| Fr | B | C | NY | S | T | Total |
|---|---|---|---|---|---|---|
| 3 | 7 | 9 | 10 | 10 | 10 | 39 |

**Example:**
**New York:**
The macro-level initiatives of New York's efforts to enhance its overall resilience against multiple natural hazards have already been touched upon in numerous other key fields, namley in SF 67 (Resilience-by-design approaches). Evidently, one may consider risk management always to be one integral part of an overall resilience strategy and planning. However, more on the micro level, the BP example of the new World Trade Center project has shown that the application of new design tools (BIM) allows for an entirely new level of risk management enabling planners and engineers not only a much more detailed identification of vulnerabilities of individual components or building parts, but also opens up new opportunities to virtually prepare and plan for an infinite number of pre-defined scenarios.

**Copenhagen:**
Again the 2012 Cloudburst Management Plan, a part of the larger Copenhagen Climate Adaptation Plan 2025 can be considered a novelty in a city's long-term risk management practice, as the key elements of risk management (risk identification, vulnerability analysis (exposure in relation to possible consequence)) are already shaped into a long-term strategy process that assigns roles, responsibilities and financial resources necessary in order to achieve the set goals.

## 1. Differentiated description of the key field

Depending on the actor level within a city (planners within the municipality, individual architects, project developers, home owners, industy, etc.), integrated risk management implies a very different perspective. On the one end of the spectrum, the individual home owner has to comply with existing building codes and safety requirements, which is, depending on the cultural and political background of the urban area, a communal, state or sometimes a regulation even subordinate to federal regulation. Urban planners within a municipality, on the other hand, have to apply a very different risk management strategy when designing new or redesigning existing urban areas/quarters/development projects. They have to consider the broader consequences, both physically and financially, of possible natural or man-made disasters and their impact on citizens and infrastructures. In practice, they do address the complex challenge 'risk' on two levels. One is the architectural design and arrangement of buildings, transport lines (over- and underground), supply lines, as well as the entire composition of a city district with respect to facility usage and people flows. The other is a comprehensive contingency planning, including the regular check-up and updating of existing preparedness and emergency plans and pactices in cooperation with all responsible first responder forces, the fire departments as well as the police.
On both levels, historically experts have mostly relied on empirical data stemming from former incidents when trying to learn from and as a consequence, improve both elements of their risk management strategies. More recently, however, new tools (especially software based) allowing to a) display entire cities virtually in 3-D including all over- and underground infrastructure and b) to simulate an infinite number of pre-defined and random incidents are opening up brand new opportunities: formerly disconnected processes, infrastructures and components of the city system and their critical interdependency can now systematically be analyzed and in turn, optimized with respect to various risks.
Hence, the design and construction of physical infrastructure as well as the entire chain of emergency response and crisis management procedures can be much more efficiently adapted so that the mutual engagement is developed towards more efficiency. In addition, it will enable the responsible stakeholders to minimize and even limit potential risks, thus preventing the cascading of the latter onto additional subsystems and components of a city system.
Within the group of cities analyzed, quite obviously when looking at four coastal cities the risk of flood/cloudbursts has been the major driver pushing for such an integrated risk management approach.

## 2. Reference to sustainability:

Acknowledging the aforementioned potential of an integrated risk management approach with respect to limiting the potential physical, human as well as economic damage caused by catastrophic incidents, the relevance to sustainability is self-explanatory: if urban systems, their individual components and nodes keep failing or even collapsing in the face of major disasters, the necessary resources that need to be invested in order to (re-) haul and reconfigure/-establish such systems completely contradicts the overall aim of any sustainability-oriented action: „Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Hence, this can also be interpreted as an imperative for urban developers, planners and operators to make an integrated risk management process an integral prerequisite for all planning and design processes of future systems, infrastructures and organizations so that vital resources are not going to be wasted time and again.

## 3. Relevance to industrial sectors?

Mobilität: High
Energie: High
Produktion & Logistik High
Sicherheit: High
IKT: High
Wasser Infrastruktur: High
Gebäude: High
Governance: High

Brief description of high importance:
As this issue has direct implications on all critical urban sectors and processes, it is without need to state that only adapting such an approach within only a limited number of sectors cannot lead to an overall improvement but will instead cause a contradictory effect: the resilience of one or some individual urban sectors cannot make up for the vulnerability of others, as their interconnection can hardly be separated on an operational level when it comes to mastering major crises.

## 4. Impact (positive & negative)

Positive:
- Allowing for an optimized resource allocation with respect to security and safety measures
- Limiting the consequences of disastrous events on infrastructures and citizens
- Enabling urban planners, policy-makers and infrastructure operators to better train and prepare for emergency situations
- Allowing first responder communities to operate most effectively and safely at the same time
- Informing citizens on potential risks and their potential to contribute to a more resilient neighborhood/city

## 5. Implementation measures:

- Introducing new simulation tools to urban planners/designers/operators and corporate players
- Informing policy-makers on necessary changes in regulations and policies directly influencing the risk management processes and practices in the various urban sectors
- Research activities focusing on the development of applicable, hands-on tools ready to be deployed on micro (individual buildings), meso- (city quarter) and macro level (city)

## 6. Actors: Who can shape things?

- Research organizations
- Insurances
- Technology providers
- IT-providers
- System administrators
- First responder communities

## 7. Prerequisites:

- Willingness of stakeholders to implement new policy and regulation
- Applicability and affordability of new risk management tools
- Knowledge transfer and awareness raising among all stakeholders (through training and education)

## 8. Obstacles/barriers:

- Additional measures are always seen as cost drivers
- So-called "Low-probability high impace" incidents can always be a tremendous enabler (see Copenhagen's Cloudburst Management Plan). Hence, no such incidents are likely to increase the resistance of actors to voluntarily allocate additional resources to safety and security measures

## 9. Indicators:

First and foremost it would be necessary to evaluate if a city has any integrated risk management plan for
a) individual sectors or infrastructures (as in most cases already existent today)
b) the entire planning and design process of new urban developments
Second, it would be necessary to evaluate whether the implementation of such plans and procedures has already lead to measurable improvements in a city or city district. The latter, of course, can only be achieved via an analysis before and after such an event when the respective functioning of such measures could be evaluated. However, in most cases such data is not available. As the example of Copenhagen clearly indicates cities are increasingly moving towards implementing such measures on a broader scale, New Yorks Resilience Plan after Hurricane Sandy is another impressive example.

## 10. Special features/remarks:

Evidently, owners and operators of so-called ‚critical infrastrucutres', a term with a basic common understanding among the nations of the developed world, do already have comprehensive risk management plans and measures in place today. However, the development of the very nature of our highly complex urban systems and their interconnection clearly shows: integrated risk management does require a multi-sector as well as a multi-hazard approach that spans across jurisdictions, sector-boundaries as well as across operational interfaces