# Developing Public-Private Partnership Framework for Managing Adverse Health Effects of Environmental Disaster (A case study of Lake Urmia -Iran)

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# Abstract

Background Due to the limited resources of the public sector, the presence of the private sector as an auxiliary to the health sector, to mitigate adverse health effects (AHEs) caused by environmental disasters, seems necessary. Therefore, the present study aimed to develop a Public-Private Partnership (PPP) framework for managing AHE of environmental disasters (case study of Lake Urmia-Iran).

Methods This is a qualitative study with grounded theory approach, conducted in 2019. Required data were collected through semi-structured interviews with 20 experts selected through purposive sampling, and analyzed using Content-Analysis. To formulate the initial framework, an experts' panel, composed of 12 experts, was formed. Delphi method was used to determine the validity of the framework.

Results Most participants found the private sector participation in this field, essential and useful. The most important infrastructure for the private sector participation was designing a legal framework and providing adequate resources and facilities. Pollutant assessment and education of families for disease prevention are among the most important areas that the private sector can participate. To evaluate the performance of the private sector, periodic and short-term reports together with documentation should be used, and the evaluation tool should be the checklists agreed by two sectors. Payments to the private sector should be for periodic objectives, based on performance, and after performance confirmation, in the form of combination of fee for services, per capita and performance-based system. Preventing waste of resources, improving service coverage, greater efficiency and attracting public participation were the most important benefits of the private sector participation.

Conclusions PPP can be considered by policy makers as an effective policy for reducing the AHE of environmental disasters (especially drying lakes). To this end, the framework presented in this study can be used as an action guide by national and local authorities and policymakers.


# Introduction

The nature, theory and conception of disasters are much debated, and the subject of much academic deliberation. Simply put, according to the Oxford English Dictionary, a disaster is something of a 'ruinous or distressing nature; a sudden or great misfortune, mishap, or misadventure; a calamity.' Perhaps this is something of an over-simplification of a complex concept. Health impacts are a major reason for the mainstreaming of concern over environmental disaster (1). There are different kinds of disasters including natural or human caused (technological, environmental, intentional/terrorism), rapid or slow onset and short or long duration. In contrast to natural disasters, characterized by readily recognized physical injury with relatively predictable recovery periods, the environmental disasters are characterized by slowly-evolving and long-term adverse health consequences, not recognizable at a glance.

Different types of disasters have different health consequences (2). Drying lakes are one of the types of environmental disasters that have their own AHE. Today, there are many global experiences of drying lakes, most notably Aral Lake in Central Asia, Salton Lake in California, Owens Lake in California and

Great Salt Lake in the Utah, USA (3). The drying lakes can have a negative impact on people's health. Respiratory diseases, increased cancers, hypertension, prevalence of eye diseases, skin diseases, psychological hazards and abortion are just a small part of the AHE of drying lakes on public health (4–8). One of the worst experiences of drying lakes is the drying of "Lake Urmia" in northwestern Iran. Lake Urmia is Iran's largest inland lake and the second largest saltwater lake in the world (9). The lake began to dry out in the mid-2000s and today is at risk of complete drying. Examination of satellite images shows that since year 2015, the lake has lost 88% of its area (10). Many environmental experts and government officials believe that the drying up of Lake Urmia has irreparable consequences not only for the Iran provinces but also for the regional countries (11). Incidence of various diseases in humans, animals and plants, reduced fertility of agricultural lands, disruption of the quantitative and qualitative equilibrium of groundwater in the region, and irreparable economic losses will be other consequences of drought in Lake Urmia (12, 13).

In recent years, human beings have made many plans to identify and control the side effects and damages of natural phenomena and disasters and have achieved good results (14). The use of existing capabilities and potentials in the private sector in the form of PPP policy is one of these plans. In general, PPP is a mechanism whereby the public sector (government and other governmental entities) in order to provide the infrastructure services (Whether water and wastewater, transportation, health, education, etc.) utilizes the capacity of the private sector (Cooperatives, Private companies, Charities, and Non-Governmental Organizations (NGOs)) including knowledge, experience and financial resources. In PPP, a contract to be conclude between the public sector and the private sector to share the risk, responsibility, benefits and to synchronize resources and expertise of both sectors in providing infrastructure services (15). In PPP, the role of government change from investor, implementer and beneficiary of infrastructure projects to policy maker, regulator and supervisor of the quality and quantity of services provided (16). Governments also use PPP as a key efficient and cost-effective mechanism in implementing policies and achieving goals (17).

Despite recent studies on the effects of drying lakes on public health, there is a need to redesign health services and, if needed, provide new services to reduce the AHE of this crisis. On the other hand, the health sector, like other sectors, is facing limited resource problems, so the presence of the private sector as partner to the health sector to mitigate the health problems caused by drying lakes, seems to be essential. Therefore, the present study aimed to develop a PPP framework for managing AHE of environmental disasters (case study of Lake Urmia-Iran).

# Methods

This is a qualitative study with grounded theory approach conducted in 2019. The study participants were experts in the field of study including experts and officials from different vice chancellors and schools of medical science universities, experts and officials from private organizations and institutions, experts and informants working in health centers, experts from research centers and other stakeholders in

the field of under study topic. Inclusion criteria included having at least 5 years of relevant work experience in the health system and having the desire and ability to participate in the study.

Purposive sampling was used to select participants. By this method, people who have the most and richest information and can provide their information to researchers appropriately, are selected as participant. Sampling continues until the information saturation stage is reached, that is, until the researchers feel that new information is no longer available (18). This phase was achieved with 15 participants in the present study, but the researchers continued sampling up to 20 individuals to ensure greater reliability.

Semi-structured interviews were used to collect data. For the convenience of the participants, interviews were conducted in a suitable room or place at the participants' workplaces. During the interviews, the guiding questions were used, which were designed using the literature review and expert opinions. The duration of each interview varied from 60 to 90 minutes. Based on the interviewees' consent, their statements were recorded using an audio recorder, and the interviewers also took notes during the interview. Immediately after each interview, recorded interviews listened several times by researchers and were transcribed word by word.

Content-Analysis was used to analyze the data, which is a method for identifying, analyzing, and reporting patterns within the text and is widely used in qualitative data analysis (18). Data were coded by two researchers. The steps for analyzing and coding the data were as follows: familiarity with the text, identifying and extracting primary codes (identifying and extracting more data related to primary codes), identifying themes (inserting extracted primary codes into related themes), Reviewing and completing identified themes, naming and defining themes, ensuring the reliability of the extracted codes and themes (agreeing between the two coders through discussion and resolving disputes).

To increase the rigor and accuracy of results we used four criteria proposed by Guba & Lincoln (19): **Credibility and Confirm ability:** To realize this, the long term engagement and reviews by colleagues and also the comments provided by experts and professional were used. Also respondent validity were used in a way that after each session, the opinions of the interviewee summarized and a summary of what he/she said during the interview will be feed backed to correct the wrong and ambiguous; **Dependability:** Two researchers involved in the coding process; **Transferability:** For this, experts' opinions and also purposive sampling were used. In addition to the above mentioned, in this study, integration in methods (quantitative and qualitative and data collection methods), integration in researcher and transparency were used.

After extracting the results of interviews, a panel of 12 experts was formed to design the initial framework for PPPs in the management of the AHE of drying lakes. The framework components were drafted by the research team and the panel members' expert opinions were used to design the initial framework. In the expert panel, each of the components of the framework was discussed and agreed based on the consensus of experts.

After determining the main dimensions and structure of the initial framework, Delphi method was used to determine the validity of the framework. A summary of the objectives, along with the initial framework developed in the earlier stages, was prepared in the form of a Delphi questionnaire containing policy options, was sent to 15 experts in the field, which eventually 12 forms were completed and submitted to the researchers. Using this questionnaire, each stakeholder rated each policy option from two dimensions of importance (whether this option is important and should be considered) and implementability (whether the health system is able to implement it). The Delphi questionnaire consisted of a 9-point Likert scale, in which options with a median higher than 7 were accepted, options with a median of 4-7 were entered in the second phase and options with a median less than 4 were excluded.

**Ethical approval**: The study had been approved by the Ethics Committee of the authors' institute. Ethical Number: IR.TBZMED.REC.1397.775. Ethical issues (including the informed consent of the participants, plagiarism, duplication, etc.) are fully respected by the authors. The confidentiality principles are respected in the information of individuals. The individuals have been assured that the results of the study would be used only for the purposes of the study not in any other cases, and each person was allowed to leave the study at any stage of study without any loss.

# Results

### Overall Opinions of Participants on PPP in Management of Adverse Health Effects of Environmental Disasters

There were different views among the interviewees regarding the participation of the private sector in managing AHE of environmental disaster. Most participants saw the use of private sector power as a necessity. Most participants saw the use of private sector potential as a necessity.

Participant No. 7: "In my opinion, the public sector and the health system alone cannot manage the adverse health effects of the lake (drying lake) ... so has to get help from the private sector."

However, a limited number of participants considered not only the private sector participation in this area unhelpful, but also considered the presence of the private sector as a disorder in managing the AHEs. However, some dissenters believed, provided that disaster not managed by the private sector, the services could be purchased from private sector and outsourced some services as project and through contract.

### Essential Prerequisites for PPP in Management of Adverse Health Effects of Environmental Disasters

The majority of participants believed that the private sector's participation in health sector had not been defined so far, and given the increasing population and the inability of the public sector to perform this task, the abilities of the private sector can be utilized, which currently the legal infrastructure and required resources to implement it, are not provided. In order to formulate a legal framework, protective and deterrent legal requirements must be considered. Also, after the provision of resources and facilities, resources must be allocated according to actual priorities and needs.

Some participants considered changing the public sector's negative view of the private sector, and the public sector's readiness for monitoring and evaluation as the prerequisites for participation with the private sector.

Participant No. 3: "We should not look at the private sector with a negative view and there should be a benefit to the private sector to be willing to participate ...".

Participants believed that by holding meetings with private sector and attracting their support, the ability and energy of this sector could be used to control AHEs in the form of PPP. The contracts should also be such that payments to private sector were based on the process and the obtained results. In the opinion of one participant, there are two prerequisites for outsourcing some services to the private sector: firs the private sector would had sufficient ability and the second the public sector had monitoring and evaluation ability. Participants believed that a committee for AHEs of drying lake should be set up, composed of experts from different related fields, which would be responsible for the surveillance system of AHEs caused by the drying lake.

**Areas that the private sector can participate**

In the opinion of some participants, there is little incentive for private sector to participate in the management of AHEs of environmental disasters. But some other participants believe that if the areas, tasks and services in which the private sector can participate are clearly identified, this will be beneficial and effective for the public sector and the private sector itself. In this case, the control and treatment of AHEs of drying lakes can be assigned to the private sector to reduce the burden on the public sector to some extent, and the private sector will also achieve its goal of earning money. The second is for the private sector to do so on behalf of the public sector, and the public sector to buy these services from them.

Areas that the private sector can participate to include education, research, consultation, management, monitoring and surveillance (monitoring and evaluation of pollutants, monitoring and reporting of AHEs' symptoms, control measures including diagnosis and treatment). According to the interviewees, the private sector can be effective in identifying patients, referring patients to treatment centers, following up treatment to the full recovery, educating families to prevent AHEs caused by dusts, follow up treatment, and so on. Participants believed that private sector knowledge could also be applied in the areas of executive and research in the form of contracts and agreements. They also saw the supply of human resources (especially specialist and experts) as another task that could be done by private sector through partnership.

Participants believe that the involvement of the private sector in the assessment the status quo and analyzing the statistical data collected through the surveillance system will be helpful, so that public sector have the opportunity to manage and strengthen the surveillance system. One participant believed that to determine the appropriate areas for private sector participation, a preliminary assessment should

be carried out to accurately identify the AHEs caused by environmental disaster. The results of the initial implementation of the surveillance system should also be introduced.

Participant No. 4: "... if the results of the evaluation are extracted and the results of the initial implementation of the surveillance system are provided, it is easy to determine in which sectors the private sector can participate."

### Monitoring and evaluation of private sector performance

Participants believe that private sector monitoring and evaluation should be systematic. The services provided must be documented and indexes and indicators developed and reported periodically and at short intervals. Inputs, processes, and outputs should be considered in monitoring and evaluation. Monitoring and evaluation should be performed by public sector staff.

Participant No. 18: "Monitoring and evaluation should be done with agreed and predetermined monitoring and evaluation checklists with specific dates ... Monitoring and evaluation should be implemented on a continuous and consistent basis, in accordance with a pre-established schedule ...".

### How to pay to the private sector for managing adverse health effects

In the interviewees' view, payments should be based on the result and effectiveness of the partnership. In fact, rigorous and rationale goals, indicators and standards should be determined and proper checklists for monitoring and evaluation should be developed, so that payments should be made based on them and for achieving periodic goals. Indicators and goals of evaluation should be based on the work process, the outcome of the activities and their effectiveness. Payments should also be based on the level of performance and after performance appraisal and approval by the appropriate experts and entities.

Most participants stated that a combination of fee for services, per capita and pay for performance methods could be used. However, the majority of participants considered paying in return for identifying and referring patients, as the best method of payment. Participants also believed that payments should be based on specific tariffs in line with the policies of the Ministry of Health as determined by the expert team. A number of participants also believed that payments should be made on the basis of agreements between the private and public sectors and be clearly and precisely included in the contract. Quality of service is also one of the things that how to measure it should be specified in the contract and have a direct impact on payments.

### Achievements and implications of PPP to manage adverse health effects caused by environmental disasters

Study participants highlighted the following as the most important potential outcomes and achievements of private sector participation in managing the AHEs of environmental disasters:

1. Avoid waste of resources: Participants believed that partnership with the private sector can help to prevent waste of resources;
2. Improving service coverage: In this regard, participant No. 1 stated: "... private-sector participation can lead to increased identification of at-risk individuals, community-based education in districts and families, and advancement of public health goals ...";
3. Greater efficiency: By waste reduction and better management of resources;
4. Access to more information: Considering the part of the community referring to the private sector for the treatment, a considerable amount of data can be obtained from the private sector, which can therefore influence health interventions and management of AHEs.
5. Opportunity for the public sector to perform stewardship tasks: Its most important achievement, given the extent of the affected areas and the diversity of health effects in need of care, will be to provide managers with an opportunity to address the more important issues and develop the surveillance system.
6. Public participation: In this regard, participant No. 8 said: "The only area where the private sector can participate is to attract people and volunteers participation. This is where we lame ...".

### Designing and validating the framework

The initial framework consists of 24 options in 4 sections including: Essential infrastructures and backgrounds for PPPs, areas and services that the private sector can participate to, how to monitor and evaluate private sector performance and how to pay to the private sector, entered into the first phase of Delphi. In the first phase, after analyzing the experts' opinion, 2 options were omitted due to low scores, 8 were entered to the second phase, and 14 were finally accepted. In the second Delphi phase, 8 forms were responded, and due to the high agreement of the first and second phase, the Delphi was stopped, and at the end, 20 options were accepted and 4 options were excluded. Based on the results of the study, the PPP framework for Management of AHEs caused by drying lake, compose of 20 options in the 4 sections including essential infrastructure and backgrounds for PPPs, areas and services that the private sector can participate, how to monitor and evaluate the private sector performance (figure 1).

**Figure 1:** Public-private partnership framework for managing adverse health effects of drying lakes

# Discussion

The aim of the present study was to develop a PPP framework for managing AHEs of environmental disaster (a case study of Lake Urmia -Iran) that was achieved through interviews with experts, expert panel meetings and Delphi.

Some participants did not have positive view about the private sector's partnership with the public sector in managing AHEs of environmental disaster. While the results of many studies and experiences of different countries reflect the positive results and achievements of private sector participation in health sector (20, 21). One of the possible reasons for this may be the weaknesses and difficulties in

privatization in different sectors of country. Because, based on the available evidences and documents, few successful experiences and models of effective private sector partnerships with the public sector are available in Iran, and also in the health sector as with other sectors there are many challenges and weaknesses in this field (22, 23). Given the positive achievements and results of PPP in different sectors, especially the health sector in different countries (24-26), officials, policymakers and experts in the field are expected to plan and make a lot of efforts to utilize the potentials and capacities of the private sector.

Designing a legal framework for PPP was one of the most important infrastructure and prerequisites needed for the private sector participation, in the view of experts. In many studies, it has been suggested that the initial legal framework should be designed by the public sector, and the views of the private sector be used to complete and finalize it. This legal framework should at least include: a clear definition of the authorities/duties of each sector (public and private), a clear definition of objectives, how to monitoring and evaluation of performance, performance standards, how to pay to the private sector and how to handle disputes and legal issues (27, 28). In high-income countries, such legal frameworks are well defined, but in middle- and low-income countries, this is not usually the case (29). Therefore, applying the experience and knowledge of high-income countries can be very helpful in developing such frameworks.

Also, in the experts' perspective, one of the most important areas that the private sector can collaborate with the public sector is to provide the required facilities/financial resources. The occurrence of any kind of disaster, especially the environmental disasters, imposes huge costs on the government, and many governments, especially in low- and middle-income countries, are unable to afford and pay for such costs. One of the effective strategies in such situations is to utilize the potentials and resources available in the private sector (30). In many high-income countries, the main approach to using private sector resources for disaster management is in the form of insurance plans. In the US, for example, flood insurance companies have been established since 1968 and play a large role in providing resources and policy making. Or, in France, insurance companies are obliged to provide people with different kinds of disaster and accident insurances and play key roles in this field (31). However, due to structural, policy and economic weaknesses in middle and low income countries, such approaches have been less developed and insurance companies are less inclined to do so, while many disasters and accidents happen in this type of countries (32).

Regarding how monitoring and evaluation of private sector performance, most participants believed that periodic and written reports with short intervals, along with documentation, should be used for monitoring and evaluation, and the tool used should also include agreed and pre-determined monitoring and evaluation checklists with scheduled dates. In a study by Berezin and colleagues (2018) in Russia aimed at providing an effective framework for assessing PPPs and ranking countries in this area, they used five indicators based on software designed for this purpose (33). In 2014, the World Bank provided a checklist for evaluating PPP projects, which can be used to provide native and practical checklists for various sectors (34). Many other studies have used checklists or similar tools to evaluate PPP projects (35, 36). Three important points need to be considered when designing and using such evaluation tools: first their

validity and reliability should be well designed so that it not biased. Second is the partnership and agreement of both the public and private sectors on the content and evaluation process by these tools. The third is to pay attention to the localization in these tools. Because the conditions of participation in different countries and even different regions within a country are completely different and the same tool cannot be used in different situations, therefore, these tools must be fully localized prior to use, in accordance with local conditions, and in accordance with the content and terms of the partnership.

Most experts believed that payments should be a combination of fee for services, per capita, and pay for performance. Various methods have been proposed in literatures for payment to the private sector (37, 38). There are several important points to consider when designing a private sector payment method; first, payments should be commensurate with the quantity and quality of private sector performance and motivate the private sector to better performance and with better quality. Second, the method of payment should be such that it divides the risk between the public and private sectors. Third, it must be commensurate with the economic and social conditions of each region and country. The payment methods and its theoretical basis mentioned by the experts in this study cover most of these points well. The important thing in this regard is the proper design and implementation of these payment methods, because in many cases, despite the proper theoretical basis, there are many difficulties arise in the implementation stage. On the other hand, given the limited experience of PPPs in managing AHEs of environmental disasters, more attention should be paid on this area.

From the perspective of the study participants, preventing waste of resources, improving service coverage, greater efficiency, access to more information, creating opportunities for the public sector to do stewardship tasks and attracting public participation are the most important benefits of PPPs in the field of AHEs of environmental disasters. In many studies have pointed to the benefits mentioned in the present study and other benefits (39, 40). An important point to note is that each of these benefits is achieved if the PPP is implemented well. Otherwise, not only will there be no benefits, but negative and harmful results. Among the most important of these are the increased costs of providing services by the private sector (41).

One of the major limitations of the present study is the lack of related evidence (in the field of drying lakes) that did not allow comparisons of findings, and hence the researchers relied on studies in the field of disaster management. Also due to the novelty of subject and the low experience of PPP in Iran, there were few experts in this field.

# Conclusions

Considering the AHEs posed by environmental disasters (especially the drying up of lakes) on the health of the local population and the limited capacity and abilities of the public sector to manage and prevent these effects, using the capacity and potential of the private sector can be very helpful in this field. PPP policy can be considered as an effective solution for this purpose by senior officials and policymakers. To

this end, the framework presented in this study can be used as a guide for national and local policymakers.

# Declarations

### List of abbreviations

| | |
|---|---|
| **AHEs** | Adverse Health Effects |
| **PPP** | Public-Private Partnership |

**Ethics approval and consent to participate:** The study had been approved by the Ethics Committee of the authors' institute. Ethical Number: IR.TBZMED.REC.1397.774.

Ethical issues (including the informed consent of the participants, plagiarism, duplication, etc.) are fully respected by the authors.

**Consent for publication:** Not applicable

**Availability of data and materials:** Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

**Competing interests:** The authors declare that they have no competing interests.

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**Authors' contributions:** H.GH and S.AA designed the project, collected data, and drafted the first version of the manuscript. R.R, N.D collected data and analyzed the data. M.GH, S.AA revised the manuscript.

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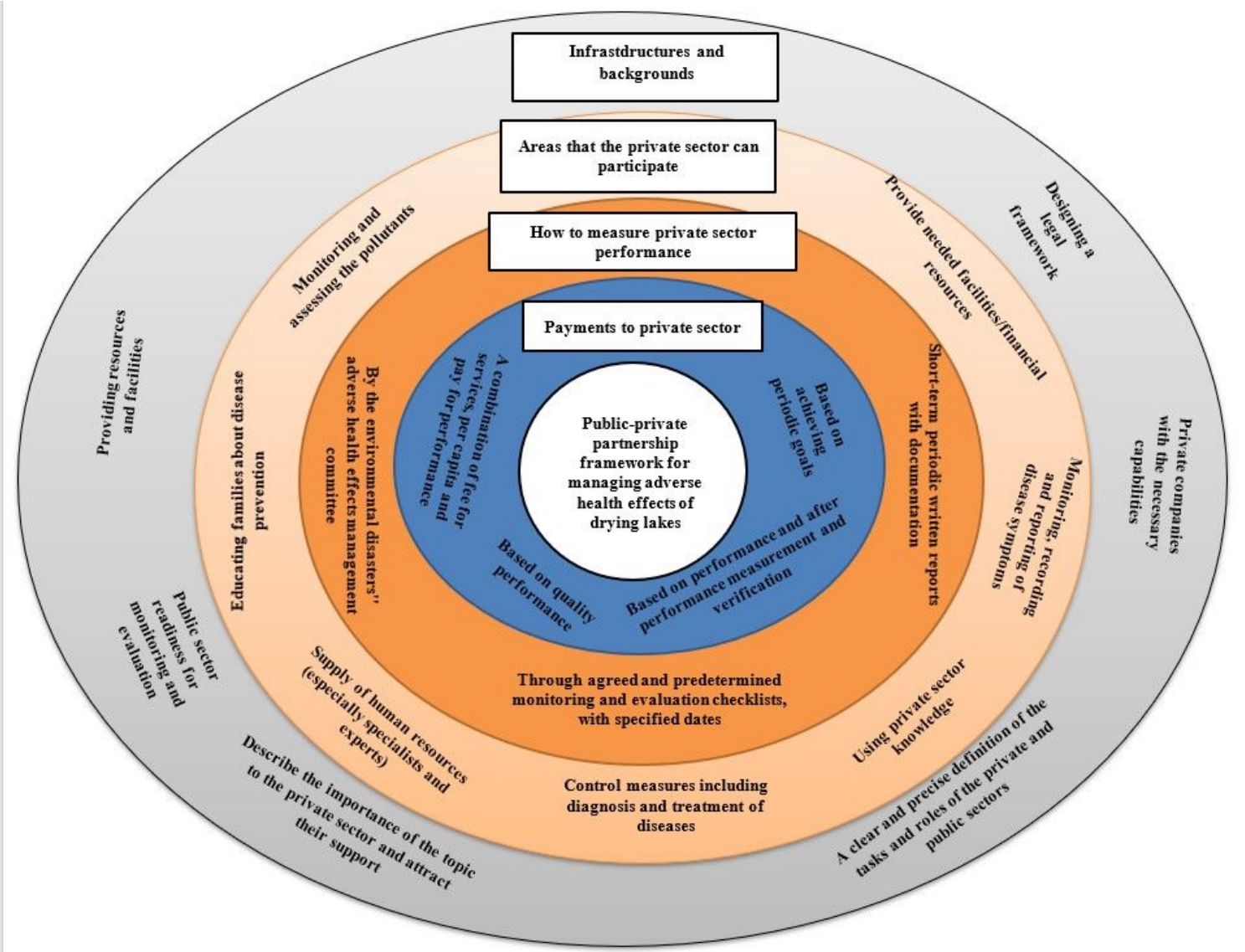
## References


1. Dorling D, Barford A, Wheeler B. Health impacts of an environmental disaster: a polemic. Environ Res Lett. 2007;2(4):11.
2. Cline RJW, Orom H, Child JT, Hernandez T, Black B. Social Support Functions During a Slowly-Evolving Environmental Disaster: The Case of Amphibole Asbestos Exposure in Libby, Montana. Health Commun. 2015;30(11):1135-48.
3. Nicholas C. Climate Change Claims a Lake, and an Identity. New York Times. 2016.
4. Bennion P, Hubbard R, O'Hara S, Wiggs G, Wegerdt J, Lewis S, et al. The impact of airborne dust on respiratory health in children living in the Aral Sea region. International journal of epidemiology. 2007;36(5):1103-10.
5. Crighton EJ, Elliott SJ, Upshur R, van der Meer J, Small I. The Aral Sea disaster and self-rated health. Health & place. 2003;9(2):73-82.
6. Diusembayeva NK, Sakiev KZ, Shpakov AE, Rybalkina DH, Salimbayeva BM, Drobchenko EA. [Health state of Aral region dwellers]. Med Tr Prom Ekol. 2015;7:5-11.
7. Falzon D. Revised international definitions in tuberculosis control: comments from the Aral Sea Area tuberculosis programme: Int J Tuberc Lung Dis. 2001 Nov;5(11):1071-2.
8. Herbst S, Fayzieva D, Kistemann T. Risk factor analysis of diarrhoeal diseases in the Aral Sea area (Khorezm, Uzbekistan). International journal of environmental health research. 2008;18(5):305-21.
9. Eimanifar A, Mohebbi F. Urmia Lake (northwest Iran): a brief review. Saline systems. 2007;3(1):5.
10. Rezvantalab S, Amrollahi MH. Investigation of recent changes in Urmia salt lake. International Journal. 2011;2(3).
11. Stone R. SAVING IRAN’S GREAT SALT LAKE Stopping Lake Urmia from turning into salt desert is the country’s top environmental priority. SCIENCE. 2015;349(6252):1046-7.
12. Gholampour A, Nabizadeh R, Hassanvand MS, Taghipour H, Nazmara S, Mahvi AH. Characterization of saline dust emission resulted from Urmia Lake drying. J Environ Health Sci Eng. 2015;13(82):015-0238.
13. Sadeghi-Bazargani H, Allahverdipour H, Asghari Jafarabadi M, Azami-Aghdash S. Lakes Drying and Their Adverse Effects on Human Health: A Systematic Review. Iranian journal of public health. 2019;48(2):227-37.
14. Ruijten M. The Dutch experience with Health Impact Assessment of disasters. European journal of public health. 2007;17(1):5-6.

15. P D. The Role of the Private Sector in the Context of Aid Effectiveness. Consultative Findings Document. Organization for Cooperation and Development; 2011 2 February 2011.
16. Ghobadian A, O'Regan N, Gallear D, Viney H. Private-public partnerships: policy and experience: Palgrave Macmillan; 2004.
17. Osborne S. Public-private partnerships: Theory and practice in international perspective: Routledge; 2002.
18. Attride-Stirling J. Thematic networks: an analytic tool for qualitative research. Qualitative Research. 2001;1(3):385-405.
19. Lincoln YS, Guba EG. Naturalistic inquiry: sage; 1985.
20. Bailey S. Humanitarian crises, emergency preparedness and response the role of business and the private sector. 2014.
21. van der Berg A. Public-private partnerships in local disaster management: A panacea to all local disaster management ills? Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad. 2015;18(4):994-1033.
22. Gharaee H, Tabrizi JS, Azami-Aghdash S, Farahbakhsh M, Karamouz M, Nosratnejad S. Analysis of Public-Private Partnership in Providing Primary Health Care Policy: An Experience From Iran. Journal of Primary Care & Community Health. 2019;10:2150132719881507.
23. Gharaee H, Tabrizi JS, Azami-Aghdash S, Farahbakhsh M, Karamouz M, Nosratnejad S. Public-Private Partnership in Primary Health Care: An Experience from Iran. 2019.
24. Comendeiro-Maaloe M, Ridao-Lopez M, Gorgemans S, Bernal-Delgado E. Public-private partnerships in the Spanish National Health System: The reversion of the Alzira model. Health policy (Amsterdam, Netherlands). 2019.
25. Hamalainen I, Tornwall O, Simell B, Zatloukal K, Perola M, van Ommen GB. Role of Academic Biobanks in Public-Private Partnerships in the European Biobanking and BioMolecular Resources Research Infrastructure Community. Biopreservation and biobanking. 2019;17(1):46-51.
26. Palaco I, Park MJ, Kim SK, Rho JJ. Public-private partnerships for e-government in developing countries: An early stage assessment framework. Evaluation and program planning. 2019;72:205-18.
27. Chen J, Chen THY, Vertinsky I, Yumagulova L, Park C. Public–private partnerships for the development of disaster resilient communities. Journal of contingencies and crisis management. 2013;21(3):130-43.
28. Busch NE, Givens AD. Achieving resilience in disaster management: the role of public-private partnerships. Journal of strategic security. 2013;6(2):1-19.
29. Lassa J. Public private partnership in disaster reduction in a developing country: Findings from West Sumatra, Indonesia. 2013.
30. Khan MR, Rahman MA. Partnership approach to disaster management in Bangladesh: a critical policy assessment. Natural Hazards. 2007;41(2):359-78.

31. Linnerooth-Bayer J, Mechler R. Disaster safety nets for developing countries: Extending public—private partnerships. Environmental Hazards. 2007;7(1):54-61.
32. Atmanand. Insurance and disaster management: The Indian context. Disaster Prevention and Management: An International Journal. 2003;12(4):286-304.
33. Berezin A, Sergi B, Gorodnova N. Efficiency assessment of public-private partnership (PPP) projects: The case of Russia. Sustainability. 2018;10(10):3713.
34. A Checklist for Public-Private Partnership Projects1 THE WORLD BANK GROUP; 2014.
35. Marx A. The Public-Private Distinction in Global Governance: How Relevant is it in the Case of Voluntary Sustainability Standards? The Chinese Journal of Global Governance. 2017;3(1):1-26.
36. Kurniawan F. An integrated project evaluation tool for public-private partnership projects: Heriot-Watt University; 2013.
37. Lawther WC, Martin L. Availability payments and key performance indicators: Challenges for effective implementation of performance management systems in transportation public-private partnerships. Public Works Management & Policy. 2014;19(3):219-34.
38. Liu J, Love PE, Smith J, Regan M, Palaneeswaran E. Review of performance measurement: implications for public–private partnerships. Built Environment Project and Asset Management. 2015;5(1):35-51.
39. Sapri M, Hariati A, Ting LS, Sipan I, editors. Public Private Partnership Benefits in Delivering Public Facilities in Malaysia. MATEC Web of Conferences; 2016: EDP Sciences.
40. Azami-Aghdash S, Sadeghi-Bazargani H, Saadati M, Mohseni M, Gharaee H. Experts' Perspectives on the Applicability of Public-Private Partnership Policy in Prevention of Road Traffic Injuries. [Original Article]. In press 2019.
41. Iossa E, Martimort D. Risk allocation and the costs and benefits of public--private partnerships. The RAND Journal of Economics. 2012;43(3):442-74.

# Figures




## Figure 1

Public-private partnership framework for managing adverse health effects of drying lakes