclear sectors. (See Table 4).

The remaining four questions focused on isomorphic lessons and organisational learning in the workplace environment. While the last question requested information from respondents on transferring lessons learned to other sectors.

Respondents were requested to provide answers on whether they have encountered isomorphic lessons [2] and organisational learning [6] within the working environment. The data shows that the three sectors have encountered isomorphic lessons in the working environment on formal learning strategy (See **Figure 3** and **Figure 4(a)** and **Figure 4(b)**). However, the result did not correlate what participants said during a focus group discussion conducted by the research that isomorphic lesson is not encountered by workers in the working environment. A participant in the aviation sector said that the industry is not aware of the term isomorphism [2]. His view was also similar in nuclear and oil and gas sectors by other participants. Additionally, Kruskal Wallis (KW) test confirmed no significant difference ($p > 0.05$) between sectors on how participants responded to the questions.

Likewise, on organisational learning, a required instrument for safety management in high-tech industries. The result could have however demonstrated that all the three sectors formally encountered organisational learning in the working environment. There were more responses in the aviation sector, compared to nuclear and the oil and gas sectors. Kruskal Wallis test confirmed that the result was of no significant difference ($p > 0.05$) between the three sectors. The test also agrees with literature findings that most organisations have not fully utilised its learning abilities [48]; as organisations struggle to apply practical methods due to the lack of tangible remedies [49].

A 10-point scale (1 = lowest; 10 = highest) was used to rate isomorphic lessons and organisational learning on their ability to promote a stronger safety culture [50] within the three sectors. Though the result indicates that the three sectors responded that isomorphic lessons is used to promote a stronger safety culture. The nuclear sector had more response, followed by aviation and the oil and gas sectors. However, KW test revealed that there was no significant difference ($p = 0.94$) between the three sectors. Similarly, on organisational learning, the online result shows the three sectors use organisational learning to promote strong safety culture. However, a KW test confirmed that there was not significant difference ($p > 0.05$) between the three sectors.

Furthermore, each sector indicated whether isomorphic lesson is a strong feature of organisation's practice. The three sectors showed on strongly agree category that isomorphic is a strong feature of organisation's practice. Conversely, what the three sectors gained on strongly agree was lost on "neither agree nor disagree" category, indicating that isomorphic lesson is not a strong feature of organisation's practice in the three sectors. Result on organisational learning was also similar to the result on isomorphic lesson. KW test revealed that both isomorphic lessons and organisational learning are not significant difference ($p > 0.05$) on how each sector responded to the questions. (See **Table 2**). The result also disagrees with what some participants said during a focus group

discussion that neither isomorphic lessons nor organisational learning have become a strong feature of the individual organisations.

It is believed that lesson learned from high-risks industries (nuclear, aviation and oil and gas) can be transferred to another sector. The result indicates that the three sectors on strongly agree believes that lessons learned and shared will help sectors improve on safety practices. The result is supported by what participants separately said during a focus group discussion conducted by this research that sharing lessons across industries will help reduce accidents.

Having critically examined all the results between the three sectors, it underscores the potential for isomorphic learning where an industry can actively learn vital lessons from another industry even if the systems seem different. There is always an underlying current of resemblances to enable organisational learning [2]. The result has revealed that all the three sectors are not using neither isomorphic lessons nor organisational learning for industry safety management. This was proven using Kruskal Wallis test on all the questions. Furthermore, responses from focus group discussions shed more light on whether finding was of any significant difference. As a result, the three sectors should seek to meet up to safe operations of industries by utilising isomorphic lessons and organisational learning. These pillars should be regarded as inseparable prerequisites tools needed to manage safety in high-risks industries, especially the UK nuclear sector.

6. Conclusions

From the foregoing, this paper proved that high-risk organisations such as nuclear, aviation and oil and gas sectors are not adequately using isomorphic lessons and organisational learning to manage safety effectively in its domain. Some of the underlying causes of accidents in high-risks industries are human factors due to active and latent failures [9].

Some of the lapses that have triggered some avoidable accidents in organisations are not limited to the following points below and efforts should be made to reverse the situations. These are:

- Lack of proper supervision or provision of formal training of staff, as a result, such organisation is prone to accidents.
- There should be a management task which includes controlling and planning of information for positive influence on performance. However, meeting up these requirements for safe operation is still the major task to managers and organisations.
- Nuclear, aviation and oil and gas industries should intensify efforts to provide trainings, planned and made flexible to incorporate learning and adopt instructional strategies that integrate the technical and non-technical aspects of performance.
- Deficient training has caught operators unaware to handle serious accident in some high-risk industries, as organisations with a strong safety focus are

continually learning.

- It is also apparent to deliver evidence-based training programs that are intended to respond directly to the need of industries, organisation and the individual on knowledge, skills and suitable attitudes that are critical for safe and efficient work performance.
- It will be of great importance for high-risk industries to acquaint and equip themselves better for effective safety management.

Further Research

Further research of this nature should be contextualised. It should also focus on examining organisation's safety cases to determine empirical evidence on the use of isomorphic learning and organisational learning as fundamental pillars to safety management.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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