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Scenario Planning for Post-Disaster Contexts

Ahmed M. Ouf[1], Jacob Oluwoye[2]
[1]Assist. Professor of Urban Design and Planning, Department of Community and Regional Planning, College of Agricultural, Life and Natural Sciences
[2]Professor of Transportation and Environmental Health, Department of Community and Regional Planning, College of Agricultural, Life and Natural Sciences

***Abstract*—** *Planning after an unexpected contextual condition, or a natural disaster, requires content and process readjustments till the environmental, demographic, and physical contexts stabilize. Planning as an evidence-based discipline suffers from data fluidity after any unexpected contextual change making the comprehensive planning model unfit to the many uncertainties. The short-term objective for post-disaster is to save lives and restore basic community functions, it requires a segmented decision-making process that uses fragmented data, and not necessarily involving all the stakeholders because of the time limitations. The first response stage to uncertain contextual occurrences, especially in post disaster conditions, is at best incremental and short-term. To the contrary of that, long-term comprehensive plans require a unified decision-making process involving all the stakeholders based on better data availability after the initial fast thinking stage. This paper's enquiry is about the appropriate planning processes for post-disaster contexts, with the goal of exploring the planning concepts, processes, and data needs in uncertain planning conditions. Post-disaster planning visions will be explored so that they are not limited to recovery or bounce back to the old plans, but rather consider new future visions to accommodate the changing contextual conditions. The paper discusses scenario planning, incremental planning, muddling through and similar planning concepts for visionary futures. It discusses the creation of theoretical frameworks for innovative community engagement in urban planning. The paper concludes with recommendations on planning for uncertainties that consider the city as a nested system, where each system has its own objectives and processes for being resilient.*

***Keywords*—** *Post-disaster planning, community engagement, Scenario Planning, Incrementalism.*

I. INTRODUCTION

The main theoretical difference between normal and post-disaster planning is that human minds are configured to consider disasters as fast-thinking events while long-term developments are slow thinking activities (GAR 2022). Fast thinking is geared towards taking binary decisions in specific small-scale situations, while slow thinking is more about evaluating full planning alternatives that comprehensively deal with all aspects of the context.

Fast thinking events, as that of post-disaster planning, (using the terminology of GAR 2022), always have short-time frames that do not allow sufficient time or data for those in charge to take any decisions that might cause long-term impacts. The immediate post-disaster fast-thinking period starts with damage reports, priority listings, demographic evacuation, and service re-connection, among other necessary short-term community needs to save lives and restore basic community functions. It focuses on bounce-back of the community's population and services as they were one hour before the disaster, regardless of whether the pre-disaster contextual conditions were appropriate. Medium- and long-term considerations of the original community planning objectives start only after the fast-thinking stage seizes or is about to seize because they both require slow thinking. When post-disaster planning is mentioned, it usually means the start of the slow thinking processes that are not intended to remove damage or save lives, but rather to achieve the community's long-term objectives. Contextual disasters, whether natural or not, resemble uncertainties that change the planning contexts and the community's futures vision.

Disaster uncertainties change the contextual settings that created the community's future urban plans in the first place, making it necessary to re-evaluate the context before resumption of any pre-uncertainty urban plan implementations. Post-uncertainty happenings rupture the continuity of existing community plans, to the extent that they sometimes render the urban plans obsolete. Post-disaster/ uncertainty planning requires re-evaluating the suitability of the declared community goals and planning objectives to predicted future context.

An example for the need to re-evaluate the future urban plan might be seen in the state of Florida where many counties had to change their future projections for in-migration after the many recent hurricanes. The fact that a good segment of the impacted population after natural disasters make decisions to either rebuild their homes or move somewhere else changes their counties' future urban plans. That also impacts on the undecided in-migrants who might change their moving decisions after reoccurring natural disasters making it necessary for the receiving counties to change their future urban plans. The U.S. Census Bureau, 2022, showed slowing down of Florida's population increase to the lowest annual growth since 1946. The map for net domestic migration by county 2021-2022 showed some counties in Florida as experiencing net out migration which is a reversal of the past few decades' trends for in-migration.

Purpose of this paper is to advocate that urban planning expectation for uncertainties should be built-in the original planning process, so that modifications of the original plan are considered from the beginning to be implemented whenever uncertainties happen. The question is not whether uncertainties will happen, as they will, but rather the question is when they will happen.

II. THEORETICAL ASPECTS FOR PLANNING UNDER UNCERTAIN CONDITIONS

In 1959 Charles Lindblom created the concept of the "art of muddling through" for contexts that are unpredictable on the long or mid-term so that actions are required to be incremental. This fits post-disaster contexts where data is still fluid, so that emergency actions are based on "successive limited comparisons or marginal analysis" (Migone and Howlett 2016). However, the art of muddling through should not be used to create a long-term plan consensus, but rather a decision-making process that the community approves of. Incrementalism is a necessity in post-disaster situations as the segmented decision-making process responds better to contextual fluidity. Examples of post-disaster short term incremental decisions are the provision of emergency food and water, medical care, infrastructure re-connection, etc. Incrementalism requires a systemic selection of the individual decision makers to achieve trust in the process. Uncertainty of the post-disaster contexts, scarcity of timely data, and the need for emergency interventions, strengthen the case for incremental decision making till the contexts stabilize. However, incrementalism adds to uncertainty on the short term as it limits the community's ability to plan for the future because of the emergency unplanned interventions that do not have detailed future strategies.

To assure that post-disaster, fast-thinking, incrementalism does not result in nepotism or discrimination, "Policy Delphi" was brought to disaster management in 1970 when it was first developed by the US Office of Emergency Preparedness. Irene Ann Jillson, in 2019, argued that "policy Delphi" in contrast to the traditional Delphi approach does not seek consensus, but rather explores alternatives that require spreading awareness and acknowledgements. Policy Delphi aids the incremental decision-making process in post disaster contexts, where full data and consensus among stakeholders are difficult to achieve. However, it makes sure that stakeholders are at least informed about the necessary actions and prepares them for participation afterwards. Policy Delphi is only a tool for considering stakeholders' alternative visions in the planning process to reduce the negative impacts of incrementalism and can be used in association with other planning approaches when consensus was difficult to achieve.

Post disaster short-term fast thinking, and its accompanying incrementalism, becomes undesirable when the contextual conditions stabilize, even when data is not completely available yet. Consequently, long-term planning needs to be seen as a second stage after the emergency short-term thinking stage for post-disaster emergency actions, it crosses over Policy Delphi towards consensus and stop incrementalism for more comprehensive actions.

The evolution of post-disaster planning over the last century shifted from simply coping with damage through recovery after the fact, towards future risk identification, risk mitigation, then planning for resilience (Mallick and Mariomi, 2022). Rational comprehensive planning does not fit post-disaster planning situations because of time and data limitations, but is good for disaster preparedness, risk mitigation plans in pre-disaster stages. Consequently, preparing scenarios for different planning uncertainties is possible using the rational planning model. When disaster hits, incrementalism and short-term decision making are more fitting to the fluid contexts that disasters create, however, rapidly reverting to rational comprehensive planning afterwards is necessary. Comprehensive planning disposes of the post-disaster short-term priority listing for more equitable results and to better integrate all the stakeholders into the process.

Bringing back community services, creating future infrastructure systems and business development require mid- and long-term planning that should not be dealt with in the post disaster fast-thinking stage. However, long- and medium-term planning after some contextual uncertainty need to consider a "new-normal" where uncertainties are expected, and their mitigation plans are prepared from the beginning and wait to be implemented whenever they happen. New-normal planning processes should also consider the possible impact of such uncertainty mitigation (risk preparedness) plans on the overall expected results of the plan. It should be noted that "new-normal" planning practices does not deal with uncertainties as abnormal events, but rather expected and prepared for, making the only unknown is the time of their occurrence.

III. SCENARIO PLANNING FOR UNCERTAINTIES.

As discussed above, the "new normal" in urban planning practice expects different risk preparedness scenarios to change the course of long-term planning in unpredictable times. Consequently, "scenario-planning" is the proper planning approach to deal with the new normal planning context where all possible changes are considered at the time of preparing the long-term plan, and their possible impacts on achieving the final planning goals are weaved into the plan. Scenario-planning requires the preparation of a core plan based on an expected state of normalcy, then at least one scenario is prepared for each possible uncertainty that the planners see possible in the future. No specific time is predicted for the use of each scenario, however, they are ready to be plugged-in, whenever the core plan implementation faces the expected uncertain situations. The use of a previously prepared scenario, when necessary, changes the results and implementation processes of the original plan, but predictably. Scenarios responding to different uncertainties facing the core plan implementation at different points of time cause slight, or major, modifications to the final core-plan objectives and results. When planning with different possible scenarios, it is embedded in the process that the final plan objectives are flexible, and that change is inevitable in the long term.

Although the literature on scenario planning was created for business, it is a great fit for urban planning where expecting contextual uncertainties is the new normal that does not try to control future implementation, but rather to be prepared for change.

"The focus is not on forecasting the future, or fully characterizing key uncertainties in terms of probabilities, but on bounding the uncertainty range and creating frameworks for discussion." Schumacker, Paul, 2016.

Scenario planning deals with uncertainties as evident in the future, but unpredictable in time and magnitude. Scenarios

create frameworks for discussion among community members before they are approved as probable deviations of the plan whenever uncertainties happen. Uncertainties trigger previously prepared and well thought-of scenarios, rather than becoming bases for on-the-spot decision making and networking in incrementalism. Community frameworks for discussion end by embedding scenarios in the long-term plan and accounting for their impacts on the final plan objectives. Scenario planning can be a vehicle for urban resilience because it uses a rational model to prepare for uncertainties in different contextual aspects while keeping full community engagement.

Each geographic location has its own probable uncertainties, such as a new earthquake in a Japan or a new hurricane in Florida, to be consid ered as a new normal for long-term planning. In the State of Florida, it needs to be a normal planning practice to prepare for flooding, potable water contamination, evacuation, and emergency services, as possible off-shoots of any urban plan. By the same token, any urban plan in an earthquake-prone area in Japan needs to consider building's earthquake safety, infrastructure resilience, public realm protection from falling debris and enough evacuation area as normal planning procedures. As argued by Schoemaker, 1995, "scenarios explore the joint impact of various uncertainties". Planners need to determine the most plausible uncertainties that they expect to encounter along the implementation path of a plan and prepare at least one scenario to respond to each uncertainty. Scenario-planning's response to expected contextual changes result in flexible futures that vary from the plan's projected future but are still within the cone of futures' visions that the community approves.

Scenario planning is a form of risk preparedness that incurs high costs for the local community because of the skill required in preparing the scenarios and contextual monitoring to determine the best timing for implementing each scenario. Scenario planning changes the community's understanding of the contextual state of "normalcy" where uncertainties become always expected and planned for as much as possible. Scenario planning prepares cities to be resilient and ready to respond to a variety of uncertain conditions that are expected to happen at unexpected points in time.

The original comprehensive planning approach had periodical plan reviews embedded in the process, so that every five-to-seven year review the plan is adjusted to its contextual changes. The planning team works periodically for plan updates in response to the sequence and magnitude of contextual uncertainties, specialists and experts are added to the planning team whenever necessary. That makes the comprehensive plan less expensive to the community at the start of the planning process but might incur higher costs when specific expertise is added urgently in the future, when uncertainties happen. Scenario planning is deemed to have high initial cost because of the large team of experts and consultants required to create probable scenarios but can be planned for. It also saves time and cost when expected uncertainties happen because the community's response to such uncertainties were previously prepared for and the stakeholders already have good understanding of those responses. Using Policy Delphi is a probable tool to gain stakeholder understanding of the different scenarios, not consensus.

Each community needs to determine the types of uncertainties they need to prepare for, and those that they will deal with along the way whenever they happen. Risk preparedness and scenario planning demand more expertise and a higher level of experience of the planning team.

IV. POST DISASTER PLANNING VISIONS

"Rebuild by Design " was envisioned by Hurricane Sandy Task Force in New York, October 2012, as an innovation over the conventional approach to disaster planning cycle of: normalcy, disruption, recovery, and resilience. Rebuild-by-Design explored other visions for the future to replace the "bounce back" process - which was a principal metric for measuring resilience (Vale and Campanella, 2005; Reed and Lister, 2014). NYC Hurricane Sandy Task Force created a Rebuild by Design competition (Rebuild) to generate new ideas for adapting the region's coastline to the effects of climate change so that recovery would not result in bringing back the same old conditions that made the city vulnerable in the first place. Contextual uncertainties in the future were considered differently in each competition entry to plan for a more resilient city in the future. In many post-disaster situations during the last few decades recovery was used as an opportunity to improve the contextual conditions of the locality by targeting better public health and environmental concerns while bringing back normal infrastructure reconstruction, business continuity and population bounce-back. (Steven D. Stehr, 2006). Rebuild-by-Design is a form of scenario building for post-disaster contexts when uncertainties were not considered in pre-disaster time.

Cases of recovery where governments take the full burden for the sake of swift recovery, were seen by Nakajima (2013) as a top-down approach that "marginalizes individuals, communities and even local municipalities in the planning process." (Kayo Murakamia and David Murakami Wood, 2014). That exact complaint was reiterated in post hurricane recovery efforts in the US, where under-represented communities complained that they didn't get a fair share of recovery funding and assistance. In the case of post-disaster Hurricane Ian, the historic area in Naples did not make the priority list of the recovery efforts for the first three months that inflamed the feelings of local minority groups. Social equity in post-disaster planning is not the focus of this research, but it is worth the mention that social vulnerability to a natural hazard is higher for lower income groups with poorer access to resources and education and lack of agency for decision-making as discussed by Kim and Sutley, 2021. Creating different scenarios to respond to natural disasters, each having a different stakeholder focus, is a good scenario planning practice for better social equity, even when no disaster is predicted. Scenario planning responds better to social equity because of its consideration beforehand when stakeholders' opinions are expressed at earlier stages, even when additional stakeholders' surveys become necessary. Community engagement is better considered when scenarios are embedded in the plan from its start.

Post-disaster response team's responsibilities go far beyond recovery that brings the community back to its previously envisioned development path, depending on the magnitude of change that the community is subjected to. Disasters might cause massive physical damage, change of the area's demographic structure, or a permanent economic change when businesses flea the area to other locations in the region. In such situations, post disaster planning necessitates new future visions that go beyond recovery as bounce back. Post-disaster planning responses to recurring natural disasters need to create thorough risk preparedness plans, physical changes to the area's morphology to avoid future disasters, or new visions for its demographic and economic roles.

The final objective for post disaster planning is more of establishing a balance between human goals for economic development and the changing global contextual conditions that are expected to bring more severe natural events. Understanding future risks is key to post-disaster planning which distinguishes it from recovery coordination and emergency decision-making procedures. It considers all stakeholders who might not be reachable during the fast-thinking stage, and data that becomes available only after the initial emergency stages. Understanding future risks guards against unexpected contextual changes before they abruptly impact on the community's future visions. Louisiana Comprehensive Master plan for a sustainable coast 2017; P.11, states "Do we allow the changing coast to dictate our future, or do we manage that change to make our future more like what we want it to be?" as a reason to embrace the need to change, despite the difficulty. The document also states that the purpose of the sustainable coastal plan is to reduce the expected annual damage from storm surge by more than 75% to 90% in different coastal locations through a combination of structural and nonstructural risk reduction projects (Louisiana 2017, p.16). The plan aimed for risk preparedness and planning for uncertainty.

Severity of the post-disaster situation determines the time frame allowed for emergency responses, resources available for different necessary responses, and the point of time when a shift from the emergency phase to post-disaster rational planning. That being mentioned, Stehr stated that even when physical damage is geographically concentrated as it was in New York City in 2001, that recovery and reconstruction takes place over many years "to fully expend the money already authorized by Congress (IBO 2004)" (Stehr, 2006, P.496). Consequently, short term emergency efforts that mitigate the direct impacts of a disaster should stop soon after the local context stabilizes to allow medium- and long-term planning for a future vision. Scheduling short and long term interventions are better thought of when the different planning scenarios are created from the beginning with timelines for each scenario and its integration in the long term process.

In contexts where natural disasters are recurrent such as in Japanese cities, normal planning practices have developed earthquake-resistant building and planning codes, but still consider additional protective strategies in the creation of significant infrastructure projects. Fukushima nuclear reactor had a "Defense in Depth" strategy for multiple containment that exceeded the normal earthquake codes for buildings and planning. The additional protection strategy had multiple scenarios for containing water pollution and allowing longer evacuation time for the employees and the surrounding community among other things. Those additional planning scenarios saved lives after the 2001 Fukushima nuclear reactor melt-down, mainly because they created scenarios for unpredictable complex systems. (Lubna A. Amir, p. 363-380).

To conclude the discussion on the post-disaster planning visions, they need to target more than recovery or bounce back to the old plans, but rather consider new future visions to accommodate the changing contextual conditions. Post-disaster planning after the fast-thinking stage of initial recovery requires the involvement of all stakeholders with good consideration of social and economic equity for all the impacted population groups, it needs to consider optional scenarios for risk preparedness against potential uncertainties. Scenario planning is a good tool for providing the necessary flexibility needed in post-disaster planning that avoids incrementalism.

V. CONCLUSION

Post disaster planning is all about dealing with uncertainties, which is changing the planners' concept of normalcy that was the basis for comprehensive planning. Post disaster planning is composed mainly of a fast-thinking stage where incremental decisions and smaller decision-making groups are necessary, afterwards slow-thinking stages re-establish the rational planning model to re-evaluate the community's future planning visions. Post-disaster planning needs to target more than recovery or bounce back to the old plans, but rather consider new future visions to accommodate the changing contextual conditions. It is an opportunity to improve social equity and create a more resilient urban future in the long-term. Planning under expected uncertain contextual conditions deals with the city as a nested system where each system has its own uncertainties and possible risk preparedness alternatives. It is better dealt with using scenario planning that embeds different scenarios for dealing with probable uncertainties.

Scenario planning is a variation of the comprehensive plan where uncertainty and less confidence in the data predictions are evident, it is more controlled than muddling through approaches where incrementalism is an emergency course of action. Scenario-planning is a good approach to control the community's vulnerabilities in the future by creating a planning scenario for each possible future risk. Each nested urban system requires multiple scenario options around a core future urban plan to respond to possible uncertainties and make the city resilient.

Scenario planning when augmented with some tool for stakeholders' opinion exploration and community engagement techniques avoid inequities that might happen after contextual uncertainties. Being embedded in the plan from the beginning provide good understanding of the plausible futures of the community, even when no consensus is not achievable because of time limitations. Consequently, a good tool for community engagement such as Policy Delphi should be included in preparing planning scenarios for any community.

Determining time frames for each stage of post-disaster interventions requires good stakeholder discussions to minimize the fast-thinking stage before more medium- and long-term planning takes over for better utilization of resources, stakeholders' involvement, and review of the community's future visions. Benefiting from knowledge exchange among disaster-impacted areas is necessary to establish post-disaster best practices, without assuming that the post disaster planning path is ever replicable among different localities. Creating post-disaster preparedness plans for infrastructure services, and amenities for each locality will create scenario planning options that complement the long-term plan.

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