Responses to accidents in different industrial sectors

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Abstract

Accidents produce external pressures on companies leading to new regulations and renegotiation of enforcement of regulations. Our perspective is institutional with a focus on the extended dialogue among regulators and the industry. The empirical focus is offshore oil and gas production, deep sea and coastal fisheries, and maritime transportation with a segment of older bulk carriers. The findings are that structural characteristics of both the industries and the regulatory regime determine the interactions between the regulated and the regulator. The paper illustrates that in industrial sectors where hazards and risks are visible and of public interest, it is easier to implement regulations through outside pressure from regulators and other stakeholders such as internationally organised unions.

Keywords:
Accidents
Regulators
Risk regulations
External stakeholders

1. Introduction

The development of risk regulation and risk management is a consequence of a modernisation process whereby social production of wealth has been systematically accompanied by technical, medical and social risk (Beck, 1986; Bernstein, 1996). In the 1970s and 1980s, major disasters revealed high hazard levels in certain industries: chemical production (Seveso in 1976; Bophal in 1984), nuclear power (Chernobyl in 1986), offshore petroleum (Alexander Kielland in 1980; Piper Alpha in 1988) and maritime transport (Herald of Free Enterprise in 1987; Exxon Valdez in 1989). Such major accidents mobilized public opinion and increased debates about safety as well as self-reflection within the industries. During the following decades, new organising principles and methods of assessing, managing and regulating risk were developed (Power, 2004). In the effort to bridge the gap from incalculable uncertainty to calculable risk, there is a need to define and model risk and organisational means to improve safety (Power, 2007). In this endeavor many actors are taking part: companies and unions, politicians who frame economic and social regulation and allocate resources, scientific communities, stakeholders within civil society, non-governmental organisations (NGOs), scientific communities, and so on (Renn, 2008).

Instrumental models of regulation have lost their dominating position in the search for better regulation and safety management systems. Furthermore, new concepts of regulation and safety management, where part of the regulatory process is delegated from the authorities to industrial stakeholders, have been developed (Frick, 2000). New concepts have been coined and are widely used, such as ‘enforced self-regulation’, ‘regulated self-regulation’, ‘meta-regulation’ and ‘internal control’ (Ayres and Braithwate, 1992). Within these frameworks of self-regulation, the enterprise is obliged to identify and assess risks and hazards embedded in its operations (Hopkins and Hale, 2002).

Consequently, there is a need to develop frameworks of problem solving whereby information from incidents is channelled back to the enterprise through efficient feedback loops. Thus, institutional and organizational designs which promote improvement among the actors will remain central in developing proactive management systems. However, barriers to improvement and learning are numerous, some of them rooted in a lack of mechanism for handling information from ‘weak signals’ and ‘early warnings’ regarding incidents (Pidgeon and Ó Leary, 2000). Accordingly, it should be assessed how the stakeholders may use and assess the incidents and accidents and overcome hindrances to improved actions. Further relevant arenas should be identified in which the companies may work together with regulators and external stake- holders in enforcement for risk reduction.

The paper examines three maritime-based industries with high numbers of fatal accidents and how enforcement actions introduced by regulators and pressure from external stakeholders contribute to improve safety and reduce risk. The empirical focus emerges from three historical case studies of offshore oil and gas production, deep sea and coastal fisheries, and maritime transportation involving bulk older carriers.

2. Analytical framework

Managing and controlling risk takes place at different system levels, ranging from the authorities that make the regulatory framework to the operators at the sharp end of the workplaces, as presented by Rasmussen (1997; Rasmussen and Svedung, 2000), Leveson (2004) and Renn (2008). Rasmussen (1997) presents the 'regulator' and the 'regulated' as the main groups of actors. The first one includes government and regulators/associations and the second management, staff and the workplace. Leveson (2004) developed a sophisticated System-Theoretic Accident Modeling and Process (STAMP) model with multiple levels such as congress and legislatures, government regulatory agencies, industry associations, user associations, unions, insurance companies and courts, and companies that operate in a dynamic relationship between 'system development' and 'system operations'.

The analytical framework presented below also uses a system-theoretic perspective with a pattern of interrelated actors at different organizational levels. In Fig. 1 the industries are grouped as local, national and international enterprises. The regulatory bodies can be national agencies as well as regional (European Union, EU) or global (United Nations, UN; International Labour Organization, ILO).

The model should be read from the 'sharp end' with publicly visible incidents or fatal accidents at the left side towards the industrial responses at the right side, indicating actions that have been undertaken as a result of external pressure. The industry makes up a complex pattern of interlinked actors with customers, vendors and suppliers, insurance companies, and so on. On a micro level the individual enterprise consists of individuals, organisational units, technical installations, along with plants, vessels, equipment, and so on. That is consistent with a socio-technical or 'man technology organisation' (MTO) perspective indicating interplay of technical/physical artefacts and social elements (Olsen and Lindøe, 2009). From this perspective workplaces are seen as communities of practice containing actors with both individual and collective mindsets (Gherardi and Nicolini, 2000; Weick et al., 1999). Furthermore, institutions and organisations are seen as learning entities in which safety culture plays an important role (Parker et al., 2006). On a national and global level the actors can be corporations, associations, global chains of suppliers and contractors, investors and shareholders, national and international unions and federations, and so on. Managing risk in the industry follows a hierarchical pattern with higher-level safety management systems (Frick, 2000) supplemented by using the relevant international and national codes and standards and procedures and routines of 'best practise' within the industry (Brunsson and Jacobsson, 2000).

Regulators enforce mechanisms of control and sanctions towards the industrial actors, based on their legitimate role in society and among the regulated bodies (Baldwin and Cave, 1999). Their role can be characterized as compensating for market failure in handling risk, informing public opinion by influencing political priorities and decisions, and influencing stakeholders and their power structure (Hood et al., 2001). On the other hand, decisions on risk management in the industries are based on responses towards regulatory agencies and organisational capacity (competence and resources). The model implies that the relationship between power and trust among the regulating agencies and industrial actors influences the pattern of interaction. This means that the regulating agencies possess the abilities to exercise sanctions and that the industrial actors accept use of such sanctions if they do not behave in accordance with the rules of the game. A relevant example may be the petroleum concession system. The oil companies accept the governmental right of distributing con- cessions. They also know that if they behave inappropriately, for example if they break safety regulations, they risk being excluded from forthcoming concession rounds. On the one hand the companies accept the governmental power in handling concessions and on the other they trust that the system will be fair and reasonable if they behave within accepted norms.

The regulations are worked out globally, as treaties and conventions, as well as regionally (for example, by the EU) and nationally, and the process is influenced by public opinion conveyed via media coverage and strong external stakeholders. Such stakeholders may be, for example, NGOs, consumers' associations or environmental activists who may enact their influential role by using information technology and mass media. An example of this dynamic was seen in 1995, when the British government announced its support for Shell's application to dispose of the Brent Spar oil storage platform in deep Atlantic waters. Greenpeace organized a worldwide, high-profile media campaign against the plan. The platform was given temporary moorings in a Norwegian fjord until Shell, under intense media pressure, in January 1998 announced its decision to re-use the steel structure in the construction of new harbour facilities (Jordan, 2001).

Given this context, we pose as our research question: What factors are influencing the responses of the companies and industries after severe incidents and fatal accidents?

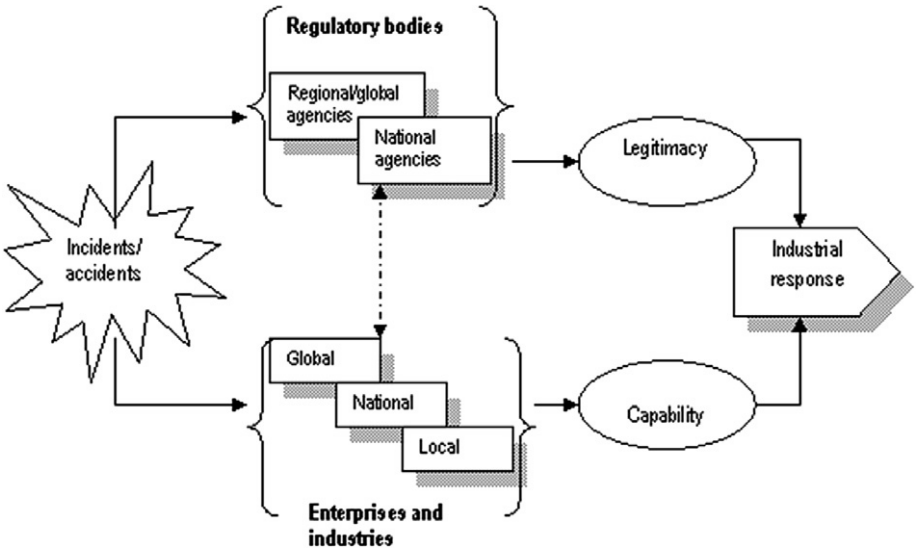

Fig 1 Analytical framework

3. Method

The empirical basis for the three industry case studies rests on multiple sources of data. The Norwegian oil and gas industry has been followed by Norwegian research institutions during the last 35 years, with a portfolio of projects related to technological change, safety management and regulation (Olsen and Lindøe, 2009). Hazards and safety management issues regarding the fishing fleet were assessed in a national survey (Lie et al., 2005) and specific issues from case studies on fishing vessels were examined (Aasjord et al., 2005). Finally, the data regarding maritime bulk carriers were collected through secondary sources (Veritas, 1997) and a specific case study (Lindøe and Karlsen, 2008). By using three critical samples as 'cases', it should be possible to identify some main generic features providing valid knowledge about the industries' responses to incidents and accidents (Yin, 2003). Even though the three industries are different, they share some similar characteristics which make them interesting to compare. All three are subject to regulatory frameworks that aim to reduce the likelihood of critical incidents.

4. Findings from the cases

The guiding perspective in the analytical model is a focus on the legitimacy of the regulator and the capability of the industry. By using major accidents as the most robust indicator, the hazards in each industry are presented. Then a broader picture of the regulatory regime, the industries and external stakeholders is presented.

4.1. Petroleum industry

The first drilling operation in the North Sea started in the mid 1960s with technologies being used by US oil companies in the Mexican Gulf under the legislation of the first Petroleum Acts in Norway (1963) and the UK (1964). Major accidents followed in the first decades. In the UK, the sinking of the Sea Gem jack-up rig in 1965 received considerable public attention, both due to the 'cost' (loss of 13 lives) and the 'benefit' of discovering the first commercial offshore gas field. The inquiry and discussion that followed led to the introduction of the Mineral Working (Offshore Installation) Act, leading to the 'juridification' of the relationship between employers and employees in the industry (Paterson, 2007, p. 48). In the Norwegian sector, the blow-out on the Bravo platform and the Alexandre Kielland disaster, with a loss of 123 lives, were eye-openers for the industry, the regulators and the public. There has not been a major accident on the Norwegian Continental Shelf (NCS) since that catastrophe but the gas leakage on the Snorre A platform in 2004 was a reminder of the potential risk of such major accidents (Schiefloe and Vikland, 2006).

From a level of almost 50 in 1976, the number of injuries per million working hours has a definite downward sloping trend and ends at about 10 in 2006. However, the indicator says nothing about severity since almost 80% of the incidents are minor injuries such as broken fingers and twisted ankles, and the differences between operators and contractors and between permanent and mobile installations should also be taken into account. Yet there is no doubt that a decline in fatal injuries has taken place (Tjelmeland, 2005).

Gas leakage is another major risk factor on platforms. From a high level of 45 severe gas leakages above 10 kg s^{-1} in 2000, the number has been reduced to below 10 in 2008. In conclusion, it is fair to state that some of the main risk indicators from the offshore sector indicate a trend of continuous improvement from the beginning in the 1970s up to now, even if some of the official data can be disputed (Ryggvik, 2000).

In the 1970s, Norway developed very stringent labour legislations, which materialized in the Work Environment Act of 1977. A unionized industry with complete collective bargaining rights and a comprehensive network of safety representatives recruited from the unions became mandatory for the offshore industry. In 1972, the Norwegian Petroleum Directorate (NPD) was established and the agency played an important role in the development of a new safety regulation regime. In 2004 the safety department of NPD was established as a separate regulatory agency, The Petroleum Safety Authority (PSA). The government allocated resources for a research program called 'Safety at the Shelf' (1978–1981), in which the NPD, the industry, and research institutions prepared new principles, methods and practises (Hovden, 2002). New legal principles (enforced self-regulation and functional requirements) were introduced throughout the 1980s. An 'External Reference Group for Regulatory Development', based on the tripartite collaboration between authorities, employers and unions, was established in 1985. It was later renamed as the 'Regulatory Forum' and the Norwegian Pollution Control Authority and the health authorities were represented (Braut and Lindøe, 2008). In the UK the Robens Committee initiated a debate on how to balance flexibility and prescriptive regulations as well as the involvement of the workforce during debates. However, it was after the explosion of Piper Alpha in 1988 that the debate burst open dramatically. The Lord Cullen Report came out with more than 106 recommendations, but it abandoned any faith in the effectiveness of the law, and, again, the involvement of the workforce came on the agenda.

At the end of the 1990s, the offshore industry on the Norwegian Continental Shelf NCS presented a self-satisfied image regarding safety. That image was opposed publicly by the unions and by the CEO and the Safety Director of the NPD (Moen et al., 2009). However, this confrontation led to the establishment of new arenas for dialogue among the actors: (1) the Safety Forum, where the most important actors meet regularly; (2) a programme for technical improvements and cooperation on safety, addressing activities with high risk potential; and (3) the Risk Trend Project, which monitors safety on a yearly basis with mutual effort from regulators, industry representatives and researchers. The hazards and the regulatory regime in the North Sea have developed through forty years in a dynamic relationship between regulators and the regulated, as summarized in Table 1.

The first column is divided into six phases related to the Norwegian HSE regulation in the North Sea (Olsen and Lindøe, 2009). The fourth column is divided in three phases following the development of HSE at the UK-shelf according to Paterson (2007).

4.2. Fisheries

The level of risk in the commercial fishing industry is much higher than for other industries (Roberts, 2004). Fatality rates from deep sea and coastal fishing in Norway from 1990 to 2005 shows that the risk of losing one's life is 25 times higher for a fisherman than for an offshore worker (Lindøe, 2007).

In Europe, the process of enforcing safety regulation in fisheries has taken place through EU legislation that has laid down minimum requirements for improving workers' safety and health on board fishing vessels (93/103EEC) and imposed a requirement for member states to implement their own legislation in 1995. The legislation was based upon the Framework Directive 89/391 (Vogel, 1994, 1998) and inspired by the positive experience with safety regulation on the NCS. The legislation claims that fishermen have to be informed of all measures to be taken regarding health and safety on board vessels; they must be consulted and participate, as well as receive suitable safety training.

The restructuring of the fisheries and allocation of limited fishing quotas have reduced profitability, particularly for the coastal fisheries. According to the national survey (Lie et al., 2005) seven out of ten coastal fishermen argue that the economy limits their opportunity to improve safety by modernizing their vessels, investing in new and better equipment, better training, and so on. Vessels built before 1980 have a low safety standard, and very few have been brought up to the requirements of today.

The structure of the fishing fleet determines how far the regulation has been implemented among the 10,000 smaller fishing vessels spread along the long Norwegian coast. Even if most fishermen agree that the rules and regulations of safety are suitable, they are of less relevance for coastal fishing. Though maritime inspectors visit 95% of vessels more than 15 m in length, only one out of every three smaller vessels are inspected. The same pattern exists for the fishery authorities and the Coast Guard. In coastal fisheries fatal accidents happen one at a time, strike small places along the cost and represent no public threat. Even if the numbers have been very high over a long period (Fig. 2) that has not given rise to a debate about safety either in the newspapers or among politicians.

Table 1
Major accidents and phases of regulatory regimes in the North Sea.

Phases	Major accidents	Norwegian HSE regulations	UK HSE regulations
-1970	Sea Gem (1965)	Act (1963) related to exploitation and exploration of natural submarine resources	Phase I: Continental Shelf Act (1964)
Entrepreneurial 1970–1976	Fire on Ekofisk A platform (1975)	NPD established regulations (1975 and 1976) relating to safe practices, etc.	Phase II: Mineral Working (Offshore Installation) Act (1971) Robens Committee in UK (1972) Health and Safety at Work Act (1974) Burgoyne Committee (after Bravo accident 1977)
First consoli-dation 1977–1980	Blow-out Bravo (1977), Alexander Kielland disaster (1980)	Work Environment Act (1977)	
Maturation 1981–1988	Piper Alpha disaster (1988)	Principles of internal control (1981), Petroleum Act (1985)	
Reorganisation 1989–1996		Petroleum Act (1996)	Phase III: The Lord Cullen Report, 1990 Offshore Safety Act (1992) Offshore Installation (Safety Case) Regulations (2005)
Second consoli-dation 1997-	Helicopter crash at Norne (1997), gas leakage at Snorre A (2004)	New framework regulation and four specific regulations (2001) PSA established (2004)	

4.3. Bulk carriers

Accidents with environmental consequences such as Exxon Valdez, or within maritime public transport such as the Herald of Free Enterprise, get high media coverage and public and political attention, while other major losses in the maritime sectors are often neglected. According to Bailey (2006) the mortality rate among UK seafarers is 26 times higher than the national average onshore. The substantial losses of standard bulk carriers between 1980 and 1996 is one example of fatal accidents happening without media or public coverage. In that period 55 ships were lost, 40 ships were seriously damaged and 611 seamen's lives were lost. All these casualties were due to structural losses (e.g. low technical standards) and not to collisions, grounding, fires, and so on. The age of the ships was the most significant factor in causing the calamities, followed by heavy weather and heavy cargo. Other important factors that influence loss rate are corrosion and maintenance (Veritas, 1997).

The loss of Leros Strength on the southwest coast of Norway shed light on the cases in the statistics. A short version of the case is presented in the box below, based on Lindøe and Karlsen (2008) and http://users.skynet.be/p.woinin/sclerstr.htm.

Leros Strength

February 8, 1997, the captain requested immediate assistance and few minutes later the ship had sunk with no survivors among the 20 person Polish crew. Oil from the ship polluted shores nearby. Insufficient legislation about responsibilities and compensation among the stakeholders was revealed in court cases that followed. Leros Strength was built in Japan in 1976 and in 1993 it was sold to Lambda Sea Shipping of Cyprus, time-chartered to a German company in 1994. In 1996 defects on lifesaving appliances, cargo doors and hatch covers were discovered and it was then approved by the Italian classification society, Registro Italiano Navale. The accident attained wide media coverage both in Norway and in Poland and the case brought new attention to ship accidents where Polish interests were involved. The Nordic Federation of Transport Workers demanded an extensive scrutiny of the accident, and the Norwegian Government granted money for diving operations to inspect the wreck. The Norwegian Maritime Directorate (Directorate, 2000) issued a report on the sinking, picturing a vessel, not seaworthy and suffering from more than two decades of decay.

The only time the ship owners approached the widows of the lost crew of the Leros Strength was immediately after the sinking to persuade them to accept a low figure settlement. After the accident, The International Transport Federation (ITF) advised the widows and their families on the cause of the sinking and supported them with legal assistance to obtain compensation. The compensation was finally settled at US$30,000 for each dead seafarer, which was actually the same amount the ship owners initially offered. In October, 2000, two widows made a statement to an IMO/ILO expert working group, stating that they still, three years and nine months after the sinking, had not received any compensation from the ship owners.

In the global maritime industry, safety improvements are taken care of by treaties and conventions from the UN's International Maritime Organisation (IMO). The first regulation, entitled 'Safety of Life at Sea' (SOLAS), was adopted in 1914 as a response to the Titanic disaster. Later on, new treaties and codes have been added, such as Standard of Training, Certificates and Watch-Keeping (STCW), various codes on issues of the caretaking of human resources, and the International Convention for the Prevention of Pollution from Ships (MARPOL). Major accidents during the late 1980s were seen as being due to human error and the fault of management. The capsizing of the ferry, Herald of Free Enterprise, in 1987 (193 lives lost) was instrumental in bringing about an effort to achieve better regulation. In 1989, IMO adopted guidelines to ensure safety, prevent human injury or loss of life, and avoid damage to the environment, especially the marine environment, and to property. The guidelines were adopted as the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code). In 1988 it became mandatory and therefore part of the regulation for the members of IMO.

The main elements in the regulatory framework regarding health, safety and environment (HSE) issues are shown in Table 2. On a global level, IMO and ILO are responsible for developing and reviewing treaties and binding agreements among the member states. Safety management systems (ISM Code) have to be adopted on a national level and implemented across the whole maritime industry.

Table 2
HSE elements distributed on a global, national and enterprise basis.

	Occupational health and safety	Technical safety	Environmental safety
Global: IMO, ILO, ITF	STCW	SOLAS	MARPOL
National: Flag State Coast stat, Port of call	International safety management (ISM) code		
	National adoption of ISM Code		
	National transport union	Port state control	Port state control
Ownership, operator/manager, shipmaster	Application of ISM Code	Application of ISM Code classification societies certifications	

5. Industrial response

The findings from the three cases can be assessed by using the analytical framework in Fig. 1. The findings are presented in Table 3 according to the two main dimensions, industrial capabilities and the legitimacy of the regulators. The industrial capability is assessed by the structural factors, economic and technical resources and industrial relations. Regulators' legitimacy is assessed by the power of the agencies, regulating principles and the role of opin- ions enforced by media coverage.

5.1. Petroleum

The industrial structure in the petroleum industry includes the main operators, the supply industry as well as shipping companies. PSA has currently supervisory responsibility for more than a hundred companies offshore, from small independent companies to majors such as StatoilHydro and ''super majors'' such as the multi- national operators Exxon Mobil, BP, Total and Shell. In addition there is an integrated system for transporting gas from NCS to European countries. The industry is a dominant economic actor, and in 2007 it accounted for 24% of value creation in Norway and 48% of the export value, which is 14 times higher than the export values of fish (NPD, 2008). The government has declared that the industry should be a 'world leader' regarding safety. Their economic, technological and administrative resources made it easy for the industry to take on the burden of the new principles of regulation with risk assessment and preventive actions (Lindøe and Hansen, 2000). The unions, representing nearly the entire work force, held a strong position toward management as a negotiating partner. They played a decisive role by acting as critical watchdogs as well as co-players in the process of implementing the rules and in appointing safety deputies with rights to stop dangerous work (Ryggvik, 2000).

The regulatory role and legitimacy of PSA as one strong and coordinating agency is an exception in the Norwegian context (Kringen, 2009). However, that approach seems to match powerful

Table 3
Comparing the regulated and the regulator across the three industries.

		Offshore petroleum industry (NCS)	Fisheries	Maritime bulk transport
Industrial capabilities	Industrial structure	A few global actors and some smaller newcomers. Strong hierarchy with contractors and suppliers	Family and individual ownership of coastal fishing. Industrial structure on deep sea fishing	Complex with separate ownership, management of ship, cargo and crew agents. Flag state with tax exemption
	Economic and technical factors	High earning and impact on global and national economy. Incitements for technological improvement	Variable, but low earning within coastal fishing. Few incitements for technological improvement	'Low cost-low standard' segments. New technology enforced by classification society
	Industrial relations	Strong, critical and competent unions	Owners and fishermen in the same unions may prevent dispute on safety	Generally weak. Short term contracts and 'third world' work force
Regulators legitimacy	Power of agencies	One strong coordinator in Norway	National agencies with weak and limited possibilities of implementing their means	IMO influence flag state and port state classification societies
	Regulating principles	Enforced self-regulation, functional requirements and clusters of legal standards	Maritime standards with limited effect on coastal fishing and few effective means	Global technical and safety management-standards. Technical assessments done by classification societies.
	Opinions, stakeholders and media awareness	High awareness regarding fisheries and the Arctic region. Effective environmentalist. High on energy, global warming, pollution and major accidents	Low awareness and few initiatives taken by involved stakeholders. Low in national media, but high in local media when local people are involved	Low awareness of 'backyard industry' Local ITF unions act in some cases Media awareness generally low

and capable operators. By developing the framework of enforced self-regulation, the NPD managed to motivate and force the industry into internal processes of improving safety standards. The close connection between the industry operators and their contractors and suppliers made communications with the NPD easy. The NPD could use licences and contracts as 'the stick and the carrot' for this process. In the end, the industry accepted the new principles of enforced self-regulation and the potential of a 'three-pillared' system of cooperation between company, union and authorities (Karlsen and Lindøe, 2006; Olsen and Lindøe, 2009).

The industry has the advantage of being able to act with the NPD and PSA as one strong and coordinating regulator. The degree of cooperation varies between the actors from time to time, and presently there exist different means of cooperation. After 2000, a period of distrust among the parties led to tendencies towards disintegration of the tripartite system and the role of the regulators. An open dispute among the authorities and industry on safety levels during the autumn of 2000 was enforced by a fatal accident on the Oseberg platform on Christmas Eve 2000. The NPD made a very critical complaint, saying that the accident seemed to be an outcome of a management problem and a culture of violating procedures. The victim's mother made public complaints to the involved stakeholders. Moen et al. (2009, p. 6) analyzed this period and stated that 'The Norwegian authorities took active actions that went far beyond a regulatory role. The intervention of the Minister of Local Government and Regional Development signalled that safety in the oil industry was considered a political issue'. The initiative was followed by the establishment of the Safety Forum, a new monitoring tool (RNNP) and specific projects of improvement within the framework, 'Working together for safety'.

Public awareness of major accidents via the media, in correspondence with politicians, debates and decisions in Parliament, is another mechanism of enforcement. The use of the media as a means of putting pressure on authorities has been useful regarding some fatal accidents, chemical exposure, diving, and so on. In general, there is an increasing awareness among the public and civil society groups regarding the negative effects of the industry, such as air pollution and global warming, polluting the seas, and adverse impacts upon the vulnerable Arctic areas (Mikkelsen and Langhelle, 2008). Issues of safe and legitimate operation will probably be strengthened in public opinion by media, action groups, and finally by politicians and legislators.

However, an important question is whether this compliance with the regulation and political will can be sustained outside the context and culture in which it has been developed (Kringen, 2009; Olsen and Lindøe, 2009). This is a challenge for the many newcomers to the NCS as well as the major Norwegian operator, StatoilHydro, moving from the NCS to into the global scene.

5.2. Fisheries

The issues surrounding fisheries are in stark contrast to the petroleum industry. The combination of a socio-economic framework with little incentive for investment, individual ownership, high risk culture, and no external pressure from media or stakeholders, does not facilitate and promote improvements. The industrial structure seems to be a hindrance to implementation of systematic safety improvements. One important factor is that the restructuring of fisheries and reallocation of fishing quotas has reduced profitability for many coastal fishermen. Another factor is that safety issues are not raised in employer–employee relations because most of the coastal vessel owners and fishermen are members of the same union. In coastal fishing fleets, the owner(s) are often included in the crew, who, in turn, live in the same local community and can be members of the same family; furthermore, there has not been any critical key stakeholder advocating for worker safety. Another aspect is that the fishermen's attitude towards risk and safety in their work can be seen as fatalistic, especially in taking for granted the likelihood of accidents (Sutherland and Flin, 1989).

There was a delay of 15–20 years from the development of enforced self-regulation in the Norwegian offshore petroleum industry to the emergence of the same principles within the maritime industries, including the fisheries. However, the conditions for implementing the principles in fisheries differ widely between deep sea industrial fisheries and coastal fisheries with smaller vessels. The survey from the fishing industries (Lie et al., 2005) shows a lack of commitment among the coastal fisheries to implementing the new principles of systematic safety management, assessing safety, making plans for preventive actions and using safety delegates as change agents. Active participation from the crew is not dominant in that part of the industry.

In contrast to the oil industry, the high number of fatal accidents in fisheries has neither given rise to a public debate about safety standards nor to a common effort among the main stakeholders to improve safety standards. Even the total pollution from the fishing fleet may be considerable, though the oil pollution from an individual vessel plays a minor role. Each incident may be of small magnitude, and the reporting systems may not expose such minor incidents to the public. Thus, pollution from fisheries is an almost non-existent issue. For the market and consumers, quality and safe marine products count more than unsafe conditions for the fishermen.

5.3. Bulk carriers

The industrial structure of maritime transport has undergone major changes regarding ownership, specialization and technology (Kristiansen, 2005). Keeping the ship seaworthy is a condition for ensuring the safety of cargo, passengers and crew, as is keeping oil from polluting the sea and shores. Consequently, there is a strong link between the cost/benefit analysis of the ship and an assessment of the societal risk, including to the crew, local communities and society as a whole. As a global trade, the means of improvement within maritime transport have to be handled on a global level. Technical improvement and standard setting organized and developed by the IMO and made mandatory through the Flag state and classification societies have improved safety and safety management systems in compliance with the ISM Code. The industrial relations and unions are weak and almost non-existent in the industry. As documented in the Leros Strength case, sea-farers and their relatives are most often isolated and unable to coordinate their claims. Often, the relatives do not know what happened with the cases of other relatives if they are in different countries or live in large countries, such as India and China (Bailey, 2006). In such cases the seafarers and their families depend upon a larger network of actors on a global level, such as the International Labour Organisation (ILO) and the International Transport Workers Federation (ITF), with national and local branches. Mobilizing and challenging national authorities as ports of call, introducing embargos on ships or imposing a blockade can be effective means of intervention.

The introduction of new regulations such as the ISM Code was a reaction to major accidents at sea and was also intended as a pro-active element in line with modern safety management principles within 'the culture of self-regulation' (Kristiansen, 2005, p. 467).

However, when ship owners, managers or their technical employees are incompetent or unwilling to follow the rules and regulations, the ISM Code has little effect (Andersen, 2003). From a strict cost-benefit perspective one could ask why they should follow rules when regular loss of life of the seafarers is not producing any change, absent public pressure, government regulation, and so forth.

Following the Leros Strength case illustrates the issue. Almost ten years after the loss of the ship a Maltese bulk carrier, managed by the same company, Leros Ship Management, was detained by the US Coast Guard in California. Among other deficiencies, it was found that the ship had cracks in its hull up to 2.5 feet long. A court in San Francisco ordered the owner of the ship to pay a US $50,000 criminal fine and also US $100,000 in restitution that would help fund environmental restoration projects in the San Francisco Bay area, even though no pollution had resulted from the incident (http://users.skynet.be/p.woinin/sclerstr htm).

6. Conclusion

The assessment of the three cases has given a better under- standing of why different industries react differently to pressure from external regulators. The three industries represent quite different types of enterprises regarding capacities and culture for working with legal issues and cooperating with external regulators. The petroleum industry is dominated by a limited number of big enterprises with ‘machine bureaucratic structures’ (Mintzberg, 1979) well suited for cooperation with legal authorities and their rules and regulations. This structure also makes it easy for regulators to identify key partners within the industry concerning safety issues. The coastal fishing industry has the opposite character: large numbers of small fishing boats with a low degree of formal organization, high degree of personal freedom and a tradition to engage in risky activities. Maritime transport has some elements of self-regulation whereby the industry has made its own risk assessments through classification societies. Regulatory authorities have difficulties in exercising control and implementing measures to improve safety due to the international organisation of the maritime sector. As demonstrated by the Leros Strength case, the result can be a laissez-faire system.

The lessons learned from the three case studies can be summarized as follows:

Firstly, structural characteristics of both the industries and the regulatory regime to a large extent determine the interactions between the regulated and the regulator.

Secondly, enforced regulations and a capacity for regulators to implement sanctions, and the presence of well-organized and competent industries as counterparts to the regulators, make a substantial contribution to the reduction of incidents and accidents.

Thirdly, the three industries have introduced similar principles of enforced self-regulation with delegation of safety management systems to the enterprises. However, new legal principles of risk regulation and safety management have a very limited effect on safety if they are not accepted as legitimate by industrial actors. Such principles may remain an empty shell of bureaucratic procedures unless they are implemented by motivated and competent actors and followed by clear industrial standards.

Fourthly, unions can play a crucial role in the implementation of regulations both as ‘watch dogs’ and as competent partners, as seen in the Norwegian petroleum industry.

Finally, some industrial sectors remain without power or incentives to exploit information about their hazards. In sectors where hazards and risks are visible and of public interest, it is easier to implement regulations through outside pressure from regulators and other stakeholders such as internationally organised unions.

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