



## Proceedings of the Resilient Cities 2018 congress

**Session: Innovators Hour**

### **Impact Bond Concept for Green Cities**

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**Abstract:**

After closely monitoring the current political discussions with respect to urban air pollution, which included threats of potential driving bans for diesel cars and cumbersome financial pressure for cities and communities, we asked ourselves how Munich Re could effectively offer a constructive contribution. Here Munich Re can support the public sector by developing a customized insurance solution to finance mitigating measurements and by doing so, relieve the public sector from a significant burden. Necessary data input can be provided by Hawa Dawa, a company specialized in urban environmental monitoring. Access to this data is provided via an easy-to-use Application Interface.

**Keywords:**

Clean Air, Impact Bond, Financing, Green Cities, Public-Private Partnership

## **1. Introduction**

To support cities implementing air quality improvement and environmental measures Munich Re is offering a new Impact Bond that mitigates both financial and impact risks of such measures. It is partnering with Munich-based company Hawa Dawa which provides a comprehensive and reliable air quality data base to help evaluate the ecological impact of specific measures. The data solution is implemented in several cities in Europe and is within the required legal framework for data accuracy.

## **2. Concept of an Impact Bond – financing of social, environmental and humanitarian projects with outcome-linked redemption**

Investment in risk-reducing measures and risk transfer, to date, are largely treated as two separate processes within disaster risk management. Particularly public entities (sovereign and sub-sovereign), confronted with contingent fiscal liabilities from exposure to natural hazards, can be faced with the decision to either allocate funds to risk-reducing infrastructure projects or to risk transfer solutions mitigating the fiscal impact.

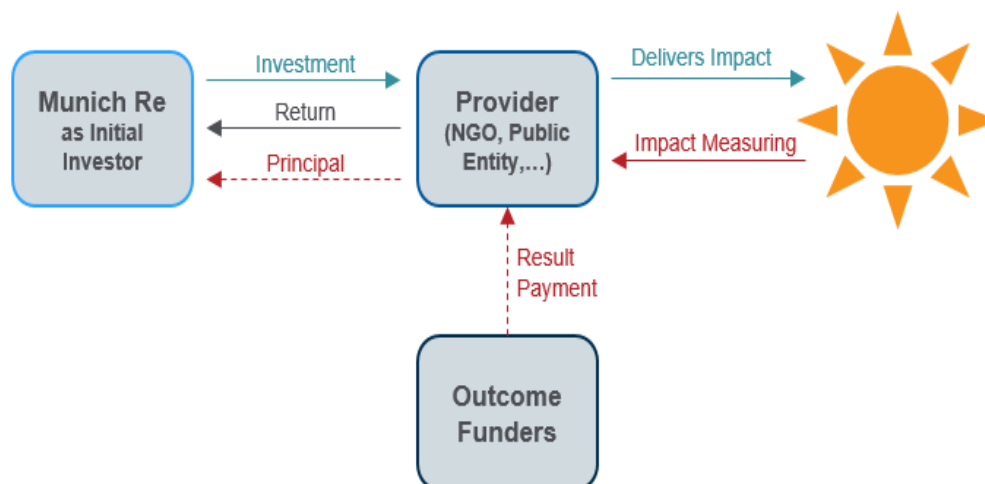
The concept in detail:

- Impact investments are investments made by initial investors to provide funds and enable a third party (public sector entity) to finance an activity to achieve an impact
- The Investment is made for a pre-defined duration and the impact is objectively measured by pre-defined variables at the end of or during the period
- Depending on the performance, the initial investor receives his principal payment as well as a return at the end of the period (“Return”). The Return can be an increasing function of the performance and consequently of the impact itself
- Generally, both the Return and principal repayment is financed by donors (“Outcome Funders”) which commit these contingent payments (“Result Payment”) dependent on the performance

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In Summary:

- Impact investments allow public entities to obtain external financing for impact creation and transfer the risks of a financial downside / non-achievement to the initial investor
- Impact investment could be social, humanitarian or environmental
- Munich Re Group is interested in impact investments which primarily include insurable risks
- Impact bonds are a means of transforming donors into outcome funders, allowing them to only pay for achieved outcomes and impact.

### 3. Impact Bond for Green Cities in more detail

The foregoing concept could be easily applied on several financing measurements, e.g. as Impact Insurance – providing compensation in case measures do not achieve desired impact on pollution levels:

With respect to urban air pollution, threats of potential driving bans for Diesel cars may become true in the near future. E.g., In German Cities, the following EU-wide requirements apply:

- Annual average NO<sub>2</sub> lesser than 40µg/m<sup>3</sup>
- Hourly average NO<sub>2</sub> lesser than 200µg/m<sup>3</sup>, not to be exceeded on more than 18 days

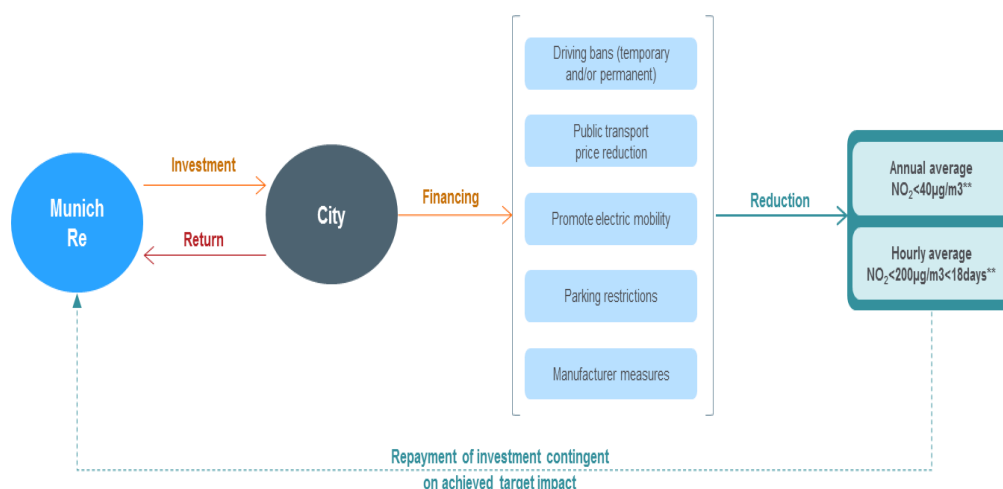
In order to achieve the target impact, i.e. not surpass the EU-wide requirements, a set of city level measures could be applied. The following list of measures is purely illustrative, non-exhaustive and does not represent any recommendation of Munich Re on suitable measures:

- Driving bans (temporary and/or permanent, local or broad)
- Public transport price reduction
- Promote electric mobility
- Parking restrictions
- Manufacturer measures

Munich Re provides downside protection in case measures do not lead to a reduction in nitrogen oxide levels below EU requirements within a predefined timeframe.

If target is not achieved with initial budget, Munich Re could:

- a) Compensate the city for a part of those initial costs; Munich Re may consider to provide initial financing for these costs as well
- b) Provide further funding for additional costs in order to extend efforts to achieve impact thereafter



- The solution would be structured as an impact investment instrument
- Munich Re invests into an impact bond to finance measures to reduce nitrogen oxide levels below EU requirements
- Dependent on the achievement of the target impact, Munich Re as investor receives his principle payment as well as a return at the end of the period
- The return can be seen as the combination of the insurance premium within the impact insurance solution, coupled with an interest for the financing component

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#### 4. Set up of Data Infrastructure – Collaboration with Hawa Dawa

Generating impact requires comprehensive knowledge of the current state of air quality affairs and a tool to evaluate the subsequent change of these affairs based on the implemented measures. The higher the spatial and temporal resolution of the knowledge base of urban air quality the more efficient and impactful measures can be, financially and ecologically.

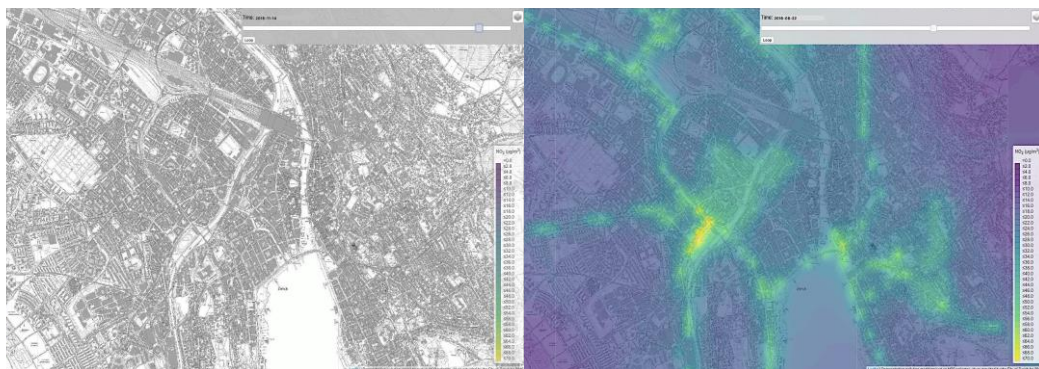
Thus, the current state of affairs in terms of the reliability, availability and accessibility of air quality data creates a vast mismatch in relation to the data need for creating smart and senseable cities. Hawa Dawa aims to transcend this barrier.

Hawa Dawa is a company based in Munich, which specializes in urban environmental monitoring. It was incubated by a joint program between the Impact Hub Munich and Munich Re.

By using machine-learning based calibration methods for its hardware, Hawa Dawa provides reliable outdoor air quality data for a fraction of traditional costs. Hawa Dawa sensor nodes measure the most important air quality parameters. The nodes can be easily integrated in public infrastructure such as light poles and buildings.

Its intelligent software combines this data with other data sources, such as weather, traffic, city geometry and street infrastructure, among others, to generate full-coverage, fine-granular air quality models; if needed in real-time. With additional integrated sensors for noise and micro-climate, Hawa Dawa consolidates all parameters necessary for policy makers to control, shift or improve the causes of urban air pollution and assess the impact of such interventions immediately, if need be. Access to this data is provided via an easy-to-use Application Programming Interface (API).

A visual example of a real-time heat map for the city of Zurich can be viewed in the following:

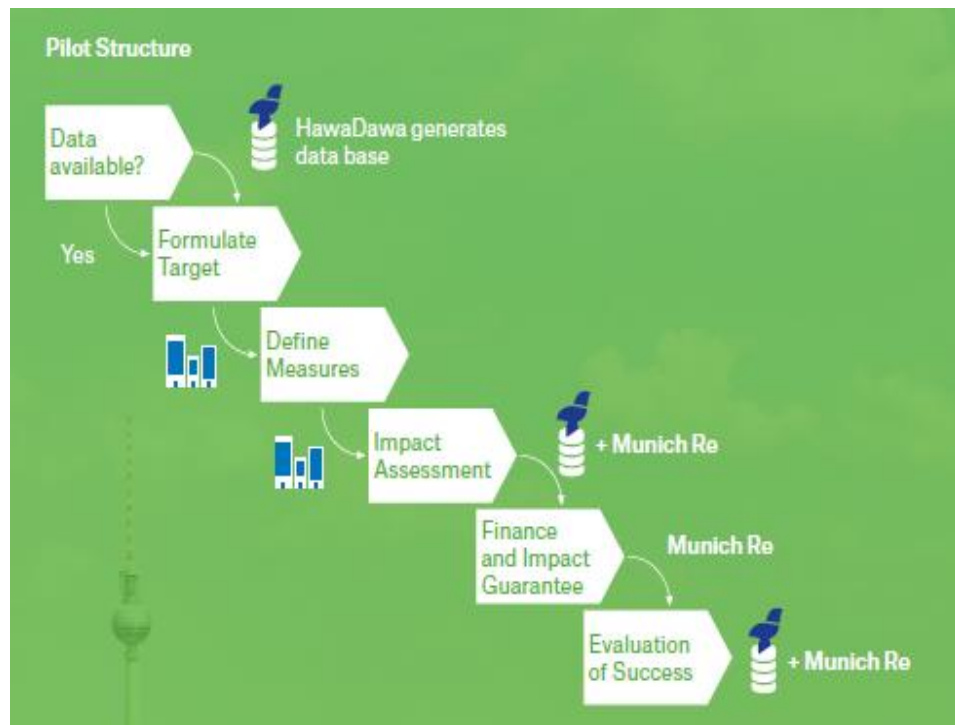


This approach is already being deployed in several cities including Munich, Bern and Zurich with costumers including city councils, Swisscom, the Swiss Post and many more. The technology has garnered a lot of recognition among others from the German Federal Ministries of Transportation and Commerce. It was also recognized as one of the Top 10 Innovations in Germany and Top 35 in Europe by the MIT Technology Review.

By setting up this system for a certain city, Hawa Dawa is able to provide an easy, reliable and cost efficient solution for monitoring and steering urban air pollution data.

## 5. Pilot Structure

The concrete steps to implement an impact bond solution could be structured as follows:



- If city decides to engage into pilot project, the availability of data is crucial in order to start the project
- In case no historical data is available, Hawa Dawa can set-up a reliable data base of citywide air quality data

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- In parallel to Data generation, the target should be defined:
  - What impact is desired?
  - How should the impact be achieved?
  - How will the impact be measured?
  - Who is going to decide on these targets?
  - How long is the implementation time?
  - Who are the stakeholders involved?
  - What are potential pitfalls, what are gains?
- Detailed impact measures are jointly defined
- Assessment of impact by Hawa Dawa (Data quality) and by Munich Re in order to lay the foundation for the insurance solution
- Finance and impact guarantee details (premium, duration, terms and conditions)
- Evaluation of success during and after the term
- Prepare for outcome investors' involvement

*Munich Re is looking for Mayors and city representatives willing to be the first to test and implement impact investments for improving urban air quality.*

*By the end of the project duration the city mayors will have a comprehensive air quality data base, support in developing the best measures and a mean to insure the impact of the investment spent in improving local air quality. In addition to the ecological, financial, technical and social benefits tied to specific measures.*

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