Chapter 1
Introduction

1.1 Human Enterprises Involve Risks

Since the old ages, human beings and even their predecessors have had to rely on their tools and weapons to survive in a wild and dangerous nature. This is why they designed simple but effective artefacts made of wood, bone and stone. Plenty of objects from the Stone Age have been exhumed from archaeological sites spread all over the planet and this testifies of an intensive lithic craft industry where a kind of standardization can even be observed (raw material, form, size). The Stone Age has been followed by the Bronze and Iron Ages where the artefacts have been improved. At this point, it is interesting to notice that the life duration of the artefacts has begun to decrease: this is mainly observable for iron objects which are rapidly destructed by corrosion and an iron sword of some centuries is less likely to be intact when exhumed than a flint biface of several millennia. The agriculture activities have been dominant in the historical ages but dedicated corporations and guilds of craftsmen have continued to develop and improve the production of objects until the industrial revolution occurred in the nineteenth century where the industry, as known nowadays, was born. Since this time, it seems that the world has entered in the Anthropocene era where the industrial systems become more and more complex and more and more likely to produce new artificial hazards from which people and environment have to be protected (safety). At the same time, the economic point of view becomes more and more prevalent and designing efficient and cost-effective systems (i.e. dependable) also becomes more and more important (dependability).

Then, any human enterprise implies some risks, those risks increase with the complexity of the systems developed nowadays and numerous events have occurred to remind that:

- Fukushima (Japan, 2011), Chernobyl (Russia, 1986), Three Mile Island (USA, 1979) for the nuclear risk.
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- Boeing 737 Max 8 (Ethiopia, 2019), Concorde (France, 2000), Tenerife (Spain, 1977) for the aeronautic risk.
- Ariane V (France, 1996), Challenger (USA, 1986), Apollo 13 (USA, 1970), for the spatial risk.
- Bhopal (India, 1984), Flixborough (United Kingdom, 1974), Seveso (Italy, 1976) for the chemical risk.
- Elgin (North Sea, Norway, 2012), Macondo (Gulf of Mexico, 2010), Piper Alpha (North Sea, Scotland, 1988) for the oil and gas risk.
- America Grande (France, 2019), Prestige (France, 2002), Exxon Valdez (Alaska, 1979), Torrey Canyon (Scilly Islands, United Kingdom, 1967) for spill oil risk.
- Lac-Mégantic (Canada, 2013), Santiago de Compostela (Spain, 2013), Eschede (Germany, 1998) for the railway risk.
- Costa Concordia (Italy, 2012), Estonia (Baltic Sea, 1994), Herald of Free Enterprise (Belgium, 1987), RMS Titanic (North Atlantic Ocean, 1912) and several ferries in Indonesia or Korea for the naval transportation risk.

The various blackouts observed throughout the world (New York, France), the stock exchange crashes (New York, worldwide), the pandemics (plague, Spanish influenza, AIDS, COVID-19) and the climatic disturbance could be added to this list which validates the commonly claimed assertion that any human enterprise involves risks and that the zero risk does not exist.

As a matter of fact, many managers were very reluctant to accept this assertion in the seventies because they claimed that applying rules and regulations was necessary and sufficient to make the risk disappear. Nowadays, some of the same managers have completely changed their mind as they have realized that they can use it as an alibi to explain that accidents occur because everyone knows that the zero risk does not exist!

1.2 Philosophy to Master the Risks

If the zero risk is a utopia, its reduction to an acceptable level has been a quest since the beginning of human history. From the trial and error approach used since the early days to the sophisticated approaches used nowadays, the key point is to use the past experience to improve the future.

In this view, the thought of the French positivist philosopher Auguste Comte who said about philosophy—“like the plain common sense, the true philosophical mind consists in knowing what is, to predict what will be, in order to improve it as far as possible”—can be adopted as a way of thinking for reliability engineers/risk managers:

knowing ⇒ forecasting ⇒ improve.
The various approaches developed in the reliability field, including those proposed in this book, have been developed to help doing that, provided that they are combined with a minimum of *plain common sense* of the analysts.