6. Lessons learned and observations

For a project to deliver Quality Infrastructure outcomes, it should have a clearly defined project objective that is supported by the project sponsor. The project objectives should inform the project requirements, performance measures and the payment mechanism to align the private and public sector priorities. The output specifications can be used to deliver Quality Infrastructure by aligning expected project requirements with measurable performance requirements to harness private sector innovation and deliver solutions that respond to the project objectives. This section summarises the lessons learned on the output specification development process documented in Section 5, as well as those from the case studies.

An output specification is a technical specification that predominantly adopts performance-based requirements to define the project scope. However, the reality is an **output specification for a PPP project remains a balance between performance requirements and prescriptive requirements**. As outlined in section 5.2, a properly crafted output specification requires striking a balance between performance requirements that allow the private sector the freedom to innovate and drive value-for-money through life-cycle efficiencies; and more prescriptive requirements that may be effective in providing certainty on specific commitments made during the planning stage for some parts of the scope. Where prescriptive requirements are used, it should be with a specific intent and rationale.

The output specification is composed of a series of documents within a PPP contract that define the functional requirements, minimum technical requirements for the design and construction and the scope and level of performance of services during the operating term. Although the overall contract structure may be similar from project to project, **the output specification should be actively tailored to be project-specific** to ensure that key project objectives are detailed to meet the end user requirements and recognise what is affordable within the project budget.

The output specification is the technical foundation of both the procurement and delivery phases and is used to determine technical compliance. During the planning phase, the public sector will identify their requirements and develop the output specifications which are included in the procurement documents. The amendments to the output specifications during the procurement and delivery phases are typically minor. **The output specification is typically finalised prior to contract signature** and any subsequent changes to it would be administered through the change mechanisms in the contract.

Adopting a structured approach to develop project requirements in the planning phase helps facilitate knowledge transfer throughout project delivery and the contract term by clearly documenting both performance priorities and minimum standards. **Engaging a range of stakeholder perspectives during the requirement development process helps to mitigate risks** from inconsistent end user expectations, complex interface management challenges, and incompatibility between expectation and overall project affordability.

It is essential the output specification is well-developed, clear, measurable and technically feasible. **A good output specification will have the following qualities** (detailed in Section 5.6 of this Reference Guide):

- **Outcomes focused:** responds to the project objectives and functional requirements of the asset;
- **Refers to codes and standards:** owner, local, national, industry or international codes and standards specify the minimum requirements;
- **Achievable:** the requirements are constructible and feasible and are informed by background studies and investigations;
- **Quantifiable:** the vision, objectives and requirements are described in terms of measurable outputs;
- **Observable compliance:** where a requirement is not quantifiable, there is a clear understanding of what evidence is required to prove the solution is compliant with a requirement;
- **Simple:** requirements are communicated using simple language and as few words as possible; and
- **Coordinated:** the structure considers how the output specification will be used and is coordinated with other project documents.

In addition to developing well defined and achievable output specifications, they should be **linked to payment mechanisms and termination provisions** to incentivise the greatest level of service delivery.

6.1 LESSONS LEARNED ON QUALITY INFRASTRUCTURE FOCUS AREAS

The G20 Leaders stressed the importance of Quality Infrastructure (QI) investment to deliver high-quality infrastructure projects at the Hangzhou Summit in September 2016[19], where it was defined as investment: "*which aims to ensure economic efficiency in view of life-cycle cost, safety, resilience against natural disaster, job creation, capacity building, and transfer of expertise and know-how on mutually agreed terms and conditions, while addressing social and environmental impacts and aligning with economic and development strategies*". This Reference Guide adopts this definition of Quality Infrastructure, and has broken it down into seven focus areas:

1. **Sustainability and longevity** of an infrastructure asset. Ability of the asset to address the needs and meet the expectations of end users.
2. **Health and safety** considerations during both construction and operation of the asset.
3. Ability of the asset to withstand **natural and other disasters**, including climate change.
4. **Job creation, capacity building, transfer of knowledge and expertise.**
5. **Social impacts and inclusiveness.**
6. **Environmental impacts.**
7. Alignment of the project with **economic and development strategies.** Ability of the asset to **respond to changes** in resource availability, population levels, demographics and disruptive technology.

Development of this Reference Guide identified observations and lessons learned that can be applied to PPP projects regardless of the asset class or location. This section defines the Quality Infrastructure focus areas and presents lessons learned that align with the focus areas, with relevant examples (cited as sub-bullet points) from the Part B case studies.

1 Economic efficiency in view of life-cycle cost - Sustainability and longevity of an infrastructure asset, while addressing the needs and meeting the expectations of end users.

The relationship between the decisions made during design and construction, and how they aim to minimise the whole-life cost of the asset and meet the end users' requirements. Considerations include:

- How the need for the asset has been identified and project objectives defined, and how these are translated into measurable requirements;
- Processes and requirements that support reliable operation and maintenance, and economic efficiency in view of whole life cost; and
- Requirements that promote good practice asset management and support the continued maintenance of an asset to meet the handback requirements.

- **Ensure that performance measures reflect the project objectives and the end user priorities:** Developing a clear vision and defining objectives through stakeholder engagement during the planning phase improves the quality of the output specification. Where this had been completed, the output specification, performance measures and the payment mechanism clearly communicated the project priorities, either through measurable key performance indicators or through payment mechanisms that incentivised the private sector to focus on the project priorities.

19 Available at: http://www.g20.utoronto.ca/2016/160905-communique.html

- **Plan France Très Haut Débit (Rural Highspeed Broadband):** The performance measures focus on meeting end user requirements. The main end user requirements are: 1) 'Access', where any internet service provider shall be able to use the network to commercialise internet subscriptions to the end users, and 2) 'Level of Service', where the network must provide satisfactory access to the internet. There are key performance indicators for each performance measure which are linked to payment if they are not achieved.

- **Consider customer satisfaction surveys:** Satisfaction surveys are good practice and are a common approach across asset classes and locations to evaluate whether the Private Partner is meeting the end user's expectations. Stakeholder feedback suggests it can be difficult to hold the Private Partner to measurable performance criteria as the surveys can be insufficiently prescribed and subjective. Adopting an industry recognised process to complete the surveys is one option that could improve the implementation of the customer survey, for example the Mactan-Cebu International Airport referenced an industry standard.
  - **Mactan-Cebu International Airport:** The Private Partner is required to undertake a passenger satisfaction survey every quarter. The industry benchmark for customer satisfaction surveys is the Airport Service Quality (ASQ) survey which has been developed by Airports Council International (ACI). It is a standardised survey which is completed by passengers at the airport once they have completed their journey through the terminal.
- **Be clear on handback requirements and condition assessments:** The handback requirements and condition assessments throughout the operating term are key mechanisms to support the longevity of the asset. In addition to regular lifecycle condition reviews, handback condition inspections typically commence five to seven years ahead of the end of term and will often be conducted by an independent third party. Depending on the jurisdiction, there will typically be a mechanism of financial retention leading up to handback to incentivise an acceptable handback condition.

  Recent projects have had more detailed requirements for the asset condition at the end of term and prescribing the residual life of key asset components is one way the output specification can promote asset quality beyond the end of the contractual term.
  - **Mersin Integrated Health Campus:** Prior to handback, an independent building survey shall be completed to assess the outstanding works required to meet the handback standards. On this project, it shall take place up to three years prior to the expiry date and involves the Owner and the Private Partner appointing a third party to undertake a condition survey of the facilities.
  - **Hong Kong Organic Resource Recovery Centre:** The project has a 15-year operating period term which is shorter than typical solid waste management PPP projects which are usually closer to 25 years. The Owner specified both the design life and residual life to promote long-term decision making during the design and construction phases.
- **Consider international standards for asset and information management:** International standards are increasingly being used to specify requirements for information quality and consistency and asset management. The introduction of these requirements points to the value of information in monitoring performance on an asset and administering a contract, and the need for a structured approach to plan, implement and review the asset management activities to promote a whole-life approach. Building information modelling (BIM) and emerging information management practices will continue to provide opportunities to improve asset delivery. The process starts by defining organisation (rather than project) objectives and developing governance standards and protocols to support implementation.

2 Health and safety considerations during both construction and operation of the asset.

A design approach that considers the health and safety of those who construct, operate, maintain, modify and demolish an asset, as well as those who work in or with it, use it or are in the proximity of it (i.e. the public).

Considerations include:

- How hazard identification and risk assessment methods are integrated into the design requirements, with the intention to eliminate or minimise the risks of injury throughout the life of the asset.
- The requirement to conform with appropriate health and safety standards and, if appropriate, go beyond these by developing a proactive health and safety culture.

- **Local law and regulations typically form minimum standards:** Local law and regulations typically form the minimum health and safety requirements, although there is the opportunity in the output specifications to include requirements above the minimum standards. When a project includes private finance, the private financing party may choose to impose their own minimum requirements to mitigate the risk of delay if a serious health and safety incident were to occur.
  - **Mactan-Cebu International Airport:** The output specification cited national legislation, however since the Asian Development Bank (ADB) was one of the lenders, the Private Partner was also required to comply with the ADB's safeguarding policy which includes occupational and community health and safety provisions.
- **Ensure proactive monitoring and intervention:** Owners typically prioritise health and safety planning and performance monitoring. Safety management plans are typically required to be in place within a defined period (dependant on the project schedule) after contract signature, and prior to construction commencing and are typically subject to Owner review. Depending on the Owner's project delivery experience, it is common for them to appoint external consultants to review the safety management plans. Persistent poor health and safety performance is typically linked to a contract default and which is monitored through monthly reporting. The Owner typically retains the right to audit health and safety performance at any point during construction and operations.
  - **Gautrain Rapid Rail:** Although the responsibility for health and safety is transferred to the Private Partner, the Owner takes a proactive interest in monitoring health and safety performance and the implementation of the health and safety management systems. A Safety Management Plan is required to reflect good industry practice. The Private Partner is then required to report on performance against the management plan.
- **Safety by design:** Where the Owner retains responsibility for the operation of an asset, there is an opportunity to incorporate "safety by design" requirements. The output specification can describe the operating functions and define constraints with the intent to reduce or eliminate long-term occupational hazards through decisions taken during the design process.
  - **John Hart Generating Station:** The Owner identified ways to incorporate "safety by design" principles into the project requirements. As an example, the design and construction requirements included general and specific requirements for operability and maintainability, confined spaces, isolation and lockout, isolation of mechanism apparatus, work at height, limits of approach, electromagnetic field, arc flash and constructability.

- **Consider requirements for system redundancy:** Output specifications can use performance requirements to specify the level of system redundancy required to ensure the healthy and safe operation of an asset. This is particularly relevant on healthcare projects, as the ability to deliver quality patient care is directly dependent on the reliability of the building systems. Under contract, the outage of critical building systems is typically subject to financial deductions in order to incentivise the private sector to prepare a resilient design and to undertake preventative maintenance to mitigate the likelihood of a system outage.
  - **Milton District Hospital Expansion Project:** The output specification includes provisions for selected equipment, devices or systems to be provided in sufficient quantity and capacity such that should the largest unit fail, the design load of the system served will still be met.

Additional industry example: Transport Infrastructure Safety Standards

In support of the United Nations (UN) Sustainable Development Goals to halve road deaths and injuries (Goal 3.6) and build Safe and Sustainable Cities (Goal 11.2), UN Member States have agreed on 12 Global Road Safety Performance Targets[20]. Targets three and four relate to transport and road infrastructure safety standards including the specification for all new roads to meet a three-star or better star rating for all road users.

Governments around the world have now adopted Star Rating targets for new and existing roads. The targets are being used for both public and private sector infrastructure including the Wellington Gateway Project in New Zealand where a minimum four-star standard was specified; Highways England with a target of 90% of travel on three-star or better roads; Concession Roads in Brazil where three-star or better standards are being specified and Indonesia where toll increases will be subject to meeting a four-star standard.

Development institutions are also encouraging client countries to meet the UN targets with the World Bank, Asian Development Bank, Millennium Challenge Corporation, Caribbean Development Bank and others including three-star or better targets on transport and road projects.

In 2018 the online Star Rating for Designs (SR4D) tool was released to "empower designers and road engineers to assess the road safety of a design and improve its safety star rating before the implementation of civil works"[21]. The SR4D tool can also "strengthen the road safety audit process, complementing it with an objective and repeatable qualification of road user fatality and serious injury risk and support the wider and more immediate application of Star Ratings as a safety performance metric" and could be considered as a requirement when developing output specifications for highway projects.

Further information can also be found at https://www.irap.org/ and a 'Business Case for Safer Roads' is found at https://www.vaccinesforroads.org/business-case-for-safer-roads/

20 https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/ (page 19)

21 Further information available at: https://www.irap.org/2018/11/new-star-rating-for-design-sr4d-tool-set-to-revolutionise-road-design-safety/ An example of the application of the iRAP standard can be found at: http://www.saopaulo.sp.gov.br/spnoticias/governo-de-sp-lanca-maior-concessao-rodoviaria-do-pais/

3 Ability of the asset to withstand natural and other disasters, including climate change.

The ability for an asset to demonstrate resilience and safety against natural disaster, terrorism, and cyber-attack risks. Considerations include:

- Implementation of best design practice processes and procedures to identify location-specific hazards and aim to mitigate the impact of natural disasters on the asset's condition and its users through design. This could include design requirements above minimum standards and specifying the required level of performance following an event.

- **Understand the site-specific risks:** During the planning phase, owners have the ability to mitigate the impact of natural disasters by considering the potential exposure when selecting a project site. The Owner is typically required to complete background research and site investigations to identify risks that can then be translated into requirements in the output specification. If the risks can be quantified, the Owner then has the option to transfer the risks to the private sector through an appropriate risk sharing model.
  - **Presidio Parkway:** The Private Partner is responsible for the first USD10 million of extra work and delay costs (in aggregate during the project term) incurred to repair or replace tangible property damage caused by seismic events. All un-insured costs above this will be borne by the Owner. By sharing the risk, the Private Partner is incentivised to develop a design that mitigates repairs for a minor (and more likely) event.
  - **Melbourne Metro Rail Tunnel:** The Owner has identified and documented projections and scenarios in a Climate Change Risk Assessment and Climate Change Adaptation Plan. The output specification includes climate resilience requirements that respond to the location specific risks. The Private Partner is responsible for delivering a design that "*must include measures for all high and extreme climate change risks to ensure the infrastructure, stations and precincts are resilient to the projected impacts of a changing climate over the relevant asset's Design Life.*"

- **Performance-based seismic requirements:** The **John Hart Generating Station** and **Presidio Parkway** case studies demonstrate how seismic requirements can be incorporated in the output specification using performance-based criteria. By adopting a performance-based design approach, the Private Partner has the flexibility to design a solution that best mitigates the risk. The output specification describes the required level of performance, depending on the defined seismic event. Typically, the seismic requirements refer to location-specific industry standards, for example the Presidio Parkway seismic requirements consisted of industry requirements (American Association of State Highway and Transportation Officials Load and Resistance Factor Design (AASHTO-LRFD) Standard), Owner requirements (Caltrans Seismic Design Criteria) and project requirements.

Best practice is evolving

The projects documented in the case studies were selected based on their current stage of development (typically either operational or nearing construction completion), and therefore do not necessarily represent current best practices to respond to climate change risks. Transportation projects in North America now increasingly refer to a base design level (for example, a one-in-100 year event) and then require a supplemental allowance for sea level rise and flooding (for example, an additional two feet). The allowance for sea level rise and flooding is based on site specific analysis of the risk and will vary between projects. There are also jurisdictions that have developed their own design guidelines to respond to climate change risks, for example:

- **British Columbia (Canada) Ministry of Transportation and Infrastructure (MoTI):** MoTI requires the potential impacts of climate change be considered during the design stage of a project. In March 2019, MoTI issued a Technical Circular providing guidance to the engineering community on how climate change risks should be considered on maintenance, rehabilitation and new construction projects.

4 Job creation, capacity building, transfer of knowledge and expertise

Promoting job creation, capacity building, and transfer of expertise and know-how to national and local communities to deliver on economic development objectives. Considerations include:

- How the requirements support participation by smaller (and local) and minority-owned firms as part of the project delivery in both the construction and operation phases.
- Requirements aimed at transferring project knowledge and developing skills in the local community or Owner to support the long-term operations and maintenance of an asset, and particularly relating to handback.

- **Consider job creation and local business targets:** Quantifiable performance measures (linked to financial deductions) are the typical way for projects with job creation objectives to align the Owner and Private Partner priorities. Good practice is to include requirements for both the construction and operating term, and to have a monitoring program in place to measure performance.
  - **Gautrain Rapid Rail:** Socio-economic development (SED) was a main objective of the project. The Owner developed a SED strategy which identified 22 elements, with targets, for the project and developed a specific schedule to document the requirements. To achieve the targets in the strategy, the Owner used the output specification to align their priorities with the Private Partner's priorities. Measurable requirements were included in the specification and independent reviews were required to determine if the objectives had been achieved and a penalty and reward regime was included to promote performance above the minimum requirement.
  - **John Hart Generating Station Replacement Project:** During the project planning phase the Owner entered into impact benefit agreements with local First Nations (traditional inhabitants of the land). The output specifications reflect this priority with the inclusion of a specific First Nations output specification schedule and requirements for Private Partner reporting, as well as potential financial deductions or contract default for non-compliances with the requirements.
  - **The Central 70 Managed Lanes project** provides another example of construction and operations period local business targets that promote job creation.
- **Ensure project knowledge is documented in plans and procedures:** Clear and current project documentation is an important element of effective knowledge transfer. The private sector is typically required to document their operating policies and procedures as well as maintenance plans prior to construction completion. The specifications typically describe the intent and content of the policies, plans and procedures, the development process (due dates and need for stakeholder input) and how and when the documents need to be updated. Typically, policies, plans and procedures are updated annually to capture lessons learned and are subject to Owner review.
- **Include a handback/handover plan:** The requirement for a 'Handback Plan' is typically included on most PPP projects, with asset documentation a key part of this. Increasingly, there are requirements for building information models (BIM) to be maintained throughout the operating term to improve asset management and the transfer of knowledge at handback.
  - **Hong Kong Organic Resource Recovery Centre:** The output specification includes requirements for BIM to mitigate construction risks and improve asset management and transfer of knowledge. At an organisation level, the Owner has defined their requirements for BIM, which in turn inform the project requirements. The Private Partner shall adopt BIM during the design, construction, and operations stages of the facility.

5 Social impacts and inclusiveness

Social impact is the effect a development's actions have on the well-being of the community. Considerations include:

- How the project considers the impact it has on the local community, and the requirements in the contract to provide positive impact or mitigate the negative impact during both the construction and operations phases. Further guidance is provided in the GI Hub's '*Reference Tool on Inclusive Infrastructure and Social Equity*'[22].

- **Establish social inclusiveness initiatives during the project planning phase:** A common approach is for an owner to engage with stakeholders to identify priorities and develop social inclusiveness initiatives during the planning stage that can then be translated into requirements in the output specification. Meaningful social initiatives take time to implement. Without the Owner leading the initiative development during the planning phase, the Private Partner is unlikely to have adequate time between contract award and construction commencement to develop meaningful programs and to deliver the project on schedule.
  - **Pan Am Games Athletes' Village:** The project addressed job creation and social inclusiveness through cooperation with the Waterfront Toronto Employment Initiative (WTEI). The Owner took a proactive approach and set out initiatives that the Private Partner could take advantage of. The project worked with WTEI, who was committed to connecting un/under-employed Torontonians with the employment and training opportunities that were generated through this revitalisation.
- **Ensure accessibility provisions:** From healthcare facilities to transit systems, current relevant standards and codes are typically used to specify the minimum accessibility provisions. For example:
  - **Mersin Integrated Health Campus:** The facility must comply with the Turkish disability legislation, and the Private Partner is required to "*ensure access routes comply with disability legislation*". More specifically, the output specifications highlight that the facility must "*include access provisions for cars or minibuses to set down disabled or elderly people at entrances, safely and without hindrance*".
  - **Pan Am Games Athletes' Village:** All accessibility requirements listed in the *International Paralympic Committee, Accessibility Guide July 2009* and the *Ontario Building Code 2006* were required to be met. In the case of conflicting requirements, the most stringent applied.

6 Environmental impacts

Environmental impacts may present themselves as temporary or permanent changes to the atmosphere, water, and land due to any development or human activities, which can result in impacts that may be either reversible or irreversible.

- How the project considers the impact it has on the environment, and the requirements in the contract to mitigate the impact during both the construction and operations phases.
- Consideration is given to the mechanisms used to reduce energy consumption over the life of the asset.

- **Use of Environmental Management Systems:** Globally ISO 14001 accreditation is a commonly used standard for environmental management. ISO considers adopting a standardised approach can have an effective role in support public policies[23]. It is worth noting that in some jurisdictions the full accreditation is required, whereas in other jurisdictions the Private Partner is required to comply with ISO 14001, but is not contractually required to obtain the formal accreditation. This distinction can be due to the depth of local knowledge in the implementation of the standard, or an assessment of the relative cost and value of pursuing certification.

22 Available at: https://inclusiveinfra.gihub.org/

23 Additional information available at: https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso_action_plan_2016-2020_en_ld.pdf

- **Consider requirements for third party certification:** Industry recognised third party certifications are a common approach to promote energy efficiency and asset sustainability. The available certifications vary by location. The certifications referenced in the case studies include LEED[24], ENVISION[25], EDGE[26] and BREEAM[27].

  A good practice approach is to define in the output specification the credits that the Private Partner must achieve to ensure that the certification achieved aligns with the Owner's objectives. Alternatively, Owners (or governments) may have their own green building standard, for example:

  - **Hong Kong Organic Recovery Centre:** The output specification includes a requirement to comply with the Government of Hong Kong's '*Green Building Performance Framework set out in the Development Bureau Technical Circular (Works) No 2/2015*'.
  - **North American Airport:** A current airport redevelopment project in North America requires both LEED Silver Certification (for design and construction and the operations and maintenance) and ENVISION Gold certification. The same project also references international standards (ISO14064 and ISO14065) for greenhouse gas quantification, validation and verification.
  - **Milton District Hospital Expansion:** The output specifications require the Private Partner to achieve the LEED 'New Construction' Silver rating certification. There is an onerous CAD2 million penalty in the form of liquidated damages to the Owner if the Private Partner fails to achieve the LEED certification within 24 months of substantial completion.

- **Consider energy targets:** Energy efficiency can be promoted by linking energy consumption to the payment mechanism. Rather than prescribing requirements, an energy painshare/gainshare approach can promote the private sector to incorporate energy saving measures into their design. Typically, the proposed energy consumption is considered during the bid evaluation process (part of the financial assessment). During the operating term the private sector performance is then measured against the target. It is essential that the Owner invests in developing their understanding of the energy usage of their asset during the project planning phase to establish a realistic energy benchmark.
  - **Infrastructure Ontario model:** In the Infrastructure Ontario model, the energy unit pricing is a risk borne by the Owner, however the energy consumption risk is shared using a painshare/gainshare mechanism. On this basis, actual energy consumption is measured annually against the energy target for that year.
  - **Agadir Mutualized Desalination Plant:** The output specification requires the energy that powers the asset to be generated from renewable sources. The Owner also desires to minimise energy consumption and the output specification incentivises the Private Partner to optimise the plant and minimise energy use by linking payment to energy consumption; the Private Partner can increase their profit by reducing their energy consumption. This approach allows the Private Partner to make trade-offs between energy costs over the term and a design solution which exceeds minimum requirements. As a result, the Private Partner decided to include an energy harvesting turbine which reduces the overall energy use of the facility.

24 Further information available at: https://www.buildinggreen.com/leed

25 Further information available at: https://sustainableinfrastructure.org/

26 Further information available at: https://www.edgebuildings.com

27 Further information available at: https://www.breeam.com

7 Alignment of the project with economic and development strategies (SDGs, national policy etc) Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology.

Ensuring alignment with economic and development strategies, and ability to respond to changing priorities or needs including aspects of climate change, population growth and disruptive technology at the national and regional levels.

- Identify how the projects align with economic and development strategies and reflect these in the project objectives and performance measures.
- How the requirements either foresee potential changes or refer to contractual mechanisms that allow future changes to be adopted.

- **Ensure that output specifications define capacity requirements:** The scale and scope of the asset is developed by the Owner during the planning stage and is informed by studies and assessments. The output specification then details the scale and scope in terms of measurable outputs. One approach to respond to growth and expansion is to develop mechanisms in the contract (rather than the output specification) that describes the process to deal with specific changes, and how those changes will be priced if they were to occur. An alternative approach is to build in additional capacity during the initial construction project. The approach will depend on the project and on the understanding of the likelihood and impact of demographic changes.
  - **Mersin Integrated Health Campus:** The design objectives indicate provision of a total capacity of 1,259 beds within the campus. The expectation was that the facility would not operate at full capacity in the earlier years but would allow for population growth. Volume-related services were provided under the payment mechanism with a guaranteed minimum capacity (70%) with occupancy above that level managed through a monthly adjustment and an annual reconciliation of actual occupancy. Expansion is to be managed through the variation procedure in the contract.
  - **Plan France Très Haut Débit (Rural Highspeed Broadband):** The Private Partner is required to take into account potential demographic growth providing an additional capacity of 20% in the design of the network and is also required to check with local authorities if real estate developments are planned in the area.
- **Consider both proven and emerging technologies:** For projects that have a critical technology component, such as waste, water and energy projects, it is common for the output specifications to require proven technology. The contract then typically incorporates mechanisms to allow changes in the future to incorporate new solutions at the Owner's cost.
  - **Agadir Mutualized Desalination Plant:** The Private Partner can propose new technologies throughout the project term to allow the Owner to incorporate new and emerging technologies. This is accommodated in the contract, not in the output specifications.
- **Consider flexibility in rapidly changing areas, such as by the Owner retaining the ICT risk:** To address technology developments associated with services in the built environment, a current approach is for the Owner to retain the ICT, or a short-term contract is awarded, often three to five years, during which the needs are more predictable.
  - **Lewisham Grouped Schools:** The Private Partner's involvement with ICT is limited to provision and maintenance of the infrastructure, while the Owner retains control of hardware (initially provided by the Private Partner through the equipment schedule, but maintained and replaced by the Owner), software and internet provision.
  - **PPP Prisons Program (Lots 1-3):** For the new prisons contracts, the expected performance levels for rapidly evolving technology equipment (such as CCTV or security) have been reformulated to allow private partners more flexibility in defining technical characteristics so they can focus on performance objectives for each equipment.

The SDGs were published in 2015 and given that the case studies selected were nearing construction completion or in operation, the specifications reviewed do not explicitly mention the SDGs. The alignment of output specifications with the SDGs and other global agencies is an appropriate area for further study as discussed in the conclusion.

Figure 10: Summary of QI focus areas and lessons learned