Stevens Institute "Maintainers" Workshop

Insurance as a Key Element in Risky Socio-technical Systems

Ann Johnson

Cornell University, Science and Technology Studies

Socio-technical systems include a diverse set of human actors, institutions, devices, laws and regulations, users and consumers, and more. But when one's focus moves from the sociotechnical systems that are integral to the introduction of new technologies to those that are essential for maintaining on-going technologies a new set of institutional, financial, and technical elements come into focus—one of which is insurance. The role of insurance has been systematically overlooked in the history of technology, despite its central role shaping and making feasible the use of technology over the past more than a century. [1] Insurance companies assess the in-use risks of various technologies, including ships, buildings, financial technologies, cars, factories, professional practices, drugs, etc. Insurance is integral to the functioning of technologies.

As I develop this idea (and I am not yet there) I want to offer two things: a new model of sociotechnical systems that includes a central role for insurance as a shaper of technological experiences and a series of revealing case studies where

[1] The main way that history of technology has paid attention to insurance is as a users of information technologies. I don't mean to minimize this work; it is important to the history of IT and office work. But it isn't about the role insurance plays in the function of other technologies, beyond the insurance industry itself.

insurance serves a regulatory and governing role. The case studies I will present in brief here include insurance for exploding steamship boilers in the early 19th century, fire insurance for urban buildings prior to the full implementation of building and life safety codes, and the role of the Insurance Institute for Highway Safety-Highway Loss Data Institute (hereafter, IIHS-HLDI) in assessing the risk of in-use automotive technologies.

In their book *Insurance as Governance*, authors Richard Ericson, Aaron Doyle, and Dean Barry outline a program for examining insurance sociologically. Ericson, Doyle, and Barry (hereafter, EDB) see the effects of insurance in society in five different frameworks: insurance as 1) an institution; 2) mode of consumption; 3) means of governance; 4) a knowledge-producing practice; and 5) a regulatory method. Each of these aspects requires attention that has previously not been given to insurance. They point out that insurance has really only been studied from narrow perspectives in law and economics, and hasn't been examined with other social science methods. They also argue that insurance is a key component of political economy, because it brings together, bridges, and interlocks powerful corporations, capital, and the state. But from an STS perspective, the aspect that EDB overlook is the role of technologies, especially in material forms, as a generator of risk. EDB blackbox technologies, as merely the things about which risk is calculated. The differences between different technologies are treated as immaterial to the calculation of risk. Different technologies pose all sorts of distinctions in the assessment and predictability of risk. My interest is precisely in

opening that black box, and understanding the interactive relationship between technologies and the ways they are used and the assessment of risk and responsibility by insurance companies and the courts that have adjudicated cases involving insurance liabilities. That's the reason why I'm proceeding with case studies.

EDB provide a nice breakdown of nine modes through which insurance can play a role in governance. These are critical to understanding how insurance plays a role in socio-technical systems, even though EDB are not trying to explain larger scale socio-technical systems. These include:

1. Knowledge about risk is produced by objectifying and calculating chances of harm.
2. Because risk is calculable, it is subject to commodification.
3. Risk is a population level phenomenon. Risk pools are created by the science of actuarialism.
4. Insurance functions as a means to protect against loss of capital—this is essential to certain activities where the loss would wide out the firm (e.g., in shipping).
5. Provides a basis for managing risk on the basis of surveillance and audit for a population (risk pool) dispersed through time and space.
6. The system works through the legal means of contract and adjudication. Courts are part of this system.
7. Functions as a futures market in security. Offers a cultural framework for concepts of time, destiny, providence, responsibility, economic utility, and justice.

8. Bridges individual and social responsibility through distributive justice (sharing losses) and restorative justice (financial indemnification).
9. Provides a political mechanism for keeping collective well-bring in productive tension with individual liberties.

One interest I have in looking more closely at insurance through an STS lens is to counter a common perception that new technologies require simultaneously developing systems of regulation. This notion is often referred to as the Collingridge Dilemma, after David Collingridge—i.e., it is difficult, perhaps impossible, to anticipate the impacts of a new technology until it is in wide use, but once it is in wide use it is then difficult or perhaps impossible to control or change (i.e., regulate) the technology one it is in wide use. This claim overlooks the role of insurance as an ad hoc and flexible (and yet often effective) means of regulation that can co-evolve with technologies as their dynamic risks become apparent and calculable. Insurance assessments are often the basis for governmental regulation—the most obvious cases of this is in today's automobiles, but this isn't the only case by any means. (NB -- Cars are a great case of a technology that has been regulated repeatedly, while in use, since its origin. I think it's the case that proves the Collingridge Dilemma lacking as a generally applicable phenomenon). Insurance companies work (exclusively?) with technologies that are in use; protypes types do not generate the kind of risk that insurance assesses.[2] Thus, I think they're a relevant focus for the idea of the

[2] I think reinsurance is an exception here, because reinsurance companies need to anticipate the risks insurance companies will be taking on the future—their assessment is of the risk portfolio rather than the individual risk pools. But

Maintainers, where the emphasis, as I understand it, is to shift the focus away from innovation and new technologies and consider the ways in which technologies really function in society, centering users, regulators, and maintainers in the analysis.

To better establish the roles insurance companies play in sociotechnical systems, I will now offer a few very brief historical cases as fodder for discussion.

Case #1: Exploding Steamboats

The oldest case I have been looking at is the role of insurance companies in 19th century American steamships. Marine insurance was one of the first applications of insurance and some analogous forms of it date back to the ancient Mediterranean. Modern marine insurance is typically dated to the formation of the Lloyd's Coffeehouse insurance market in London, which materialized in the 1680s, and eventually led to the creation of the Lloyd's insurance market in the 18th century. Marine insurance covered a number of things and policies were written to customize coverage. Generally the categories of coverage were cargo, property, hull, and casualty and liability. In the case of steamship boiler explosions the relevant coverage is over casualty and liability. Casualty claims focus on restitution for injuries and property damage; liability covers risk borne from lawsuits, most often made over deaths caused by the insured's technologies. John Burke's article on "Bursting Boilers and the Federal Power" (*T&C* 1966) is the story of how the US

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reinsurance is most significantly interested in financial rather than material technologies.

wrote its first technology regulations in 1852, in order to set standards for steam boiler construction and inspection. Buried in Burke's footnotes are a series of liability claims against and between steam ship operators and their insurance companies. The most important case is the Estate of Isaac Perrin v. Protection Insurance Company in 1838.[3] Perrin was the captain of the steamboat *Moselle*, which exploded in Cincinnati in April 1838. Perrin was killed, along with 150 others, and his estate sued the insurance company that underwrote the casualty insurance on the ship. The Protection Insurance Company, in defense of not paying the damages claimed, argued that Perrin had been negligent, as the operator of the ship. But the court ruled for Perrin's estate, saying that the policy explicitly covered boiler explosions. As a result of this case, boiler explosion insurance was no longer routinely covered as part of a casualty and liability policy; separate, more expensive coverage was the new option. But thinking the Perrin case was solely responsible for the re-assessment of risk of boiler explosions overlooks the degree to which these disasters were relatively common from 1820-1850—thousands of people died in explosions between 1820-50. The primary risk of a steam engine was its boiler exploding and until boiler construction was standardized and regulated (which an 1852 bill did) insurance was the only means of assessing the risk. Steamboats were riskier than locomotives because non-fatally injured passengers often drowned. Further reading of these cases will hopefully show the way insurance companies

[3] *Cases Argued and Determined in the Supreme Court of Ohio, in Bank, Term December 1842*. 126-129.

changed their policies as companies were better able to assess explosion risks quantitatively.

Case #2: Fire Insurance on Buildings

The first fire insurance company was created in London in 1681, although efforts to pool risk of fire had been in the works since the 1666 London fire. Fire insurance was not only coverage for property damage (and potentially liability) but it was also a policy, which bought the holder access to a fire brigade or department. I.e., the first fire departments were parts of insurance companies to protect the properties under policy. Eventually fire departments became municipal services, still funded in part by insurance company payments well into the 19th century. The earliest fire insurance company in the US was formed in Charleston SC in 1732. Benjamin Franklin also formed an fire insurance company. The case I've been looking at is Cole v. Germania Fire Insurance Co, filed in the NY Court of Appeals in April 1885. The policy covered a structure on 547-555 West 21st St. in New York City against loss or damage by fire. The building was owned by a firm, C. F. Dielmann and Co. One of the conditions of the original policy made it void in case of increase of hazard by erecting neighboring buildings. After the original policy was issued, Dielmann erected a wooden drying house for lumber about six or seven feet away from the insured building. But the policy covered not only Dielmann but also a mortagee of the property, W. C. Herrick. When Dielmann went to renew the policy the insurance broker noted the increased hazard and wanted to change the policy. Herrick sued, saying his position should not be changed by the actions of the building owner to

another property he had no control over. Furthermore the clause in the contact required a mortagee to notify the insurance company of the increase in hazard; Herrick claimed he had no expertise in assessing fire hazard so shouldn't be required to inform the insurance company. The court found for the insurance company, which raises questions about the expertise needed to assess fire hazard.

Case #3: (not a legal case but an case study of an institution with a critical role) The IIHS-HLDI (Insurance Institute for Highway Safety and Highway Loss Data Institute), is a set of non-profit 501-c-3 institutions based in Arlington VA with a research facility in the Research Triangle region of NC. The two institutions fulfill different, but complementary roles. The IIHS-HLDI are funded by contributions from automobile insurers in the US, but their testing is important to a much wider constituency—including both drivers and government regulators. The IIHS is the largest tester of automobile models that are available on the open market; the HLDI collects government statistics about accidents to assess the risk of cars and their drivers on the road. IIHS provides the basis for setting rates for car models and their features, therefore hierarchically ranking various risks. The HLDI focuses on the various risks of different vehicles, but also ranks drivers, in demographic groups, in terms of their actual risks. Both institutions collect information critical to the NHTSA in recalling deficient vehicles—hence defining those deficiencies and manufacturing defects.[4] IIHS provides recommendations to consumers helping to

[4] The question of what constitutes a deficiency is complicated. In the famous case of Ford and Firestone and the rollovers of the Ford Explorer in the 1990s, Ford was excused because the rollover prone Explorer was a poor, but not defective, design.

define broadly used categories like "safe"—note the use of IIHS rankings in advertising for cars today. IIHS also establishes new groups of experts (eg actuaries and statisticians, automotive engineers, psychologists, trade unions, and more) into discussions about highway risk. While IIHS-HLDI plays a quasi-regulatory role, one must not overlook the interests of these organizations. The IIHS-HLDI have a dog in the fight about assessing the riskiness of technologies; the more risk they assess the higher the policy cost will be which funds the IIHS-HLDI. One case in which this was argued was in assessing the reasons for the statistically disproportionate number of single cars crashes that automobiles with early ABS had. Insurance underwriters had to decide whether to continue to provide a discount to cars with ABS or whether ABS-equipped vehicles should incur an additional charge for the risk of these single car accidents. Initially some insurance companies eliminated their ABS discount, but as the single car accidents were better assessed based on HLDI information and the government somewhat controversially required ABS on cars, questions about how ABS should affect rates faded away.[5]

Based on these cases and a few others (e.g., I have a case on the liability ship owners and holder of marine insurance policies have for oil leaks from ships that produce significant oil spills) I think a larger scale examination of the way insurance affects

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Firestone's tires, on the other hand, had a manufacturing defect, something not part of a design. The defective tires were much more harshly penalized in the courts, although both companies could argue that only in combination did the blow-outs and rollovers occur.

[5] This example also raises the question of whether ABS should be dealt with as a generic technology, as some systems work better than others. But is that risk then assessed in the overall risk of a certain model? These are questions that the data collection of the HLDI and IIHS raise.

the use of technologies is warranted. Insurance also opens up a number of questions about the development of expertise in risk assessment and responsibility for reporting changes in the risk landscape—especially then the responsibility for reporting falls on a user or party who is inversely interested in the reporting (ie., the consequence of reporting is that one's policy will become more expensive).