

**Submission by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) to
the WA climate health inquiry**

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Introduction

Climate change will have a significant impact on the health (Sprickett et.al. 2008) and resilience of Perth's residents. This paper will focus on how a water sensitive approach can both help the community adapt to a new environment, and minimize greenhouse gases in the earth atmosphere.

A water sensitive approach manages all aspects of the water cycle in an integrated way, thus achieving sustainable, resilient, productive and liveable communities. It is a systems concept and as such, doesn't reduce water to the traditional silos of water supply, water demand, water efficiency, water reuse, water quality management, and groundwater management without considering the interactions between each of them. Instead water sensitive approaches apply a place based approach, suited to the unique local characteristics and opportunities of a particular location.

Governance of stakeholders engaged in water sensitive cities

The Cooperative Research Centre for Water Sensitive Cities undertook a collaborative engagement process that resulted in a community of practice focused on helping Perth transition to a water sensitive city. This community of practice is called the Water Sensitive Transition Network and provides a platform for discussing ideas and sharing knowledge. In particular they seek to implement strategies to protect and enhance the wellbeing of people and the environment through actions documented in Perth's "Transition Strategy" (Hammer et al., 2018). Actions are referenced according to the Transition Strategy and include:

- 4.2 Integrate WSC principles into WA's climate change policy to address the water energy nexus.
- 2.1 Partner with researchers to provide evidence which strengthens relationships between water system services and mental and physical health (e.g. urban heat, WSC business case)
- 2.2 Undertake a coordinated education program to increase the community's understanding of how urban activities impact the health of wildlife and people
- 2.3 Reduce contaminants, including nutrients, organic material and sediment, entering the Swan and Canning rivers and maintain or improve environmental flows
- 2.4 Implement trials and demonstrations of both technical and governance solutions that aim to improve environmental health, including an explicit learning agenda (link to actions 3.4 and 4.3)
- 2.5 Continue the Drainage for Liveability program

2.6 Translate policy goals for the wellbeing of people and the environment into system-wide standards and programs of implementation

These provide key areas of overlap with the climate and health inquiry that the inquiry can use to facilitate change.

Adaptation to climate change

Some of the climate related challenges facing Perth include:

1. hotter average temperatures
2. higher number of heatwaves and bushfires,
3. higher number of extreme events (flooding, storm),
4. reduced security of water supply from rainfall-dependent sources
5. new and changing disease pathways (eg mosquitos bringing diseases south)
6. Increased CO2 levels from energy consumption and other sources of GHGs (Greenhouse Gases) including methane, nitrous oxide, ozone etc.
7. land clearing reducing the carbon sequestered in the environment,
8. Impacts on food production and seasonality
9. changes to social capital (networks and interactions), mental health, recreation in the local community.
10. Increased pressure on existing ecosystems within the urban environment and the ecosystem services they provide (water quality treatment, air quality, cooling, recreation)
11. Reduced water availability through drought.

A water sensitive approach helps the community reduce risks and build resilience through:

- **Water supply and security:** A water sensitive approach that retains water higher in the catchment and provides an integrated, whole of water cycle approach, through both centralised and decentralised systems (ie hybrid systems¹). This provides clean and health water where it is needed as well as water for the irrigation of greenspace.
- **Ecosystem health and ecosystem services:** Using water to support a green urban landscape which provides ecosystem services including amenity, and recreation, treatment of stormwater, food production.
- **Disaster preparedness and response:** Better disaster response planning that builds community capital and protects the most vulnerable from water caused, or mitigated, events including floods, heatwave and drought.

Mitigation of greenhouse gasses

The way we manage water and deliver ecosystem services has the potential to have a significant impact on greenhouse gas emissions.

¹A hybrid system is a combined centralized and decentralized system. It starts with the existing centralised system. However, when major augmentation of water supply or downstream wastewater / stormwater disposal systems are required, it uses decentralized systems that close the loop between supply and disposal at a local scale. The cost of decentralized systems is offset by avoided costs to upgrade centralized systems.

Some of the challenges are:

1. Water production and wastewater disposal can be energy intensive which needs to be increasingly mitigated with new sources of renewable energy and associated technology.
2. A shift to climate independent sources of water (e.g. reverse osmosis of seawater or highly treated wastewater) will be increasingly important for Perth's water supply and more renewable energy generation will be needed to reduce or mitigate associated GHG emissions.
3. By products of biological processes in wastewater treatment plants include carbon dioxide, methane and nitrous oxide. New technologies should be explored to reduce and negate these emissions and recover resources.
4. Increased temperatures will increase demands for cooling and hence energy consumption. Again, an electricity network with greater emphasis on renewables such as solar power, and greater energy efficiency in household appliances will be important outcomes to mitigate an increase in GHGs.
5. Changes in CO₂ and other GHGs, can have second order impacts on human health, some known and others are difficult to predict

A water sensitive approach helps understand the water-energy nexus, and avoids maladaptive approaches by minimising greenhouse emissions through:

- **Water supply and security:** Identifying climate resilient sources of water that use less fossil fuel sourced energy and more renewable energy, and in some cases inclusion of hybrid systems that augment centralised with decentralized systems.
- **Ecosystem health and ecosystem services:** Using urban greening programs to reduce urban heat and demand for cooling, whilst at the same time sequestering carbon, improving air quality, and reducing atmospheric levels.

Strategy

Mandate for action

The general public in WA do not currently embrace the need for transformational change in managing this health crisis. Although there is general acceptance for desalination as a climate-independent supply in the water sector; and there is community understanding of climate impacts on bushfires in the Fire Sector; the community is yet to prioritise and demand better management of the health impacts from climate change. We can learn from the water, waste and fire sectors how to create this mandate for action. For example the war on waste has gained momentum and health can learn from waste as well as piggybacking on the momentum created. We may soon see a TV show on the "war on heat" along similar lines to the "war on waste" that provides this mandate.

To address this, the community will require greater educational awareness on the need for action and the implications of delayed action. One implication is that the relationship between health and climate change is non-linear and that a doubling or quadrupling of heatwave days will be more than twice or four times as hazardous in terms for morbidity and mortality. However experience can be a good teacher and the work of Nigel Tapper (ref upon request) comparing deaths from the European heatwaves in 2009 and 2014 found that despite the 2014 event being more severe, there were less deaths due to improved response planning². A lack of action now will potentially lock the health sector into an undesirable path that will be increasingly difficult and expensive to manage.

We would welcome the Department of Health having an increased role in providing this community education around health and social impacts. This includes what is occurring now, how impacts will worsen in the future, and why swift and decisive action by government is essential. Any solutions could also be marketed to the community based on multiple benefits including, but not limited to health. For example trees make suburbs cooler, but also capture carbon and make communities more liveable. Marketing of solutions can also empower communities to act through increased knowledge, for example reducing water use and hot water heating which reduces the carbon footprint.

Climate change is only one of many shocks and megatrends buffeting the health sector. Other trends include population growth and associated increase in energy demand, rapid urbanization and technological change which will all influence strategies and solutions. All mega trends have aspects that help and hinder public health and wellbeing. For example 10% of the world's energy consumption is being used by the internet, whilst as a technology it is also critical for sharing information on how to reduce greenhouse gas emissions and respond to disasters.

The water and fire sectors provide examples of how to declare the emergency our climate is facing and take decisive action to invest public funds in a climate resilient approach. This requires both community awareness raising and leadership by government. The development of the community mandate for change should lead, while changes in mandatory policies and legislation happen in parallel.

Framing Health within the system

Health is a complex dynamic system making the interplay with climate change a seriously wicked problem. Focusing solely on the carbon footprint of hospitals, whilst important, ignores the systemic nature of the problem and misses out on opportunities to create healthier communities that are resilient to climate change through synergies across multiple sectors (eg water).

² Reduced mortality was due to a number of factors including improved heat forecasting systems, improved preparedness planning for emergency services and the creating of cooling centres in the local governments

Traditional planning approaches requiring a comprehensive, whole of system understanding, will never be available in this uncertain world. However, we need to start action today, through an adaptive management approach, that begins before all issues and solutions are fully known. Adaptive management through small scale trials that are implemented and evaluated need to be used to assess their impact on health outcomes before being scaled up.

While the linkage between health and climate change is the primary focus of this inquiry, it should be remembered that health also links with water, energy, built environment and urban landscape. This is illustrated in the causal loop diagram in figure 1. It illustrates how health, energy, water, ecosystems and the built environment have positive and negative interactions on each other. A narrow focus on how health services can mitigate greenhouse gases ignores the broader problem of how communities can adapt to climate change and maintain health under enhanced greenhouse effect.

This inquiry needs to consider the role of three key decisions points: 1) water supply, 2) urban development, and 3) early warning systems associated with disaster preparedness planning. These three control points are illustrated as black boxes in diagram 1 and will help deliver better health outcomes through alignment with a water sensitive approach.

Whilst a better system understanding of impacts and solutions for key components is necessary, it is not sufficient. It is equally important to understand the nature of the problem and ways to transition to a climate resilient community. As a complex problem the system is constantly changing, subject to feedbacks, contains unknown unknowns, and requires a different way of assessment and management. Prescriptive approaches where each authority lists outputs in a series of gateways will need to be replaced by an outcomes oriented approach that facilitates tradeoffs, and compromises within or between sectors. This will limit maladaptation in other parts of the system and promote synergies and opportunities.

Explanation of diagram 1

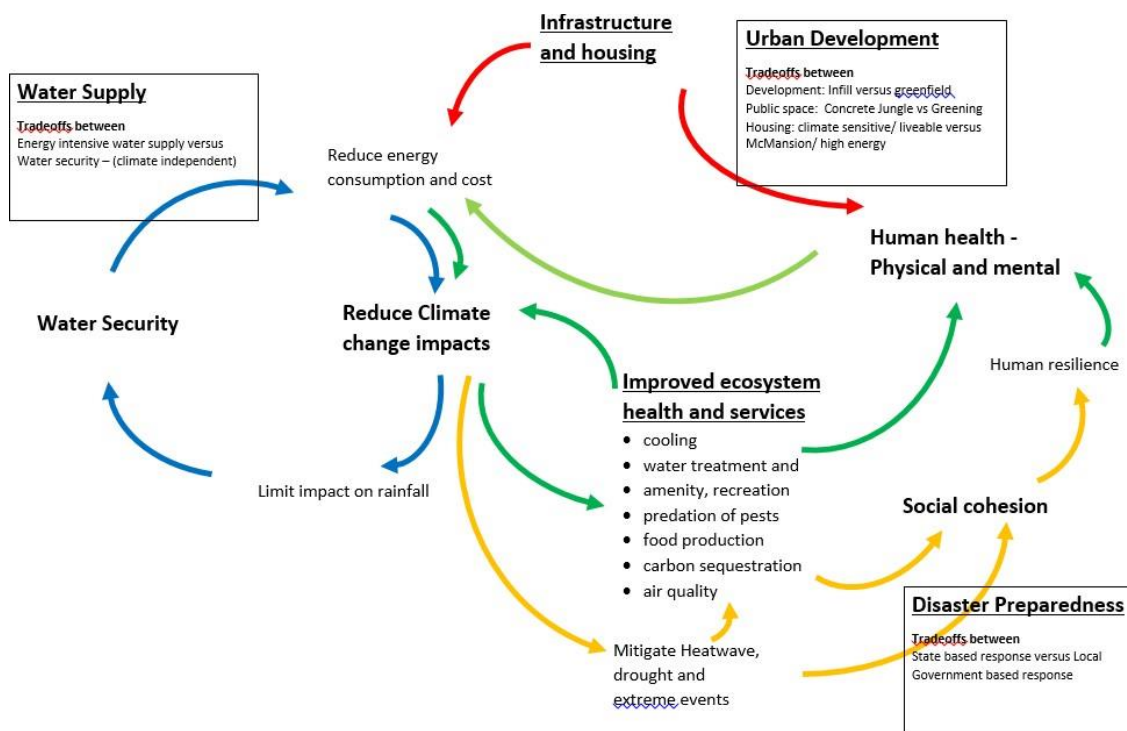
The Blue loop. Climate change is reducing rainfall and the availability of water in both surface catchments and groundwater aquifers. Decisions around water supply such as desalination have provided a climate resilient source, but at the same time has the potential to increase energy consumption if not managed through renewable sources.

Red loop. Decisions on the design of Urban Environment (including the type of development, urban landscape, and built form) will have significant impacts on the livability of our suburbs as well as both human health and energy consumption.

The Green loop. Climate change will impact on the health of ecosystems and the ability for them to deliver ecosystem services such as: shade trees for cooling and sequestration of CO₂; water treatment through wetlands; and recreation and amenity through high quality public open space. These in turn impact on mental and physical human health, through enabling people to exercise and live in a clean, green and cool environment. In turn, the way we maintain health in health centres, as well as residential homes, will loop back again and impact on energy consumption through the carbon footprint of our hospitals and demand for airconditioners in the home.

Yellow/ orange loop(s). Climate change will impact on the ecosystem health and hence the services it can deliver through amenity and recreation opportunities provided through high quality public space. The ability to access public open space will in turn will influence social cohesion and resilience to social and environmental change. In addition, social capital (supported by shared public spaces) in the local community will impact on mental and physical health impacts due to extreme events. Climate change will increase the severity and number of extreme events including heatwaves, bushfire, flooding and storms as well as changing the seasonality of events such as those related to food production. Both urban greening (Myers, 2019) and exposure to extreme events (Global Health Alliance 2019) have long term positive implications for human health

Diagram 1: Causal loop diagram



Planning Frameworks

Traditional approaches of risk assessments and vulnerability assessments are appropriate when they are part of an adaptive management approach. In addition the water sector provides examples of how to benchmark, negotiate across competing values and plan a transition to water sensitive city or a climate resilient community. These frameworks that describe a local government’s transition to a more sustainable and resilient future state are available for download (CRCWSC 2018) and could be adapted to the health sector and combined traditional frameworks:

- CRCWSC Index for Benchmarking (CRCWSC) particularly goal “ensuring quality open space)
- CRCWSC Visioning and building narrative(s) that connects with both health practitioners and the local community
- CRCWSC Transition Planning including the Transition Dynamics Framework (CRCWSC) particularly the role of policy, platforms for connecting and knowledge.
- CRCWSC transition planning including Action development, implementation and monitoring
- Health risk assessments at LGA scale (part of the new Health Act)
- Public grants and alternative public-private funding models for LGAs and others to implement actions on the ground
- Evaluation framework including both quantitative and qualitative approaches

- Vulnerability assessments that go beyond standard ABS data – eg using Social-Economic Indexes for Areas (SEIA) aggregated at the LGA and smaller geographic scales.

Social capital, vulnerability and resilience

Social capital has been shown to increase the resilience of individuals to survive an extreme event (Australian Red Cross 2012) while social connections are essential for mental wellbeing. The way that the health, and associated sectors plan, target and develop strategies is critical. It is important to understand and educate the community around how to stay healthy and stay safe under climate change. However equally important is the engagement process that develops social capital as a desirable, but unintended, ‘byproduct’ of any planning process. For example it is not the report as an output of a local emergency response plan that is the answer but as much the process of its production. Instead of a top down report delivered by consultants external to key stakeholders, a more collaborative process is required. This would engage the community to collaborate and learn through co-design that also builds social capital and hence builds resilience and the ability of the community to adapt.

The traditionally vulnerable groups (elderly, children, disabled and sick, low socio-economic status, non-English speaking backgrounds etc) will remain at risk. However they will be joined by emerging newly vulnerable groups who we currently are unaware of and are yet to engage. This will be particularly apparent with isolated individuals who don’t have social capital. For example the mental health of newly vulnerable groups such as the wealthy living on the oceanfront or farmers on increasingly marginal land are already starting to emerge. Alternatively, some groups that are traditionally vulnerable and exposed may have high adaptive capacity through social capital (eg non-english speaking but with strong community connections).

Detailed Actions

Actions are categorised into three topics (Water Supply, Urban Development and Disaster Preparedness) that correlate to the categories shown in black boxes on diagram 1.

Water Supply

Actions to **support use and management of water** as it contributes to health include:

- A. Water sensitive urban design to keep **water higher in the catchment** via hybrid systems. This water can be used for fit for purpose uses including infiltrating stormwater to recharge groundwater and reuse through irrigation, or using other wastewater streams.

- B. Promote and support Integrated Water Cycle Management and Water Sensitive Urban Design in **infill developments and new greenfield developments** through use of Town Planning schemes and other levels of planning.
- C. Improved **groundwater management** to adapt to climate change, including managing saltwater intrusion under rising sea levels/ groundwater depletion and over-allocation under lower rainfall climates by backyard bores, agriculture and local governments.
- D. Assess changes and develop appropriate planning response to **inundation and flooding within river flood plains**, as driven by climate change and urbanisation. This includes the implications of: a) changed hydrology (and flooding) due to land reclamation; and b) increased bank erosion due to more intense events.
- E. Assess changes to land and groundwater **salinization** and groundwater levels due to sea level rise.
- F. Assess changed risks for **sewerage pump stations along the swan** due to increased extreme events, higher sea levels.
- G. **Prioritisation of LGA water for use in irrigation of public open space** through protection of groundwater allocations and support in the development of alternative water sources for LGA or competing users of water.
- H. Promote development of fit for purpose and low energy water schemes for **horticulture and agriculture** particularly in the peri-urban areas.
- I. **Equitable models for sharing** of benefits, costs and risks of water supply across stakeholder and through time.
- J. Using **energy efficient and renewable energy** in centralized and decentralized/hybrid water supply and disposal systems
- K. Inclusion of water sensitive approaches including water quality treatment, recreation amenity through greening and planning for extremes of drought, flood and heatwaves through **LGA Public Health Assessments**
- L. Identify and link to water programs such as:
 - a. **Water for life** by Water Corporation and
 - b. DWER revised **groundwater allocation** plans.
 - c. DWER **Water planning** and DLPH **Land Planning**
 - d. Link into the **Water Sensitive Transition Network** and associated organisations

Urban Development

Urban Landscape and greenspace

Actions to **support urban greening programs** in the public open space include:

- A. Communicate the narrative around how **greening delivers physical health outcomes** through reduced urban heat island (eg certain cancers, coronary heart disease, dementia, diabetes, stroke).

- B. Communicate narrative around how **greening delivers mental health outcomes** through promoting social interaction and connection between residents their local community and the natural environment (eg depressive disorders etc.).
- C. Protect existing vulnerable ecosystems and increase irrigated greenspace (whilst avoiding maladaptation) through **water sensitive urban design that provides multiple benefits**. Vegetation systems should be used to treat stormwater, for example via biofilters. The economics and feasibility of alternative water supplies should be explored, for example the capture and reuse of stormwater for irrigation of public open space via managed aquifer recharge (MAR).
- D. Utilise planning process that both identify and promote **synergies across multiple benefits** (eg heat mitigation, air quality, water quality improvement, amenity, recreation and physical health, mental health, livable and walkable communities, carbon sequestration and energy efficiency, security of water supply, food production, etc) from water retained in the urban environment (eg plants, wetlands and living streams).
- E. **Greening programs in industrial areas**, where people commonly work outside, and in vulnerable industries (roofers/ tilers, construction workers, garden staff, maintenance and road crews, trolley collectors in shopping centres).
- F. **Equitably provide public open space** across the high and low socio-economic councils. For example, outer suburbs in greenfield development areas often lacks amenity compared with those living in the safe, walkable, transport accessible, leafy western suburbs.
- G. Improve **water quality discharged to the natural environment** through natural buffers, wetlands and biofilters whilst mitigating against vector borne diseases.
- H. Identify and link to greenspace programs:
 - a. Inclusion of nature/water sensitive approaches to greening including heat management through **LGA Public Health Assessments**.
 - b. Build upon the state governments proposed “**Local Government Greener Perth**”.
 - c. Develop a **WA urban forest policy** for Greater Perth that supports multiple benefits and both provides shade canopy and cooling as well as identifies and increases resilience of already vulnerable ecosystems to extreme events.
 - d. Calculate health related economic benefits (heat, mental health etc) and use in planning as part of decision making through **Investment Framework for Economics of Water Sensitive Cities (INFEWS)** and similar tools. In addition use assessments of who pays and benefits to negotiate equitable sharing of costs and benefits.
 - e. Link into the **Perth Nature Link** and associated organisations.

Development type

Actions related to **promoting good development** include:

- I. Support an **outcomes orientated approach in Local Governments** (eg allowing tradeoffs between say height restrictions for better greenspace)
- J. Department of Health to play a **stronger advocacy role** in urban design. This includes driving stronger legislation around urban greening and climate sensitive design in both infill and greenfields developments. It also includes driving Best practice through existing legislations such as the Public Health Assessments and Town Planning Schemes. Examples could include Better Urban Water Management and Design WA
- K. Support a state level **Community awareness campaign** to communicate the need for good infill that avoids a concrete jungle. “Good infill” can both maintain greenspace and support more high density living close to the city
 - **Develop exemplar sites of good infill** in to combat community opposition to the perception that higher density means a concrete jungle. This could be supported by holding place based collaborative workshops (ie design charrettes) that bring together key stakeholders. On example is the CRCWSC process for “Ideas for Bentley” or “Ideas for Ocean Reef”
- L. Assess the **health implications of urban sprawl** considering loss of ecosystem services, increased travel times and energy consumption and carbon footprint.
- M. **Community Education around how to design good infill** and water sensitive greenfields developments. This could utilize CRCWSC Infill Evaluation Framework and typologies catalogue that provide examples of good design and ways of evaluation of developments.
- N. Advocate for better modelling of potential heat impacts from infill and greenfield developments using tools such as the CRC Water Sensitive cities **scenario tool - urban heat module**.
- O. Identify and link to urban development programs:
 - a. Advocate for **design award or accreditation criteria for precincts** to addresses livability and health outcomes under climate change. Examples could include EnviroDevelopment (UDIA), WaterWise Developments, Planning Insititute of Australia, Infrastructure Sustainability Council of Australia, One Planet Living, Australian Water Association, Stormwater Industry Association, Property Council and other industry association awards.

Built form

Actions to support improved built form includes:

- A. Department of Health to play a **stronger advocacy role** in building design in both infill and greenfields developments including.
 - a. Expand **R codes** to encompass more health related outcomes (heat, greening etc) beyond accessibility
 - b. Incorporation of **urban heat mitigation** in the Building Code of Australia

- c. Promote infill designs based on the CRC water Sensitive cities **Infill typologies catalogue** and using the **Infill performance evaluation framework** resulting in urban heat mitigation, increased infiltration of water and greening.
- B. Identify and link to built form programs:
 - a. Advocate for **design award or accreditation criteria for buildings** to address livability and health outcomes under climate change including greenstar certification, and awards sponsored by Housing Industry of Australia, Master Builders Association, Landscape Industry Association of Western Australia,

Disaster Preparedness

Actions **promote preparedness** for floods, droughts, heatwaves and bushfire include:

- A. Communicate the narrative around **physical health outcomes as a consequence of disasters** (eg physical trauma, exacerbation of existing diseases etc.). This could include early severe heat warnings for the community.
- B. Communicate narrative around **mental health outcomes as a result of disasters** (eg impacts of uncertainty and fear on stress levels, depressive disorders, emotional trauma experienced by pregnant mothers and how this is being transferred to unborn child etc.).
- C. Through awareness raising, create the willingness in the community and local governments to **invest time in being prepared for extreme events** before they occur.
- D. **Professional and community education** around what are the issues and how to respond

Actions to **identify and target vulnerable** groups:

- A. **state government to provide an overarching framework** to assess vulnerable groups in Western Australia for a range of factors including health risks
- B. Individual LGAs to **identify where the vulnerable** communities are within their region.
- C. **Evaluate the health outcomes, resilience and social capital** of the most vulnerable
- D. Ensure **data collection processes** enable the collation and comparison of data on mortality and morbidity at the LGA scale. This is essential for adaptive management.
- E. Ongoing **tracking of previously unknown or emerging vulnerable** groups (beyond elderly and poor)
- F. Share success **stories on how to support the vulnerable** and scale up within and across councils
- G. Identify and link with Programs that are able to build social capital in vulnerable groups including:
 - a. Disaster response programs including **“Know your neighbor”**
 - b. Senior services programs including **“ageing in place programs”**

Actions to **support disaster preparedness planning by LGAs** includes:

- A.** Inclusion of water sensitive approaches that support **disaster preparedness through LGA Public Health Assessments**
- B.** Change the **threshold conditions** that trigger action during the lead up to extreme events and to support a more proactive responses by local government.
- C.** Support in the development of **Heatwave response** plans
- D.** Support in the development of **extreme events (flooding/storm and bushfire) plans**

Evaluation, Research and Education

There needs to be ongoing evaluation across all system components to enable adjustment of the strategy as more information becomes available. This is based on the concept of Adaptive Management that requires an ongoing investment in evaluation and planning.

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