**Zeitschrift:** Ferrum : Nachrichten aus der Eisenbibliothek, Stiftung der Georg Fischer AG

**Herausgeber:** Eisenbibliothek

**Band:** 93 (2024)

**Artikel:** What is QSMRTS? : Thinking about a new subdomain in the history of technology. Closing remarks to the 43rd History of Technology Conference "Good, durable, safe"

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**DOI:** https://doi.org/10.5169/seals-1061987

# What is QSMRTS? Thinking about a new subdomain in the history of technology

## Closing remarks to the 43rd History of Technology Conference "Good, durable, safe"

Matthias Heymann

This formidable conference highlights once again that the history of technology is characterized by fashions and biases.[1] Its topic was well chosen: quality and safety requirements of technology in history so far represents a rather small field of expertise that has received only little attention in the past.[2] The situation reminds me of the early 1980s, when the young discipline history of technology boasted significant male-dominated enthusiasm and self-confidence with its strong focus on engineers, invention, and innovation and fueled by the charisma of fascinating technologies in history, which Leo Marx 60 years ago referred to as the "technological sublime".[3] In this situation a young female scholar came along and – with her impressive and much acclaimed book – raised attention for a forgotten side in the history of technology: the user and the consumer.[4] Ruth Schwarz Cowan helped give birth to the discovery of a new dimension of the discipline beyond research, invention, development and innovation: the users and their appropriations of technology, the people and cultures that select, assume and transform technologies and their usages and, at the same time, feature as subjects to technological and cultural change. This dimension, later mostly referred to as the cultural history of technology, in fact became a leading paradigm.[5]

The theme of quality and safety of technology in history seems another nearly forgotten side or dimension in the history of technology with relevance across the whole space between innovation and use of technology. It bears relevance for research and innovation at the development stages of new technology, but it remains a major, often invisible factor throughout the lifetime of technology and its stages and contexts of usage. I will try to draw a few conclusions from the conference's presentations and discussions around two major levels of analysis. First, the analysis of the tangible, material dimension of quality and safety of technology that comprises new forms of knowledge and skills, new standards and regulations, specialized experts and actors and new institutions and organizational configurations. Second, the analysis of the intangible, cognitive and discursive dimension of quality and safety of technology comprising perceptions, discourses, narratives and interests.

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### Knowledge, actors and institutions

Quality and safety of technology represents a rich, specialized knowledge domain and research field. Marius Mutz coined the term "knowledge culture of quality control" and Guillaume de Syon analyzed different national "engineering cultures of quality control." I believe these concepts make a lot of sense. Quality and safety require more than knowledge and defined procedures. They rest on shared values, practices and habits, entail specialized types of expertise, skills and language, and build on learning practices, the accumulation of experiences and processes of disciplinary socialization and cultural formation. The conference contributions have shown that the knowledge basis of quality and safety alone comprises a rich set of competences and skills, including tacit forms of knowledge such as the skills derived from years of practice (see, for instance, Mutz, Sutter, Nikolow and Leimbach), training of senses (Lychatz/Rasch) as well as the development of defined and standardized research-based quality practices such as test procedures, testing tools and control systems and standards (for instance Spicker, de Syon and Lobach).

> Quality and safety require more than knowledge and defined procedures.

Furthermore, quality and safety were a matter of continuous innovation and professionalization. In the case of material testing, to take one example, activities ranged from developing increasingly sophisticated testing tools and instruments to complex platforms of experimentation (Spicker, Lychatz/Rasch, Poulopoulos) and from devising testing procedures and legal frameworks about testing demands to building dedicated institutions for material testing and control such as the Prussian Office of Material Control (Materialprüfungsamt). Rapid technical change forced the community of safety engineers to adjust their procedures and tools and to develop new technologies for maintaining and improving safety. The Residual Current Circuit-Breaker (RCCB, in German *Fehlerstrom-Schutzschalter*) introduced to us by Frank Dittmann helped avoid dangerous electrical shocks and represented a peculiar example of safety technology invisible to the customer.

Claudia Sutter has shown that different levels of institutions were involved in quality control already in early modern times. They ranged from the highest level of regional administration, the mayor and council, for establishing appropriate legal frameworks, to the level of guilds taking responsibility for standards and certification and the level of craft associations defining specific rules. Controlling and standard-setting institutions and authorities also reached a significant level of differentiation and specialization. The Berlin Prothesis Testing Authority during World War 1 that Sybilla Nikolow discussed represented a notable example. Today quality control departments have become standard in companies to ensure the quality and safety of processes and products, for example at GF Piping Systems, a division of the Georg Fischer Corporation (Schiller). In addition, the emergence of a large number of institutions – company and university departments, legal frameworks and bodies, consulting and insurance companies – has come to represent a complex structure or ecosystem around quality and safety control.[6]

The conference contributions suggested that quality control and safety largely seemed to be a matter for engineers. Surprisingly, users and consumers – those actors which supposedly profit from good quality and safety – rarely turned up, despite the recent attention to them in the history of technology.[7] As one rare example, Frank Dittmann presented cartoons from the early 20th century to convey the risks of electricity in case of inappropriate behavior. Revealingly all these drawings presented as users only poor women suffering electric shocks, apparently passive victims without their own voice. Sybilla Nikolow in her contribution discussed a competition about the quality and performance of arm protheses during World War One. These protheses were assessed by a relatively large assessment committee with a diversity of experts. Tellingly the list of assessors *only* included experts, not any users of such protheses, who might have been able to share valuable experiences from the users' perspective. Timo Leimbach in his contribution suggested that software managers commonly defined the specifications of software products rather than its users. So, where are the users in these histories, without which quality and safety would not be a major concern?

> The very terms quality and safety appear mostly defined and filled with meanings conceived and negotiated by engineers rather than other actors.

That engineers, overwhelmingly male engineers as we may suspect, massively dominated the understanding and shaping of quality and safety procedures was confirmed at a lunch discussion during the conference. In Germany, the private, non-governmental association VDI (Association of German Engineers) assumed responsibility as a norm-setting institution, including norms for quality and safety. Hence, the very terms quality and safety appear mostly defined and filled with meanings conceived and negotiated by engineers rather than other actors, such as users. Is there a risk that we as historians uncritically adopt these meanings that guide our research and understanding? Should we at least consider other and potentially broader perspectives? At least, I missed a few themes at

this conference that go beyond an engineering-focused history of technology (though this may be coincidental, as a conference is limited and can't cover everything).

One of these topics we did not cover much at this conference is *labor safety* or *occupational safety* (only Elisabeth Kölmel, who had to cancel her participation, briefly mentioned it as one of the tasks of the Chemisch-Technische Reichsanstalt). Labor safety may fit a different bill in the engineering and regulatory world, though it arguably matters in the broader theme of quality and safety of technology.[8] Even more surprisingly, the terms *maintenance* and *repair* also did not turn up. Quality of technology, however, matters throughout its lifetime. Shouldn't maintenance be conceived of as a part of preserving quality over more than just the moment of development, innovation and early use? This omission seems to correlate – at least to some degree – with the absence of the user and uses of technology. It is somewhat surprising given the recent development that maintenance and repair have been discovered and much discussed as an important new topic in the history of technology.[9] It seems that we easily fall back to some of the much-discussed biases in the history of technology, the engineering and innovation-centered view, though I do not doubt its importance.

> Shouldn't we conceive quality as related also to the durability and long-term reliability of technological artifacts that ideally do not fail or fall apart in ever shorter intervals?

Another topic that I could have imagined well-placed at this conference is the recently rediscovered concept and catchphrase of *planned obsolescence*, the purposeful design of technology with a smaller lifetime than possible and often without opportunity for repair, which producers deliberately pursue in order to accelerate sale cycles and maximize profits. Though planned obsolescence has a long history (the concept reaches back about 100 years at least) and its importance has grown tremendously in recent years, it has so far hardly met with much interest in the history of technology.[10] Shouldn't we conceive of quality as related also to the durability and long-term reliability of technological artifacts that ideally do not fail or fall apart in ever shorter intervals? Experiences that parts run down quickly, connections break, plastic parts fall apart, storage batteries fail, motors break down and so on should certainly matter in the history of technology. What do quality and safety departments think about strategically implemented limited lifetime? Shouldn't we as historians include it when we investigate the quality and safety of technology in history?

### Perceptions, narratives and interests

Quality and safety are ambiguous terms, not technical facts, and not in any way clear. Georg Neuschütz, Member of the Divisional Management of GF Casting Solutions, alluded to this condition when he raised the central question in his opening address: "What limits of safety are acceptable?" Safety and its limits are subject to interpretation and negotiation. They depend on perceptions, values and priorities, which certainly differ among people, even among experts. In addition, as historians we know that perceptions, values and priorities change in time. The Zeppelin was in 1930 an accepted technology in Germany, enthusiastically received by cheering crowds and used as a regular means of transport across the Atlantic Ocean. The Hindenburg disaster in 1937, the explosion of the largest Zeppelin ever built while approaching its landing site close to New York, immediately put an end to Zeppelin traffic. It eventually called attention to the risk of traveling with huge amounts of pure hydrogen as a lifting gas (helium filling was not available at that time and much too expensive to warrant regular airship services).[11] A risk perceived as acceptable for more than 30 years (despite numerous accidents) had suddenly turned unacceptable.[12]

Engineers who are familiar with complex technology may rate it as very safe, while others question its safety. Nuclear power technology is a notorious example.[13] Quality, safety and risk demand debate and negotiation. Perceptions need to be discussed, expectations aligned, and appropriate standards negotiated, ideally with all relevant societal groups involved including the users. Perceptions are also often linked to specific narratives and stories with which they interact. The description of aluminum as a "green metal," which Simon Lobach introduced to us, is on the one hand a marketing slogan helping the case of aluminum lobbyists. On the other hand, it shapes a narrative about environmental friendliness to create positive customer perceptions. Quality and safety standards need not only to be defined and implemented, but to be communicated and made accessible and acceptable to customers and lay people. Standards involve communication and education because safe uses of technology require appropriate user knowledge and behavior.

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As historians we are aware that historical processes as well as history writing are embedded in language, narratives and stories, and depend on discursive practices. Developing and selling technology, defining and implementing quality and safety standards, and exciting, enlightening and educating users depend on discursive practices. Which

are the stories that engineers, safety experts and regulators devise? To what degree is the level of language, narrative and stories left to technicians and engineers, as Nicole Hesse suggested when discussing wind technology? Frank Dittmann's female victim caricatures mentioned earlier represented quite powerful narratives about inappropriate behavior (as well as gender bias). Most likely it was male engineers that constructed these narratives (and male artists that created the cartoons). Writing history involves exposing such narratives critically. In any case, as concluded already in the first section, historians of technology are well advised not simply to follow the understanding of engineers in history and adopt (or fall prey to) narratives, discourses and discursive strategies that engineers devised and normalized.

At this conference, we heard about a diversity of interests of historical actors.

This argument is linked to a much broader condition and challenge in history and history writing. Historical actors pursue specific vested interests which stand behind and form understandings and practices, which shape narratives and discourses (purposefully or not), and which historians aim to expose, disentangle and understand. At this conference, we heard about a diversity of interests of historical actors, whether explicitly addressed or not. Engineers, engineering associations and industries, as well as rulers and states, did not only pursue their interests of improving the quality and safety of technology, but also their interests of increasing power and control, such as the expansion of the electricity industry in competition with the gas industry (Dittmann), the conquest of tropical markets for electronic devices (Ruamcharoen), the increase of profitability through "lean production" in organizational IT development (Leimbach), the use of military technology as an element of building dynastic power in Saxony (Mutz) and the optimization of arm protheses to better integrate people with disabilities into the labor force (Nikolow).

Engineers often cultivate the narrative of the disinterested and objective experts, which we do not take for granted. Some businesses pursue strategies of planned obsolescence to better compete on the market and, at the same time, construct and circulate narratives and identities of sustainability with the help of expensive marketing strategies. Such caveats that are not usually openly exposed, and sometimes also unconscious behavioral patterns of historical actors, may not easily be recognized, and underline once more the importance of critical historical analysis.

## Conclusion

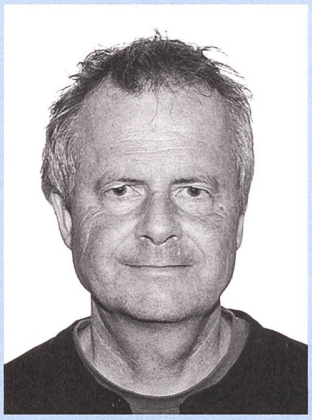
Quality and safety of technology in history is a rich, complex and sophisticated knowledge domain, a broad research field in its own right. While quality and safety of technology in engineering represents a highly professionalized, differentiated and institutionalized field, this is hardly the case in the history of technology. Attention to this field appears rather limited, so far, maybe not least because its actors and institutions are less visible than the technologies that stand behind. Large bridges and dams are eyecatchers in the landscape. Railways, Zeppelins, aircraft and rockets raise much attention. Radios, television screens, computers, smartphones and GPS navigation have become everyday devices for millions of users. Quality and safety appear much more invisible and represent another field of technology that bears more significance than historians have been able to see or been willing to accept.[14]

The historical field of quality and safety of technology deserves to be made more visible and to receive more attention. This conference has shown, I think, that it promises to offer a rich set of topics and questions that open new perspectives and add new dimensions to our discipline. In fact, this field could be conceived as a comprehensive new subdomain in the history of technology. It covers themes across the whole life cycle of technology, ranging through quality and safety, maintenance and repair, reuse, recycling, disassembly and disposal, and including topics such as for example planned obsolescence. It accounts for the variety of relevant actors from engineer and innovator to trader and retailer, customer, user, insurer and regulator, maintainer, repairer, recycler, waste collector, waste trader, and so on. It aims at global geographical coverage, not least because global supply and waste chains of technology raise significant questions about quality and safety and its environmental and social impacts. It investigates material and physical (knowledge, actors, institutions) as well as discursive dimensions (perceptions, narrative and interests) of history. Not least, it links crucial societal questions and challenges including issues such as global justice, resource security and sustainability.

The formation of this subdomain partly seems well on its way.[15] It holds the promise to offer new perspectives and new stories on technology and its history. It will not reinvent the history of technology, and may not be revolutionary, but it adds a new and important field for historical knowledge that bears the chance to improve our understanding of technology. This subdomain still lacks, to some degree, bringing its parts and its historians together, constructing institutional coherence and forming and negotiating a self-identity. A particular challenge on this journey may be the invention of an appropriate and visible name for such a comprehensive academic endeavor. The engineering terms quality and safety appear rather limited and loaded, boring and conservative. Who has a proper idea for an exciting, attention-raising name of this subdomain? Or should we even, for the lack of a better term, go with a lengthy and unsexy list such as "Quality, Safety, Maintenance and Repair of Technology Studies" and whatever daring acronym (QSMRTS or QS/TS or QSS or others)?

## About the author

### Matthias Heymann, Prof. Dr.



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## Annotations

1 David Edgerton, The Shock of the Old: Technology and Global History since 1900, Oxford 2007. Matthias Heymann, Konsolidierung, Aufbruch oder Niedergang? Ein Review-Essay zum Stand der Technikgeschichte, in: NTM, Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin 21 (2013), p. 403–427.

2 The ISIS Explore Database for the history of science and technology only lists eight articles using the concept of quality control. E.g. Muhammad H. Zaman, Tarun Khanna, The Cost and Evolution of Quality at Cipla Ltd., in: Business History Review 95 (2021), p. 249–274. Amy Zader, Technologies of Quality: The Role of the Chinese State in Guiding the Market for Rice, in: East Asian Science, Technology and Society 5 (2011), p. 461–477. Safety, in contrast, received some more attention. E.g. James P. Kraft, Havoc and Reform: Workplace Disasters in Modern America, Baltimore 2021. James B. McSwain, Petroleum and Public Safety: Risk Management in the Gulf South, 1901–2015, Baton Rouge 2018. Ana Romero de Pablos, Atomic Technologies and Nuclear Safety Practices in Spain during the 1960s, in: NTM: Zeitschrift für Geschichte der Naturwissenschaften, Technik und Medizin 30 (2022), p. 197–221.

3 Leo Marx, The Machine in the Garden: Technology and the Pastoral Ideal in America, Oxford 1964. Edwin T. Layton, Mirror-Image Twins: The Communities of Science and Technology in 19th-century America, in: Technology and Culture 12 (1971), p. 562–580. Eugene S. Ferguson, Toward a Discipline of the History of Technology, in: Technology and Culture 15 (1974), p. 13–30. John M. Staudenmaier, Technology's Storytellers: Reweaving the Human Fabric, Cambridge, Mass. 1985. Thomas Parke Hughes, American Genesis: A Century of Invention and Technological Enthusiasm, New York 1989. David Nye, American Technological Sublime, Cambridge, Mass. 1996.

4 Ruth Schwarz Cowan, More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave, New York 1983. Joy Parr, Industrializing the Household, Ruth Schwartz Cowan's More Work for Mother, in: Technology and Culture 46 (2005), p. 604–612.

5 E.g. Mikael Hård, Zur Kulturgeschichte der Naturwissenschaft, Technik und Medizin: Eine internationale Literaturübersicht, in: Technikgeschichte 70 (2003) p. 23–45. Mikael Hård and Andrew Jamison, Hubris and Hybrids: A Cultural History of Technology and Science, New York 2005. Thomas J. Misa, Leonardo to the Internet: Technology and Culture from the Renaissance to the Present, Baltimore 2003 (further expanded editions 2011, 2022). Martina Hessler, Kulturgeschichte der Technik, Frankfurt 2012.

6 E.g. Bernhard Url, Partnering to Evolve the European Food Safety Ecosystem, in: Journal of Consumer Protection and Food Safety 18 (2023), p. 1 f. The IEEE Public Safety Technology Initiative promotes the concept of a "Public Safety Ecosystem" (https://publicsafety.ieee.org/topics/what-is-a-public-safety-ecosystem, status 8.2.2024). Likewise, the German DEKRA markets a "DEKRA Safety Ecosystem" (https://www.dekra-uk.co.uk/en/dekra-organisational-and-process-safety-ecosystem, status 8.2.2024).

7 Ruth Schwartz Cowan, The Consumption Junction: A Proposal for Research Strategies in the Sociology of Technology, in: Wiebe E. Bijker, Thomas P. Hughes and Trevor J. Pinch, The Social Construction of Technological Systems, New Directions in the Sociology and History of Technology, Cambridge, Mass. 1987, p. 261–280. Nelly Oudshoorn and Trevor Pinch (eds.), How Users Matter: The Co-construction of Users and Technology, Cambridge, Mass. 2003.

8 E.g. Kraft (see n. 2), Mark Aldrich, Safety First: Technology, Labor, and Business in the Building of American Work Safety, 1870–1939, Baltimore 1997. Kirill Chunikhin, Risk and Respirators: The Hazardous Trajectories of Soviet Occupational Safety, 1940s–1980, in: Technology and Culture 63 (2022), p. 603–633.

9 Stephen Graham and Nigel Thrift, Out of Order: Understanding Repair and Maintenance, in: Theory, Culture & Society 24 (2007), p. 1–25. Andrew L. Russell and Lee Vinsel, After Innovation, Turn to Maintenance, in: Technology and Culture 59 (2018), p. 1–25. Lee Vinsel and Andrew L. Russell, The Innovation Delusion: How our Obsession with the New Has Disrupted the Work that Matters Most, New York 2020. Stefan Krebs and Heike Weber (eds.), The Persistence of Technology: Histories of Repair, Reuse and Disposal, Bielefeld 2021, open access: https://www.transcript-verlag.de/978-3-8376-4741-9/the-persistence-of-technology/ (status 16.5.2024). Heike Weber (ed.), Themenheft Pflegen, flicken, re-arrangieren, Praktiken des Erhaltens und Umarbeitens von Technik, in: Technikgeschichte 90 (2023), p. 73–176.

10 Giles Slade, Made to Break: Technology and Obsolescence in America, Cambridge, Mass. 2006. Joseph Guiltinan, Creative Destruction and Destructive Creations: Environmental Ethics and Planned Obsolescence, in: Journal of Business Ethics 89 (2009), p. 19–28. Bernard London, Ending the Depression through Planned Obsolescence, New York 1932.

11 Douglas Botting, Der grosse Zeppelin: Hugo Eckener und die Geschichte des Luftschiffs, Munich 2002. Manfred Bauer and John Duggan, LZ 130, »Graf Zeppelin« und das Ende der Verkehrsluftschifffahrt, Friedrichshafen 1994.

12 I casually labelled the zeppelin a flying "hydrogen bomb", which elicited the witty remark from the audience that aircraft today may likewise be regarded as "kerosene bombs".

13 Arne Kaijser, Markku Lehtonen, Jan-Hendrik Meyer and Mar Rubio-Varas (eds.), Engaging the Atom: The History of Nuclear Energy and Society in Europe from the 1950s to the Present, Morgantown 2021. Wolfgang Rüdig, Anti-nuclear Movements: A World Survey of Opposition to Nuclear Energy, London 1990. Joachim Radkau, Aufstieg und Krise der deutschen Atomwirtschaft 1945–1975, Verdrängte Alternativen in der Kerntechnik und der Ursprung der nuklearen Kontroverse, Reinbek 1983.

14 Compare Edgerton, chapter 1 (see n. 1).

15 This conference is an example. For the history of recycling and repair, see for example Russell/Vinsel and Vinsel/Russel (n. 9) and the movement of the maintainers, which their call for action inspired, see https://themaintainers.org (status 16.5.2024).