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Using Standards in Risk Management Regulations: a Swedish case study

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Risk management in land-use planning often boils down to practical decision-making situations, such as deciding on safe distances between residential buildings and other types of developments and dangerous goods transportation routes or hazardous industries. The practical approaches to managing risk in land-use planning vary across countries, ranging from prescriptive regulations on managing risk to non-standardized approaches requiring managing risks without detailing how to do it in practice. The current paper aims to contribute to the discussion on which regulatory approach is preferred by applying the current knowledge base on using standards in risk management to a specific case of recently published government recommendations for managing risk in land-use planning in Sweden. The approach of this paper is to compare the Swedish regulator's recent recommendations with a set of key aspects that should be considered when assessing the use of standards in risk management regulations. It is concluded that a hard regulatory approach is primarily favorable for non-complex land-use planning decision situations where conditions are well-known. A soft approach is more beneficial for complex decision situations characterized by significant uncertainties and an unfamiliar risk canvas. Reviewing the Swedish guideline, it can be concluded that the soft, process standard-type guideline intended for use in all land-use planning situations does not incorporate the current body of knowledge in the field.

Keywords: Standards, standardization, risk management regulations, land-use planning, transport of dangerous goods, Sweden.

1. Introduction

Risk management regulations are, with few exceptions, the responsibility of the state. Casual observation, academic inquiry, and official surveys indicate substantial variety in how risks are regulated (Hood et al., 2001). There are variations between states and between risk domains within a single state. At the heart of risk management regulation variations are what to regulate and to which level of detail. Regulations can apply to the risk management process (i.e., the activities required to adequately manage risk) or focus on how to perform certain risk management activities.

The level of detail is related to two basic types of policy instruments: hard law and soft law (e.g., Meyer 2012; Olsen et al. 2020). A main characteristic of hard law is its precision, where rules unambiguously define the conduct they require, authorize, or prescribe (Abbott et al., 2000). The soft law approach instead sets goals that allow the actors to select and agree on the means for achieving the goals. Consequently, a hard law risk management regulatory regime contains prescriptive requirements, presenting how something is to be achieved in a "command and control" fashion (Lindøe and Baram 2020), while a soft regime defines functional requirements that focus on what is to be achieved or describe the required performance rather than outlining the required solution. This dichotomy of risk management regulations is also referred to as performance-based vs. prescriptive requirements (e.g., Foliente 2000) and goal-oriented or function-oriented vs. prescriptive regulations (e.g., Lindøe et al. 2018; Penny et al. 2001).

Risk management regulations for land-use planning are no different. Even if the challenge of managing risk in land-use planning is similar across countries, the approaches for doing it vary from soft to hard. In relation to managing risk in land-use planning, the various regulatory regimes are often characterized based on the level of standardization (Ingvarson 2020). A low level of standardization, corresponding to a soft approach, includes limited prescriptive requirements on how risks should be identified, analyzed, and evaluated. Highly standardized regulations (i.e., hard approach) are more prescriptive in terms of explicit requirements on method, assumptions,

modeling tools, data input, risk acceptance criteria, etc.

A research project was launched at Lund University to explore how to use standards when governing risk management in land-use planning. The research project aims to add to the knowledge base of how to use standards in risk management regulations for land-use planning by exploring the strengths and weaknesses of the different approaches. In this paper, the knowledge developed in the research project is applied to a specific case of recently published government recommendations (i.e., a type of standard) for managing risk in land-use planning in Sweden.

This paper covers risk management for land-use planning in relation to transport of dangerous goods on rail and road (so-called non-stationary risk sources) since this is the scope of the government recommendation used in the case study. However, since much of the discussion on the strengths and weaknesses of using standards in risk management regulations is not domain-specific, conclusions in this paper may also be relevant to other risk domains and contexts.

2. Risk Management Regulations for Land-use Planning in Sweden

This section briefly introduces the Swedish approach to managing and governing risk in land-use planning as a basis for analysis.

2.1. *Governing land-use planning*

Governing land-use planning in Sweden is almost exclusively decentralized, with local-level initiatives being the primary engine for new developments and land-use planning mainly being performed at the municipal level (Lundström et al. 2013). The "municipality planning monopoly" (Blücher, 2013) implies that the local level decides where, when, and how development may take place.

At the center for all land-use planning activities is the Planning and Building Act (hereafter referred to as the Act), which stipulates how planning is to be executed (i.e., the planning and decision-making process), the various planning instruments, and what kind of information is required in the decision basis. The Act is quite flexible and non-specific when it comes to methods for performing the planning process and developing the content of planning instruments (Hedström and Lundström, 2013). In brief, a main planning instrument is the detailed development plan, a legally binding plan regulating the land use of a particular area.

The main actor in the land-use planning process is the municipality, with its politicians making the formal decisions on how to use the land and its civil servants providing a comprehensive decision basis in compliance with the Act's expectations and ambitions.

Despite the municipality planning monopoly, some checks and balances are provided by other governments. The County Administration Board is responsible for considering the interests of the state in the planning process and for coordinating planning issues involving multiple municipalities. The civil servants on this regional level also safeguard public interest and the so-called "national interests" (i.e., areas of societal concern and national importance, e.g., ecology, cultural heritage, recreation, transport infrastructure, power production, etc.) specified in the Act. The County Administration Board may intervene and cancel a detailed development plan if the plan is unsuitable due to accidents related to health, safety, security, flooding, or erosion risks.

The role of the National Board of Housing, Building and Planning is to provide advice, follow up, analyze, and transfer experiences from the implementation of the Act. Other national government agencies provide advice in relation to their respective competence areas. In practice, the national government agencies play a limited role in the land-use planning process.

Complaints about municipal plans are handled by the legal system of the Land and Environmental Courts. Hence, the only elected officials involved in the current land-use planning process are the local politicians in the municipality.

2.2. *Regulations for land-use planning risk management*

Even if the Planning and Building Act is at the core of land-use planning regulations, the Swedish regulatory framework for managing and governing risk in land-use planning is complex and intricate (Bofjäll 2020). There are separate regulations for different aspects, and various government agencies play different roles in implementing the regulations. For example, environmental risks such as air quality and noise are managed by the Environmental Protection Agency and the Public Health Agency, while the

Civil Contingencies Agency oversees the implementation of land-use planning in relation to the Seveso directive for the control of major accident hazards involving dangerous substances. Consequently, separate governmental bodies are involved, each with its specific legal practices and historical development, so navigating the legal landscape may be challenging for stakeholders.

Without going into legislative details, it can be summarized that the common ground for Swedish risk regulations for land-use planning is that there are clear requirements for identifying, analyzing, and evaluating risk as part of decision-making. How to do this is not defined so developing the knowledge base informing decisions using risk assessments is primarily left to the various actors in the land-use planning process, often on a case-by-case basis.

According to the Swedish land-use planning regulations, local authorities are responsible for ensuring risks are managed, with regional authorities functioning as supervisors to ensure that the local authorities adequately manage risks (Hedström and Lundström 2013). The role of the national authorities is to provide guidance on how to manage risk, but their recommendations are not legally binding.

With non-prescriptive regulations, stakeholders have had a long-lasting demand for guidance on how to perform risk management activities (Ingvarson 2020). Since the late 1990s, a large number of land-use planning guidelines and recommendations have been issued by regulators at the local, regional, and national levels, as well as by industry associations. These guidelines represent a wide selection of preferred approaches, suggested risk metrics, and risk acceptance criteria. Some recommend the use of safety distances between transport routes for dangerous goods, including limitations on land use, while others promote the use of risk metrics such as individual risk or societal risk with corresponding acceptance criteria. In extreme cases, this may, combined with the municipality planning monopoly, lead to situations where the risk is described and characterized similarly but evaluated differently in comparable locations. For example, development may be allowed close to a dangerous goods transportation route in one municipality but not in an adjacent municipality if risks are defined, analyzed, and evaluated differently in the decision basis.

2.3. D*evelopment of the Swedish guideline*

The frustration over lacking prescriptive requirements for how to use risk assessments as a decision basis in land-use planning has grown over time. In 2021, Sweden's three largest County Administrative Boards, representing more than half of the country's population, turned to the national government with a request to commission the National Board of Housing, Building and Planning to: 1) develop nationwide guidelines for risk management in land-use planning specifically for the transport of dangerous goods, and 2) establish a national forum where this topic can be discussed and further developed. Part of the request was granted in 2022, and the National Board was tasked with developing a guideline for managing risk related to land-use planning and the transport of dangerous goods on rail and road.

A guideline was developed mainly in-house by a group of seven officers with some support from a consultancy company due to inadequate expert resources available with the National Board and the strict schedule for delivery. A reference group was formed with members arbitrarily invited ad hoc representing two municipalities, three regions, four national agencies, six County Administration Boards, and three researchers (including the author). Two meetings with the reference groups were arranged (however, half the members only participated in one), and 16 persons from the reference group were interviewed in separate sessions as input to the work. Reference group participants were also invited to provide review comments on draft versions of the guideline, but the review process was ad hoc and unstructured, resulting in few participants actually providing feedback.

The finished guideline was reported as requested by the end of May 2023. The delivery contains a report (Boverket 2023) with the intention of publishing all its content as online articles in the existing online handbook ("PBL Kunskapsbanken"). In terms of content, the guideline includes a 12-step process to manage dangerous goods in land-use planning: 1) Communicate and cooperate; 2) Plan and organize; 3) Identify risks; 4) Analyze risks; 5) Evaluate risks; 6) Risk measures; Develop planning documents; 8) Consultation and review; 9) Develop decision basis; 10) Make decision; 11) Implement planning documents; 12) Follow up.

The structure of specifying 12 steps is new compared to earlier guidelines and recommendations used in Sweden, but the content of the risk management process is similar to what has been recommended before. This means that additional guidance on how to perform certain activities (e.g., using quantitative or qualitative risk assessment methods or which risk acceptance criteria to use) is not provided.

To a large extent, the new guideline contains information and practices that are already well-known to practitioners. The only main new element introduced by the guideline is a recommendation to form local/regional-level risk management committees to gather land-use planning risk management and dangerous goods competencies (e.g., planning officers, rescue services, crisis response teams, external transporters, etc.). As part of the delivery, there was no response to the request to establish a national forum for discussions and knowledge transfer.

3. Framework for Assessing the Use of Standards in Risk Management Regulations

A main takeaway from the Lund University research project is a framework with a set of key aspects developed to synthesize the knowledge generated by the research activities (Ingvarson 2020; 2021; 2024; Ingvarson and Hassel 2023). The following aspects are required to be considered when assessing the use and design of standards in risk management regulations: 1) uniformity, conformity, and predictability; 2) risk identification; 3) efficiency and effectiveness; 4) best available knowledge; 5) compliance; 6) flexibility; 7) competence; 8) facilitate risk governance; and 9) legitimacy.

Before applying the framework to the 2023 Swedish guideline, it may be valuable to characterize the kind of standard it represents. One of many ways to categorize standards is to distinguish between process or outcome standards (Brunsson et al. 2012). Process standards regulate processes within and between actors without predetermining any specific outcomes. Outcome standards (also referred to as product standards (de Vries 1999)), on the other hand, stipulate that adopters have to deliver a specific output. Using the different categories of standards and regulations, the Swedish guideline is a soft process standard describing which risk management activities are expected rather than specifying exactly how they should be performed.

4. Analyzing the Swedish Guideline

Applying the knowledge developed in the research project in terms of the above-mentioned framework, the aspects to consider when developing government recommendations for managing risk in land-use planning are discussed in this section.

4.1 Uniformity, conformity, and predictability

Among the expected benefits of a hard approach is that it contributes to uniformity (e.g., defining, identifying, analyzing, evaluating, and communicating risk) and predictability, making risk more comparable and, therefore, more manageable. These benefits are not achieved with the soft approach selected for the Swedish guideline. The actors in land-use planning asking for more detailed guidance on what to do (i.e., risk identification, risk analysis, risk characterization, risk evaluation, risk communication, etc.) and how to do it (selection of risks, choice of risk analysis methods, calculation tools, input parameter values, risk acceptance criteria, etc.), are not heard since the guideline does not provide such guidance.

Using standards to increase uniformity and conformity is understandably desirable from a practitioner's perspective since it will simplify their work. For regulators, they would receive information in a familiar and approved format, which would facilitate review. However, producing conformity and homogeneity may be counterproductive since risk management and governance often require diversity and heterogeneity (Aven and Ylönen 2019; Olsen et al. 2020).

A hard approach would, in many cases, simplify risk management activities, potentially leading to fewer resources required and lower competence requirements with actors. This may be most valuable for non-complex planning situations where conditions are well-known (e.g., a new development in the vicinity of a single transport route for dangerous goods). A soft approach where risk management activities are tailored to the specific situation would be more relevant in unique and/or unfamiliar complex planning situations. However, the Swedish guideline does not distinguish between the two types of situations,

providing limited guidance for land-use planning actors.

4.2 Risk identification

Using a hard approach that outlines the relevant risks or defines how to identify them is attractive for situations and systems that are well-known and non-complex. An inherent challenge of standards is, however, that standards are built on past experiences. A characteristic of complex risks is that they are associated with significant uncertainties (i.e., limited historical data), which is typically required for successful standardization. Consequently, hard regulations are less suitable for non-familiar and complex risks since standards may reduce the capacity to discover "unthinkable threats" and "new risks on the horizon" (Olsen 2020).

For risk identification purposes, two kinds of regulations may be useful: 1) an outcome-type standard listing all potentially relevant hazards, or 2) a process-type standard defining how to identify risks with no indication of what the hazards may be. The Swedish guideline represents a third variant of lesser value: a soft regulation requiring identifying risks but not how to do it in detail. Neither does the guideline provide guidance on how to identify other types of risks than those associated with transport of dangerous goods.

4.3 Efficiency and effectiveness

A common success factor of standardization is that it is expected to bring efficiency (doing things right) and effectiveness (doing the right things). In terms of using standards for risk management, there seems to be no difference from this perspective (Aven and Ylönen 2019; Belluck et al. 2006; Foliente 2000; Kica and Bowman 2012; Nyvik et al. 2021). Being explicit in terms of what is required allows actors to streamline their internal work process (regardless of whether the actors are regulators or consultants producing risk assessments), experiences are easily shared between actors, and there is less need for "reinventing the wheel" since recognized solutions can be reused, and there is no need to explore alternative solutions.

This aspect is a missed opportunity in the Swedish guideline since they do not include requirements on how risk management activities should be performed. The selected soft approach, however, stays clear of negative situations of potentially increased administrative requirements if the standard includes higher ambition levels than current practice or what is required in the specific situation (Aas and Johnsen 2007; Antonsen et al. 2012; MacRae 2011). It is reasonable to believe that the upsides of increased efficiency and effectiveness of hard regulations would outweigh the disadvantages of an increased administrative burden.

4.4 Best available knowledge

Since standards are "expert knowledge stored in the form of rules" (Jacobsson 2000), it is implicit that they represent the best available knowledge. It may be argued that the Swedish guideline does not fully meet this expectation due to the limited resources and expertise made available to develop the document. The regulator did not have adequate expertise available to develop the guideline, and the reference group perspectives, knowledge, and know-how were not fully utilized.

Standards are criticized for failing to keep up with changes, so they become outdated due to new knowledge or alternative solutions becoming available/developed (Aas and Johnsen 2007; Clark-Ginsberg and Slayton 2019; Nyvik et al. 2021). Publishing the Swedish guideline as an online handbook is likely to reduce the time required to update requirements. However, this is not the most critical aspect of standards representing the best available knowledge. More importantly, the guideline was developed as a project that is now closed and the responsible authority does not sustain the relevant expertise to keep up with novel technologies and new insights.

4.5 Compliance

An undisputable strength of a hard approach with detailed prescriptions is that the standard then represents defendable, auditable processes and a way to demonstrate and verify compliance (Belluck et al. 2006; Foliente 2000; Jore and Moen 2015). The more detailed the requirements are, the easier it is to use the standard to perform the required activities and verify that they are performed. The back side of being explicit about what is expected is that the standard specifies minimum solutions and does not encourage higher ambition levels (Clark-Ginsberg and Slayton 2019; Nyvik et al. 2021). This means that compliance with the standard is in focus, not how to achieve the optimal level of risk. A strong compliance-driven focus may lead to loss of ownership and reduced motivation to perform risk management activities, thus reducing the quality of activities (Antonsen et al. 2012; Olsen et al. 2020).

Focusing on compliance with prescriptive requirements for land-use planning risk management would hopefully result in improved performance and an enhanced decision basis. Actors who otherwise would perform poorly, regardless of why they are sub-standard, would be forced to improve. This improvement opportunity is missed with the Swedish guideline. Standardizing risk management regulations for non-complex risk situations characterized by a high degree of agreement among actors would help raise the bar for most decision-making situations. Resources can then be routed to the more complex and controversial situations where non-standardized approaches can stimulate "out of the box" thinking and novel solutions unrestrained by detailed requirements for performing risk management activities.

4.6 Flexibility

Prescriptive standards have, by nature, negative implications on the flexibility of solutions allowed. Prescriptive requirements intend to limit flexibility by prescribing a one-size-fits-all type solution that is not tailored to the specific situation. This may result in standards being a barrier to innovation and novel solutions (e.g., Aven and Ylönen 2019). If the standard does not correctly reflect the situation studied in a particular case, the characterized risk levels relate less accurately to the actual risk.

Using the transportation of toxic gases as an illustrative case, if a rare gas is transported that is outside of the specification in the standard, models of gas dispersion are less accurate than would be the case if a less prescriptive standard would open up for modelling optional gases. So, the soft Swedish guideline is strong on the aspect of flexibility.

4.7 Competence

Managing risk is about managing uncertainties. Doing so requires specific skills and competencies to produce risk assessments and interpret their results. Reliance on prescriptive standards may lead to deteriorating technical competence (Antonsen et al. 2012; Lindøe and Baram 2020), potentially negatively impacting the quality of the decision basis. In land-use planning, many specialist competencies are required to cover a range of disciplines, of which risk is only one. If there is a "recipe" to follow, there may be less need for specialist risk management competence.

If less risk competence is available to decision-makers, the risk may be misinterpreted or downplayed. So, on the one hand, hard regulations may require less specialist risk competence. On the other hand, more risk competence is required to manage the risk adequately. In this paradox, the disadvantages of a prescriptive approach outweigh the benefits if managing risk is reduced to a "tick the box" activity and adequate competence is not available. Risk management is more than just ensuring that the decision basis is provided; adequately managing risk requires experienced specialists who are up to speed on the most recent risk science advances to help inform decisions. From a competence perspective, the soft approach of the Swedish guideline is beneficial in that it does not contribute to long-term deteriorating risk management competence.

4.8 Facilitate risk governance

Managing risk in land-use planning is, in practice, primarily associated with assessing the likelihood of fires, explosions, and toxic releases and the severity of the consequences should these incidents occur. However, many argue that there is more to managing risk than just performing risk assessments and interpreting their results. According to SRA (2018), governing risk includes the totality of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analyzed, and communicated and management decisions are taken. Other risk sources (e.g., airborne particles, vibrations, noise, etc.) are currently considered using standard methods in land-use planning, although most often not integrated into the same risk assessment as fires, explosions, etc.

Hard regulations for governing risk may help facilitate the integration of several sources of information in multi-actor risk assessment processes (Aas and Johnsen 2007; Olsen et al. 2020). However, if one type of risk is standardized, other risks may be neglected or receive inadequate attention. It is, therefore, challenging from a risk governance perspective if some aspects underpinning decision-making on land-use planning are highly standardized if other aspects (e.g., costs, impacts on the economy, environmental concerns, aesthetics, cultural environment aspects, socioeconomic factors, etc.) are not.

Since the Swedish guideline represents a soft approach, risk governance in terms of facilitating the inclusion of risk perspectives, actors, mechanisms, etc., is not made easier. On the other

hand, by not introducing a set of risk acceptance criteria, the discussion on what level of risk is acceptable and to whom (e.g., MacRae 2011) is left unattended. If it is challenging to agree on managing conventional risks related to fires, explosions, and gas dispersion, the challenge is even greater to reach an agreement on acceptable risk levels covering all other risk aspects in land-use planning.

4.9 Legitimacy

Regardless of choosing a hard or soft approach to managing risk for land-use planning, strong buy-in by actors is required. If standards are used, participation and influence from a wide range of actors in the production of the standards will increase legitimacy. Standards and standardization are sometimes criticized for inadequate transparency (i.e., public access to information and decision-making procedures) and inadequate or imbalanced stakeholder representation (e.g., involvement of participants and representation from academia, the public, etc.), generating legitimacy concerns (Aven and Ylönen 201; Kica and Bowman 2012; Lindøe and Baram 2020).

To meet the expectations in terms of legitimacy, any standard used in risk management regulations needs to be developed as a joint transparent effort with all relevant actors (regulators, consultants, academia, and decision-makers) to ensure good representation from stakeholders and access to practices, experience, and recent achievements in risk science. From this perspective, the Swedish guideline falls short. The involvement of actors other than the responsible regulator was inadequate in the development phase of the standard, with only two meetings with an informal ad hoc reference group of which half of the members only participated in one meeting and whose review comments and input were only superficially considered.

5. Conclusions

The ongoing discussion on whether a standardized or non-standardized approach is most suitable for governing risk management in land-use planning triggered a research project at Lund University. The output from the research activities includes a framework with a set of key aspects that are required to be considered when assessing the use of standards in risk management regulations. Considering these aspects, it can be concluded that a hard regulatory approach is primarily favorable for non-complex land-use planning decision situations where conditions are well-known. A soft approach is more beneficial for complex decision situations characterized by significant uncertainties and an unfamiliar risk canvas.

The 2023 Swedish guideline for land-use planning of transport of dangerous goods was published in response to Swedish actors' frustration over lacking prescriptive requirements for using risk assessments as a decision basis. By applying the framework to the guideline, it can be concluded that the soft, process standard-type guideline intended for use in all land-use planning situations does not incorporate the related current body of knowledge.

To meet the actors' need for practical, detailed guidance in a soft regulatory approach, a forum for discussion and experience transfer may prove valuable to help establish best practices in line with the most recent risk science advances. The potential value of such an arena for collaboration represents an interesting direction for future research. Swedish regional-level authorities suggested this kind of forum, but it is so far unattended by the national authorities.

Another potential topic of future risk management and risk governance studies is the lack of political influence when evaluating risk in land-use planning in Sweden. Despite the municipal planning monopoly, elected representatives play a limited role in controversial decisions in land-use planning since only non-elected regulators or court officers will settle any disagreements.

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