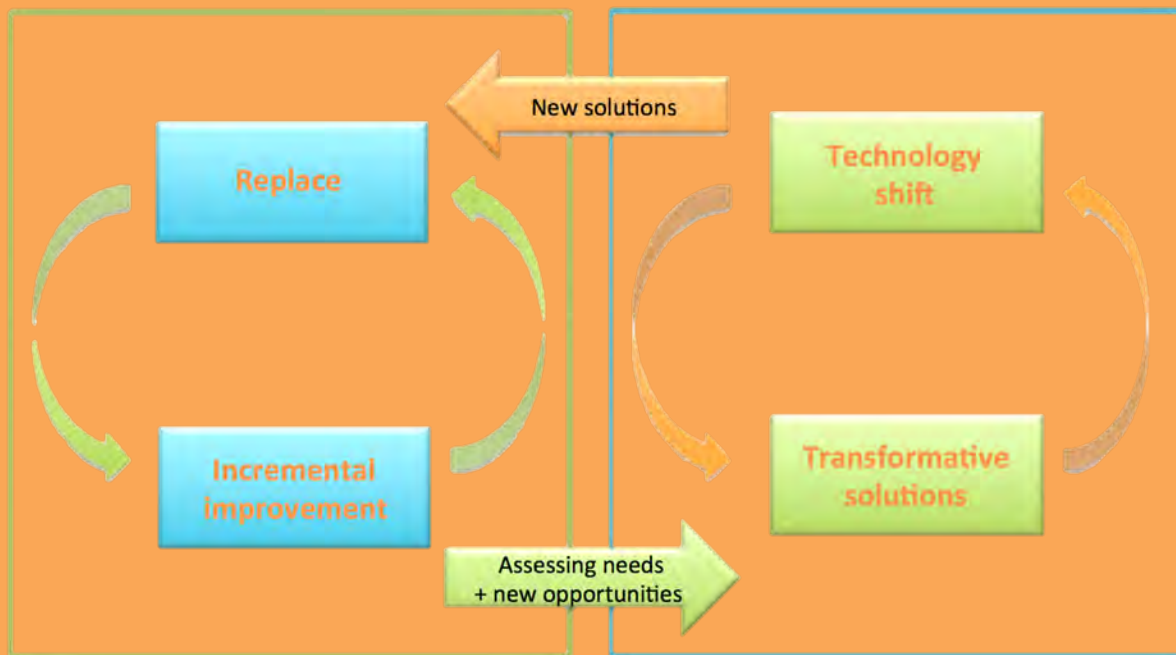


Public procurement and transformative solutions

A migration strategy for India's procurement in the 21st century



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Executive Summary

This report is an outcome of thought-leadership collaboration between stakeholders in India and Sweden that seeks to spur momentum to ensure innovative and global sustainable development through the mainstreaming of transformative solutions.

The collaboration is based on two national public procurement projects, one in India and one in Sweden. The objective is to explore ways that allow public procurement to deliver economic development, innovation, poverty reduction and global environmental sustainability by supporting transformative solutions.

As the key outcome of the work, a migration strategy has been developed that will enable, and support, a shift from current procurement to a procurement that supports transformative solutions. This strategy will help move focus from only incremental improvements (that are not enough and sometimes even destructive) to 21st century solutions that are truly sustainable from a global perspective. Such a strategy will also encourage increased transparency and cost efficiency in the procurement process.

The report is based on the assumption that three trends are converging:

- First, a rapid increase in availability of new sustainable solutions that are transformative and can provide what we need in smart, resource efficient and inclusive ways. However, there is still a challenge for these solutions to become mainstream and the lack of support from public procurement is a serious barrier that must be addressed.
- Second, a growing recognition that current “green” measures often either move the problems instead of solving them, or incrementally improve the situation while the overall trend remains negative. At a time when we face multiple collapsing systems that threaten the very existence of our society as we know it, from climate change and eco systems to local pollution and water shortages, this “green” approach must be changed. They must be seen integrated with social challenges such as poverty, joblessness, and skewed demographics.
- Third, political processes that support transformative solutions with public procurement are under way. A new bill in India is underway that, if key parts are accepted, will encourage and support the kind of measures that are needed to support transformative solutions. These measures include capacity building, increased transparency, integration of environmental and social aspects, full life cycle costs, and total value of ownership. In Sweden the Public Procurement Committee presented their finding in March 2013 after two and a half years’ work. These findings focus strongly on how public procurement can support transformative solutions and present a number of concrete measures.

Based on these three converging trends four areas that are important and where public procurement could play an important role were selected in dialogue with key stakeholders:

1. Lighting: From old street lighting to smart LED lighting
2. Mobility: From physical transport to smart mobility
3. Health: From industrial health to 21st century solutions
4. Sanitation: From linear sanitation waste to circular resources

For all these four areas examples of procurement and solution-providers that

collaborate to deliver transformative solutions were identified. Based on these cases, suggestions for a migration strategy were developed that, if implemented, will help accelerate uptake of – not just these specific solutions – but a broader shift from incremental improvements of unsustainable solutions to transformative solutions.

The migration strategy builds on the experience from the above cases and discussions with procurement experts. The structure was created to allow for significant flexibility due to the diversity of needs in different areas. It also recognizes that procurement looks very different in different areas and different governments, e.g. local, provincial and central.

Today there are many examples where procurement has supported transformative solutions, but they are almost exclusively ad-hoc and driven by individuals that see opportunities that are outside their traditional area of work. In order to make sure that transformative solutions are supported, there must exist an organizational structure and a responsibility that result in a situation where the organization reports on how the potential opportunities for transformative solutions have been assessed.

It is not important where in the organization this assessment take place, what is important is that the assessment includes those who have the mandate to make the decisions that transformative solutions need, as they often require new groups to work together and change what parts of the organization will pay for the service (the latter for example due to changes in upfront costs and running costs).

To establish a migration strategy for 21st century procurement, a process is added where radical technology shifts and transformative solutions are analyzed. This second process is added to the existing process where replacements and incremental improvements take place.

The result is a structure with two phases. A first phase where the daily procurement that is replacing current solutions, and where incremental improvements are taking place. A second phase where radical technology shifts take place and transformative solutions are identified.

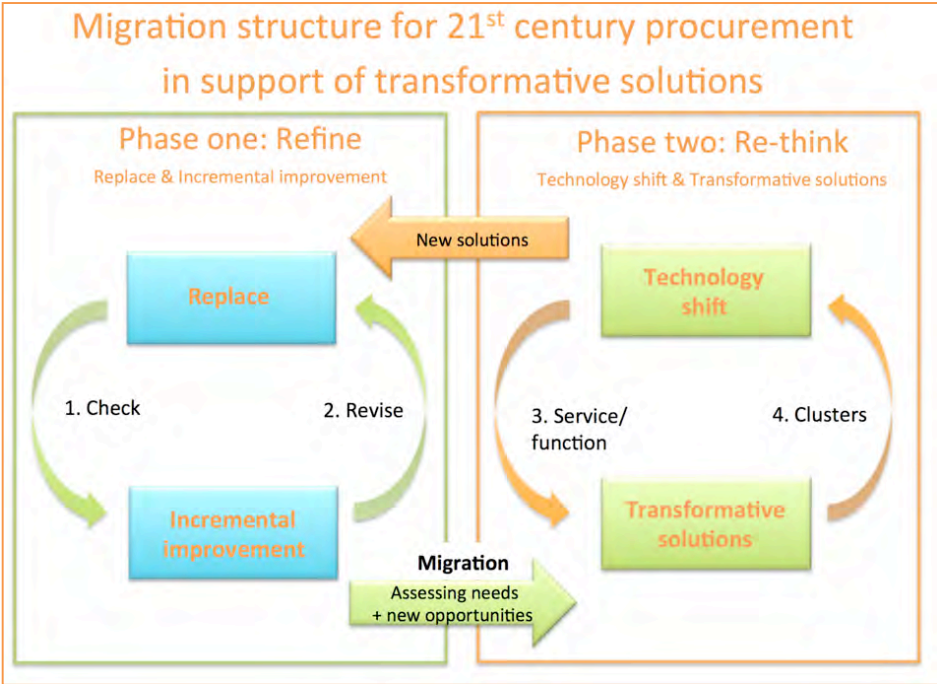


Illustration: Migration structure for 21st century procurement

The migration strategies include the following elements:

- Establishment of a “migration bridge”: To allow an organization in a structured way to move from current procurement to a situation where they rethink what they need. To ensure that this happens it is important to clarify responsibility within the organization, when in time as well as where in the organization it is best to move from refining current procurement to also re-thinking the way services can be provided.
- A change of reference point: To ensure that use of new transformative solutions is the reference, not current unsustainable practices.
- Cluster support: To encourage new groups of companies to deliver the solutions that are needed.
- Clear goals: To support transparency, identification of best practice as well as evaluation.
- A global perspective: To promote a perspective where transformative solutions can be used by those most in need.

Below is an overview of examples of four different kinds of procurements in the two phases.

Four different approaches to public procurement			
	Procurement focus	Examples	Innovation & Green
Phase one: Refine	1. Replacing (product) Replacing a non working product with an identical new product.	1. Changing a light bulb 2. Changing a car (or parts of a car) 3. Building a new hospital	> Innovation: No tools > Green: No tools
	2. Incremental improvements (of product) Upgrading with a minor improvement. The improvement could be in quality, LCA impact, design. Incremental implies that the rest of the product stays the same.	1. From one CFL to a better CFL 2. More fuel efficient car 3. Building a more sustainable hospital	> Innovation: No direct tools, but underlying technology improvements in parts of the systems > Green: Green labels/ green criteria
Phase two: Re-think	3. Radical improvements (of product) A new technology is used instead of the old within the same system.	1. From CFL to LED 2. From fossil car to electric car/bus 3. From hospitals to include telemedicine and remote diagnostics	> Innovation: Technology shifts through criteria allowing for totally new technologies or through pre-commercial procurement, etc. > Green: Technology procurement
	4. Transformative change (service perspective) A service is provided that reduce the need for natural resources by >80% or even turns a current problem into solutions (e.g. Buildings that are net producers of renewable energy, electric cars and renewable energy that is part of a sustainable energy system.)	1. From different technical light sources using electricity for lighting e.g. through design, smart windows, fiber optic cable. Linking parts (like street lights) to systems (like rural and urban lighting) using integrated solutions such as LED/solar/ battery . 2. From physical mobility to virtual mobility (e.g. tele-working & 3D printing) 3. Including proactive work with remote health support and improved lifestyle.	> Innovation: Cluster creation, support for shift in business models, system solutions. > Green: Cluster creation, support for shift in business models, system solutions.

Illustration: Four different approaches to public procurement

As flanking support for transformative solutions and improved public procurement three initiatives should be considered:

1. Capacity building

In order to allow decision makers to understand, identify and develop strategies that support transformative solutions, capacity building is often necessary. With new technology this capacity building can be made tailor-made and tools such as the cluster platform for transformative solutions is currently being developed.

2. Economic assessments such as LCC, TCO and TVO

In order to ensure that transformative solutions are not disregarded due to higher upfront costs, it is important to develop methodologies that can estimate the Life Cycle Costs (LCC) and Total Cost of Ownership (TCO). It is important to note that the TCO can differ from LCC depending on what is included. LCC can include externalities and other costs/benefits that could be considered in the procurement, while TCO usually only refers to the actual costs during the ownership. TVO is of particular interest for transformative solutions as it evaluates any additional benefits, such as the mobility and multi-functionality of laptops when compared to nothing when buying cars for commuting, that often are included in transformative solutions.

3. Revising rules and regulations

Much of current rules and regulations are based on assumptions that were correct in a centralized and industrial economy where ecological sustainability was not important. Today the speed of technological development, connectivity, new business models and need for radical efficiency when it comes to use of natural resources require a different set of rules and regulations.

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1. Introduction

1.1 The context for the work

The report is based on the assumption that three trends are converging.

- First, a rapid increase in development of new sustainable solutions that are transformative and can provide what we need in smart and resource efficient ways. However, there is still a challenge for these solutions to become mainstream and the lack of public procurement is a serious barrier.
- Second, a growing recognition that current “green” measures often only move the problems instead of solving them, or only incrementally improve while the overall trend remains negative, at a time when we face multiple collapsing systems that threaten the very existence of our society as we know it, from climate change and eco systems to local pollution and water shortages.
- Three, political processes that support transformative solutions with public procurement are under way. A new bill in India is under way that, if key parts are accepted, will encourage and support the kind of measures that are needed. This includes increased transparency, integration of environmental aspects and full life cycle costs. In Sweden the Public Procurement Committee presented their findings in March 2013 after two and a half years work. These findings focus strongly on how public procurement can support transformative solutions and present a number of concrete measures.

Twenty years ago most of the solutions available were an option between on the one hand, end-of-pipe solutions that only reduced the negative impacts, or on the other hand a reduction in quality of life. Since then there has been a virtual explosion of solutions that deliver true sustainability (delivering services that nine billion people can use while staying within the carrying capacity of the planet’s eco systems). Rapid technological development, especially in the field of ICT, storage and renewable energy, mean that technical solutions are now available. Together with better understanding of the necessary changes in economic incentives and changes in business models, we have a situation where exponential growth of transformative solutions is possible. However, these solutions remain on the margins and one of the main reasons for that is that they are not supported by public procurement.

Many of the global challenges humanity must solve such as climate change, aging population, and unsustainable consumption levels of different natural resources, suffer from decades of insufficient action. These challenges can no longer be solved by only focusing on incremental improvements of existing technologies in current systems. Most of the current work falls into three categories:

- So marginal, that underlying trends such as population growth and changing lifestyles result in an overall negative trend. E.g. improved fuel efficiency while the overall car fleet is increasing (resulting in overall increase in emissions), or improved agricultural practices while meat consumption is increasing (resulting in an increased need for land as meat is the most resource intensive way of providing protein).
- So local, that the result is that the problem moves rather than being solved. E.g. the closing of polluting industries that then move to other countries while the products are

imported, or a shift from fossil fuel vehicles to vehicles that use unsustainable bio-fuel from other countries.

- So short-term. that they result in unsustainability lock-in. E.g. a shift from coal power plants to natural gas power plants that reduce emissions but result in an investment that still emits so much greenhouse gases that they contribute to dangerous climate change, or focusing on intelligent transport systems that optimize the current physical movement paradigm, resulting in further investments in roads and other infrastructure instead of also including smart virtual mobility.

In order to avoid the three categories above new transformative solutions through technology leaps and/or totally new ways of organizing different activities resulting in sustainable lifestyles are needed. One of the most important tools to deliver concrete change is public procurement.

For more than 20 years the importance of public procurement in relation to sustainable development has been highlighted in all major conferences where the major challenges of our time have been discussed. Sustainable Public Procurement (SPP) was identified in Agenda 21 and in Chapter III of the Johannesburg Plan of Implementation as one of the means to achieve sustainability.¹ More recently, SPP was recognized as a priority theme for all regions during the 19th Session of the Commission on Sustainable Development (New York, May 2011), and highlighted as a key enabling policy instrument for sustainable consumption and production towards a green economy in UNEP's Green Economy Report.²

Both in Sweden and India the role of public procurement to support transformative solutions is being explored. A collaborative pilot has been launched to link on-going work in India and Sweden to strengthen each other as well as ensuing additional benefits. This report is the result of the collaborative pilot for transformative solutions that built on a Swedish procurement pilot for transformative solutions and similar work in India.

The work builds on earlier work in the area of green, or sustainable procurement as well as work to encourage procurement for innovation. Instead of the linear and incremental approach that almost all the earlier work has focused on, the focus is on disruptive and transformative solutions.

¹ 18. Encourage relevant authorities at all levels to take sustainable development considerations into account in decision-making, including on national and local development planning, investment in infrastructure, business development and public procurement. This would include actions at all levels to:

...

(c) Promote public procurement policies that encourage development and diffusion of environmentally sound goods and services; http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm

² UNEP (2012): The Impacts of sustainable public procurement:

<http://www.unep.fr/scp/procurement/docsres/ProjectInfo/StudyonImpactsofSPP.pdf>

1.2 Methodology and approach

The report was based on interviews, workshops, secondary analysis and two formal consultations. Spread over six months, the project was announced at the first consultation on 15 October 2012, organized at the CII-CESD's "Sustainable and Inclusive Solutions: Summit & Exhibition", in Delhi. This first consultation was important not only to announce the project, but also because it introduced the concept of procurement for transformative solutions to the participants. The consultation was mainly attended by business. Significant was the participation of the Indian Ministry of Finance with which rests the responsibility of public procurement policy. The outcome of the consultation was an in-principle support for the project and identification of certain sectors to study for case work.

Three areas – health, mobility, and lighting – were identified for case work. The objective of each case work is to illustrate transformative solutions and a demonstration of public procurement.

The final draft of the report was discussed in a second consultation on 4 March 2013, in Delhi. During this meeting business, as well as the Ministry of Finance, underscored the importance of the project. The findings in the report were well received.

Two follow-up activities were identified. The Ministry of Finance invited CII-CESD to provide inputs to include transformative procurement as part of the evolving legislation on public procurement in India. The other follow-up activity endorsed by participants is to set up a platform for clusters.

1.3 Transformative solutions

The concept “transformative solutions” covers the kind of solutions that deliver economic development in all the different countries with an innovation approach that manage to bring together global poverty alleviation and global environmental sustainability for the 21st century.

It is also an attempt to establish a concept that allows serious stakeholders to differentiate between on the one hand solutions that aim for global sustainability that support equity and on the other hand, solutions that are no more than green window dressing that result in unsustainable lock-in or substitute one environmental problem for another.

It is important, again, to acknowledge that incremental improvements *can* play an important role, both in taking steps towards transformative solutions, and once transformative solutions are in place, as a strategy for continued improvement.

Transformative solutions are often system solutions, and for those solutions to work, incremental improvements of underlying parts are often needed. These incremental improvements can be both technical and institutional.

The shift in reading from “dead tree paper” to the use of an e-reader is an example of how incremental improvements are needed to deliver a transformative shift:

> Feeling of reading: Better screens with better contrast that feel like paper or better.

> Usage: Better batteries allowing at least a full working day.

> User friendliness: Software that allows notes in texts as well as improvement in download and transfer time of documents.

Definition of transformative solutions

Transformative solutions are defined as solutions that use global and equitable sustainability as the reference. Based on this perspective the criteria for such solutions are in most cases at least 80% reduction of natural resources and/or GHG reductions in relation to how a function/service is provided conventionally in today’s society. This kind of improvement is what is needed in order to support poverty alleviation and allow nine billion people to use functions/services within the carrying capacity of the planet. Transformative solutions often provide a function/service in a totally new way compared with the conventional way of providing the function/service.

Three kinds of transformative solutions:

1. Technology solutions such as video meetings instead of flying to meetings, teleworking instead of commuting with a car, e-books instead of paper books.
2. Integrated solutions such as smart e-health, e-education and e-governance where new technology solutions are implemented together with new ways of organising the way the services are provided.
3. System solutions that turn earlier problems into opportunities such as buildings that are net producers of renewable energy instead of using large amounts of electricity, or mobility solutions such as carpools, public transport and telework that include storage of intermittent renewable energy.

All of the above solutions have in common that they require a significant amount of innovative thinking and an assessment of the actual needs that the procurement is meant to provide. An assessment that looks beyond the technology and system currently used to provide the function is required.

Two kinds of business models related to transformative solutions:

1. Business models that are based on the service used in society (not a particular product). A business model where material and modules are designed to be used in a way where the lifecycle environmental impact and economic cost are optimised. This supports a business model where a function is rented to the user rather than a traditional business model where products are sold.
2. Disruptive business models that disrupt traditional channels to market, business processes and models, to enhance significantly customer experience in a way which impacts upon the value chain as a whole.

The first focuses on the business model from the company’s and customer’s perspective, the second from society’s perspective

These are all incremental improvements in current technologies and software that allow the user to have the same or better experiences in areas they are familiar with. Still, the main change that is needed is usually a social/market change, e.g. when leading events start to provide documents in digital format instead of physical,³ when meeting organisers assume that tables are the standard for taking notes, or when meetings always have an option to participate virtually.

What is interesting with many transformative solutions is that they also open up new opportunities. For example e-readers allow users to collaborate on documents in real time, share notes, search documents and notes and have access to almost unlimited amounts of documents everywhere. Once the new solution is in place it is hard for a new generation that takes these new features for granted to understand how an older generation could cling to an out-dated solution.

While transformative solutions might be a challenging concept initially, the clear focus of the idea (solutions for 9 billion people) makes it easy to keep a clear direction.

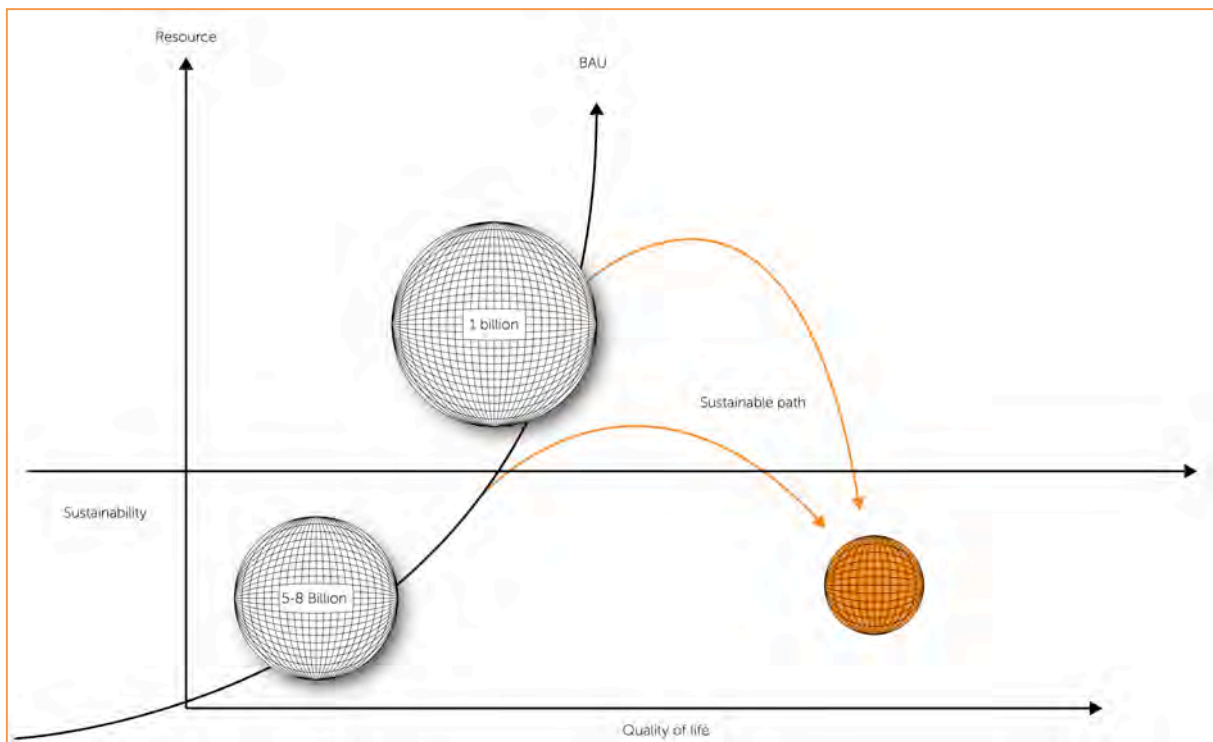


Illustration 3: Transformative solutions and a 9 billion filter.⁴

³ A concrete example is the 94% reduction of paper at COP18 due to the fact that the organisers finally realised that people rather carried only their tablet/laptop than five kg paper. <https://twitter.com/pamlin/status/276999841081593856>

⁴ http://transformative-solutions.net/2.0/files/material/LCL_Transformative_Solutions.pdf

1.4 Unsustainability lock-in

The global challenges regarding sustainable development have been accentuated in the last few years. We are now approaching, and in some cases already beyond, thresholds where we will see rapid changes and collapses unless action is taken to reverse the unsustainable trends.

Today GHG emissions are increasing even faster than expected, at least two thirds of our most important ecosystems – including tropical forests, freshwater and marine – are already overexploited and polluted. The increasing demand for a number of resources, such as crude oil, phosphor, and rare earth metals, are forcing us into even more sensitive and difficult areas. Conflicts, driven by the urge to ensure access to fertile soil around the world, have begun to increase.

There is a growing understanding that many of the so-called sustainability strategies and initiatives today actually are counterproductive. This understanding is creating some frustration and even denial among some groups that today claim to be green.

The reason for the failure of current initiatives to deliver the kind of solutions that are needed, and instead being counterproductive, is due to a combination of many things, but in particular two:

1. When the environmental problems became mainstream political issues back in the 1960's/70's structures were created to deal with these problems. It was assumed that only a few incremental improvements were needed and that ad-hoc measures were enough. This was not necessarily a bad assumption; if change had begun back in the 1960's, when the discussion started, it might have been possible to achieve a smooth transition towards a very different and sustainable economy. Unfortunately this did not happen. Since the first global

Definition of “Unsustainability Lock-in”

Unsustainability lock-in is defined as a situation when society has great difficulty, or is even unable, to reach sustainability targets due to earlier investments/decisions that are irreversible, or difficult to undo.

The reference for unsustainability is the planetary boundaries, but the concept can also be used in relation to targets set by governments, companies, etc.

It is important to note that a country/company can set targets that they reach while at the same time contributing to unsustainability lock-in in relation to planetary boundaries.

One common conflict between targets and planetary boundaries are the GHG targets that countries have under the Kyoto protocol. These targets could be a first important step, but instead they are often encouraging investments in incremental improvements in existing systems, or encourage policies that move emissions to other countries rather than result in absolute global reductions. The result is a situation where it will be increasingly difficult to reach the reductions needed to avoid dangerous climate change

Two main categories of unsustainability lock-in exist:

- “Grey unsustainability lock-in” happens because there is a lack of interest or capacity to focus on sustainability. A country or a company might ignore the planetary boundaries and invest in fossil fuel infrastructure, such as coal power plants and roads that encourage increased fossil fuel car use.
- “Fake green unsustainability lock-in” happens because there is a focus on incremental improvements that are locking society into an unsustainability path, while claiming to be sustainable/green. A company, government, or NGO might promote increased efficiency in fossil fuel cars and call them green. But the initiative results in emissions that are too high and make transformative solutions, such as car sharing, teleworking and decentralised production more difficult. A dual lock-in strategy is to support offsetting that keeps western societies investing in unsustainable solutions while at the same time only delivering incremental reductions in poor countries. Companies, governments and NGO's might do this because they lack an understanding of what is actually needed, because they focus on short-term communication/economic benefits, or because they don't think it is possible to deliver the reductions necessary.

conference in 1972⁵ almost all of the important trends have continued to worsen. A major problem is that almost all strategies and institutions dealing with sustainability, including most NGO's, still focus on incremental improvement in parts of the existing system without regard to the overall negative trends.

2. The discussion about the problems and solutions related to sustainability is still dominated by companies that create the problems. These companies operate within a system that economically rewards those that ignore long-term consequences of their actions. So even when the companies talk about sustainability, and invest heavily in PR projects, there is usually very little happening with regard to new solutions and businesses models.

The oil, energy and car companies are good examples. We can even identify what can be called an "unsustainable industrial complex"⁶, the companies themselves, politicians responsible for the sectors, the consultants working with these companies, journalists covering these sectors, and even many of the NGO's working with these companies. These groups tend – for various reasons such as education, personal contacts, pride, fund-raising strategies, tradition, need of income, etc. – to focus on incremental changes and they assume that the companies will continue to operate like they do for the foreseeable future. Increasingly these groups recognise the need for transformative solutions, but think it is someone else's responsibility. It should be noted that many of the most interesting transformative solutions, and passionate people pushing for these solutions, exist in companies that today are creating the problems.

A common, maybe the most common, reason that incremental improvements are undermining sustainability is related to a phenomenon called lock-in.⁷ A lock-in can be described as investments in infrastructure, organisations and equipment that keep creating problems over time due to high emissions and/or use of natural resources.

"Without a bold change of policy direction, the world will lock itself into an insecure, inefficient and high-carbon energy system."

IEA 2011

The marginal improvements that sometimes are used as an excuse for current work, are not only too insignificant to deliver what is needed, they also make it more difficult or even impossible to achieve the necessary improvements.

An example of a lock-in can be investments in coal power plants that make these plants slightly more efficient, but also extend their lifetime. These investments and activities shift focus away from energy efficiency and system change. Once the investment is made it is hard to close the plant, less money is available for smarter investments that can deliver the same thing, and finally – and maybe most destructively – money has been provided to a stakeholder that often is an active lobbyist against sustainable change and networks have been created that define what is sustainable or not in the media and in relation to policy makers. Similar lock-in situations can be found in more efficient fossil fuel cars, slightly more efficient buildings, slightly better meat as food, etc.

⁵ <http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97&articleid=1503>

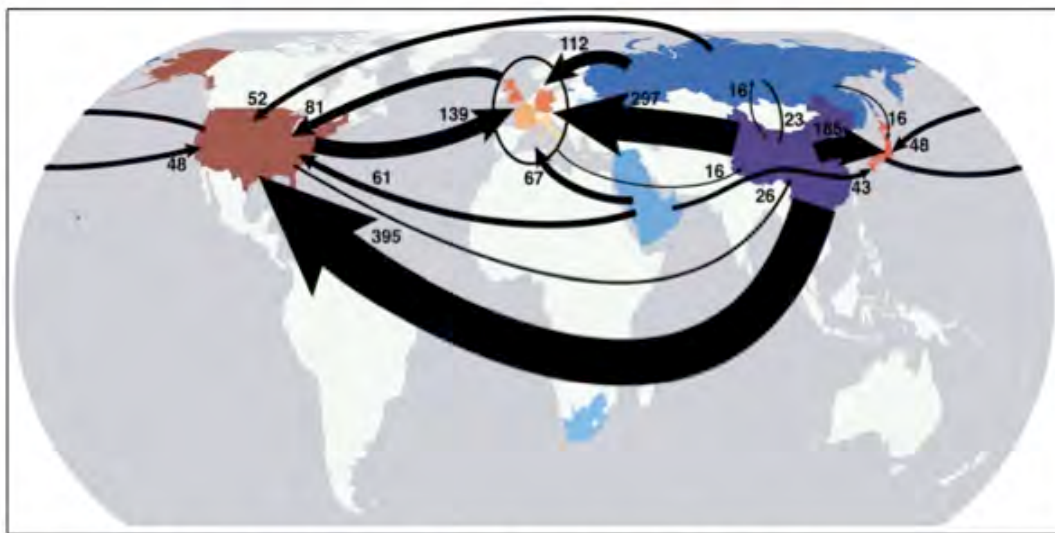
⁶ The current network of stakeholders obstructing sustainability has a lot in common with the well-known idea of a military-industrial complex that is a powerful agenda setter that creates both supply and demand. http://en.wikipedia.org/wiki/Military-industrial_complex

⁷ <http://www.worldenergyoutlook.org/media/weowebiste/2011/pressrelease.pdf>

It is important to note that incremental improvements can be part of transformative solutions if they contribute to a strategy that ultimately will deliver transformative solutions. It is only when they are done without consideration for global sustainability that incremental improvements become part of the problem.

Lock-in has been described, by many leading experts, as one of the most difficult sustainability and innovation challenges in society. Even conservative organisations like IEA have warned that the world is on an unsustainable path and has only a few years to change the current path if we want to avoid dangerous climate change.⁸ Still, very few policies among governments or companies acknowledge lock-in as a factor to consider.

How current initiatives are resulting in unsustainability lock-in becomes visible when we adopt a global perspective and track carbon emissions. Many of the initiatives in the OECD have only moved the emissions, not reduced them, due to a narrow focus on national emissions. The result is a situation where emissions have been moved, in particular to China (see illustration 2).⁹



From dominant net exporting countries (blue) to dominant net importing countries (red).

Illustration 4: Consumption-based accounting of CO2 emissions, by S. Davis & K. Caldeira

Interestingly, very few calculations have been done by OECD governments regarding their full carbon impact, so exact numbers for individual countries are hard to come by.¹⁰ One of the few governments that to their credit have produced official numbers is the UK. These numbers clearly show that all the actions in the UK since 1993 have not resulted in any real overall reductions. The emissions from the surface of the UK have marginally decreased, but the overall emissions (the total carbon footprint) required to allow people in the UK to live like they do have increased by 5 per cent between 1993 (the year after the Rio conference and signing of the climate convention) and 2010.¹¹

⁸ <http://www.worldenergyoutlook.org/media/weowebiste/2011/pressrelease.pdf>

⁹ http://dgs.stanford.edu/labs/caldeiralab/Caldeira_research/Davis_Caldeira.html

¹⁰?? 's and some academics did early work in this area, e.g. The import of CO2 emissions from China and India -)Sweden's contribution to reduction of CO2 emissions - a global dimension <http://www.pamlin.net/new/?publication=the-import-of-co2-emissions-from-china-and-india>

¹¹ <http://www.defra.gov.uk/statistics/files/release-carbon-footprint-dec2012.pdf>

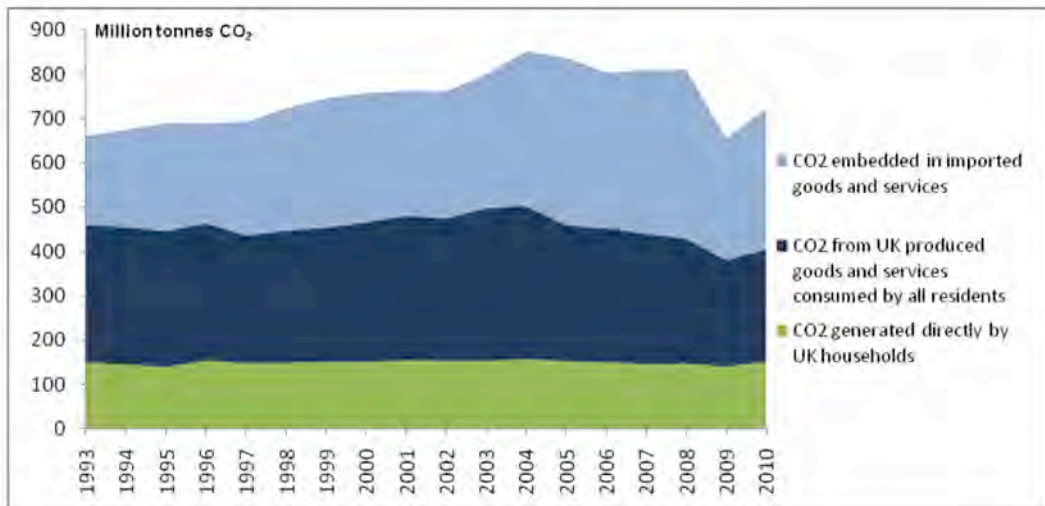


Illustration 5: UK's Carbon Footprint – CO₂ emissions associated with UK consumption 1993 to 2010.¹²

As they have not developed very many solutions that are globally sustainable, the idea that governments from OECD send delegations to countries like India and China – offering capacity building and technology transfer – is therefore slightly ironic from a global sustainability perspective. The fact that no one is a leader when it comes to truly sustainable solutions should be seen as an opportunity as these solutions are available, but need global collaboration for implementation. In the process to ensure broad global uptake of transformative solutions, India might be the world's most important country due to its strategic role as a bridge between east and west, between the developed and developing world, as well as being active member of both G20 and BRICS.

However, in order to move beyond lock-in due to un-strategic incremental improvements and to turn challenges into opportunities, a new strategy for public procurement is required, both in India and other countries.

¹² <http://www.defra.gov.uk/statistics/environment/green-economy/scptb01-ems/>

BOX 1: Illustrating case of incremental investment resulting in unsustainable lock-in

Delhi is a classic case of an Indian city that went from bad to good and back to bad with regards to pollution. The world sat up and took note of Delhi's transformative shift from diesel to CNG to fuel its public transport. Taking action on the Supreme Court's orders to ban diesel use in public transport, Delhi's air improved and pollution stabilized between 2002 and mid-2008. Fuel standards were introduced and sulphur content in Indian fuel was reduced from 10,000 parts per million (ppm) to current 50 ppm.¹

However, since 2008 air pollution levels have been rising steadily. The gains the city made because of the CNG transition in public transport are lost. The fact is that Delhi's automobile population has exploded during this period. The city registers 1,400 vehicles a day. This is more than double what it did in the pre-CNG period. Over 1.2 million car trips are made daily between Delhi and its neighboring cities. That's why even when each vehicle has become cleaner – fuel quality and vehicle emission standards have been progressively tightened at a considerable cost – air quality remains poor because of the drastic increase in the number of private vehicles.²

Worse, government policy has meant that diesel vehicles sell instead of petrol. The price differential between petrol and diesel gives diesel vehicles the edge. The fact is that diesel is now a confirmed carcinogen. Also, diesel vehicles are allowed higher limits for NOx and particulate emissions as compared to petrol cars.

Various improvements of the transport system are currently being considered or tried. The Metro already covers more than 200 km in Delhi and is likely to increase to 420 km by the end of Phase IV in 2020. Investments have been made in upgrading buses and their scheduling and monitoring is being enhanced through GPS and other technologies. Smart traffic management systems are being tested. Other regulatory measures such as banning diesel cars in Delhi, congestion tax, and fuel efficiency standards for cars are also being considered. Some of these measures are radical (that because the nature of the problem is alarming) and collectively they may have transformative impact on Delhi. However, with a population of 16.8 million that is expected to surge to 20 million by 2025, these measures are anything but transformative.

DTC (Delhi Transport Corporation) is planning to run its buses on fuel obtained from wastes such as vegetable waste and sewage sludge. Delhi Jal board's Kehopur plant has been selected as the pioneer site for setting up a biofuel plant. The project is to be carried out with the help of Sweden and will try to keep the costs effective and competitive with CNG.³

The current focus on moving from CNG to bio-waste in public transport is a new initiative that risks to divert focus from the main question, how mobility in Delhi can become sustainable.

What is needed is a shift in focus from improvement in individual transport modes to a situation where transformative solutions for mobility can be included, in order to ensure that innovation is supported and individual well-intended initiatives are not undermined by a lack of assessment of the overall situation.

This would require collaboration over departments and authorities on issues such as broadband connectivity, building standards that allow for solar PV for future charging of electric cars, public transport, policies regulating tele-working and even the possibility of local production.

¹ "Fighting Delhi's smog", Sunita Narain, Centre for Science and Environment, http://www.business-standard.com/article/opinion/sunita-narain-fighting-delhi-s-smog-112112600027_1.html

² "Fighting Delhi's smog", Sunita Narain, Centre for Science and Environment, http://www.business-standard.com/article/opinion/sunita-narain-fighting-delhi-s-smog-112112600027_1.html

³ <http://greencleanguide.com/2011/10/20/dtc-buses-to-run-on-biofuel-from-sewage-sludge/>

2. Current situation

2.1 Basic facts about public procurement in India

Public procurement is a complex and important part of India's economic development. It is a system-wide activity across the central and state governments and their autonomous and statutory bodies and public sector enterprises, with a wide variety of sector/institution specific requirements. Local governments, at the Municipal and Panchayat levels, also follow their individual procurement practices.

The procurement system is further made complex as India does not have a single public procurement policy or public procurement law. There is no separate department in the Central Government to guide public procurement authorities.

In the absence of a comprehensive public procurement law, procurement is governed by and large by the General Financial Rules (GFR), 1963 (as amended in 2005) and the Delegation of Financial Powers Rules (DFPR), 1978, issued by the Department of Expenditure in the Ministry of Finance. The Directorate General of Supplies & Disposals (DGS&D) has its own manual of procurement, and the Central Vigilance Commission (CVC) prescribes guidelines to be followed by all central entities.

Under the broad framework of the GFR, the various departments and other public organizations have developed their own procurement manuals and procedures which they adhere to in conducting procurement activity.

The data on public procurement in India is limited to estimates, due to the absence of specific published data on public procurement. Consistent with the World Bank estimate, the Planning Commission of India in its draft Public Procurement Bill, 2011 had indicated total public procurement in India in the range of Rs.12 to 15 lakh crore.¹³

Rs.12 to 15 thousand billion is about USD 773-966 billion at exchange rate of 1 USD=Rs.45 and a PPP correction factor of 2.9 (Ministry of Finance,

Government of India 2011). Converting to Euros and calculating an average of that span leaves us with €665 billion.

With approximately €665 billion in public procurement India's public procurement is third largest in the world, after US and China, and ahead of Japan.¹⁴ India's public procurement is more than twice the size than the total volume of public procurement in

Public procurement in selected countries (approximate numbers)

EU: € 2 580 billion
US: € 1 000 billion
China: € 747 billion
India: € 665 billion
Japan: € 578 billion

Total sum: € 5 570 billion

"The scale of public procurement is simply enormous and estimates vary between 15 to 20 per cent of GDP or about Rs. 12 to 15 lakh crore per annum in case of India."

The Public Procurement Bill, 2011
Planning Commission
Government of India

¹³ http://planningcommission.nic.in/reports/genrep/public_pro_bill.pdf

¹⁴ EU, US, Japan: http://ec.europa.eu/internal_market/publicprocurement/index_en.htm

China: Public Procurement in China: European Business Experiences Competing for Public Contracts in China

Germany, estimated to roughly €250 billion per year.¹⁵

Other estimations indicate that India's public procurement might be even larger. E.g. according to a paper by the Competition Commission of India (CCI), out of the total public procurement, public sector enterprises (PSEs) alone procure to the extent of Rs. 8 thousand billion annually (the figure relates to 2008-09). Further, it is assumed that procurement by the public sector enterprises is increasing in the range of 10 to 15 percent annually. This takes the current procurement figure by the public sector enterprises (PSEs) alone to about Rs. 10 lakh crores.

During the period 2000-01 to 2010-11, public procurement multiplied by about 3.6 times, increasing from M420,400 to over 1,530,000 crores in 2010-11. The annual growth was recorded at about 14 percent. Interestingly, this figure is consistent with the Planning Commission estimate of public procurement at M15 lakh crores.

As mentioned above, the public procurement market in India is highly fragmented and therefore the total amount is an estimate. Procurement of goods and services is carried out by ministries, departments, municipal and other local bodies, statutory corporations and PSUs both in the Centre and in states. Besides the central ministries and departments, public sector enterprises also form a major share in the overall public procurements.

A major amount of public procurement is done by various State Government Departments. Most of the States have a system similar to the Central Government. The procurement is generally governed by State Financial Rules/Codes, issued by the Finance Department of each State as orders. However, two States Tamil Nadu and Karnataka have come out with specific legislations on public procurement and Himachal and Kerala are in the process of drafting bills on the subject.

The two major bodies overseeing the probity of the procurement process are the institution of the Comptroller and Auditor General (CAG) of India and the CVC.¹⁶ Government of India has commodity-wise purchase directorates including information technology, mechanical engineering, automobiles, steel & cement, hardware, workshop & machine tools, paper & paper products, oil & chemicals.

Despite the almost overarching reach of the Directorate General of Supplies and Disposals (DGSD) and Public Work Departments (PWDs), public procurement in India is fairly decentralized. Each state and every Public Sector Unit will have their own procurement agencies.

The annual expenditure on public procurement for the Central Government is in the range of Rs. 2.5-3 thousand billion. This includes procurement by all Central Government agencies, including defence procurements. Public procurement in India constitutes about 15% of the total budget. Departments like defence, railways & telecom allocate about 50% of their budget to procurement, which happens to be higher than the expenditure of most of the state governments¹⁷.

¹⁵ <http://www.bmwi.de/English/Navigation/Technology/Strong-policy-framework/fostering-innovation-through-public-procurement.html>

¹⁶ http://www.cuts-citee.org/pdf/Government-Procurement-in-India_Domestic-Regulations-Trade-Prospects.pdf

¹⁷ <http://www.cci.gov.in/menu/speechesbypratyushsinhacvc.pdf>

2.2 Key Public Procurement in India

2.2.1 Railways

During the year 2009-10 the total expenses of Indian Railways were Rs.829 billion.

The budget for procurement alone was Rs.279 billion, about USD 18 billion.

The procurement was done for items for manufacturing, fuel, and items for construction as:

- About 40% was for purchase of items required for manufacturing
- 30% for purchase of items required for repairs, operation and maintenance,
- 27% for purchase of fuel and remaining for purchase of items required for construction¹⁸.

2.2.2 Public Healthcare System:

The budget allotment for the National Rural Health Mission (NRHM) has been increased from Rs. 195.486 billion in 2009-10 to Rs. 223 billion which is a 14% increase over the previous year. The Government of India has decided to increase healthcare expenditure to 2.5% of the GDP by the end of the 12th Five Year Plan (2012-17). In Sep. 2012, Union health minister has cleared Rs. 13 billion for states to support their purchase of medicines under the National Rural Health Mission (NRHM).¹⁹

The health expenditure is about 4.5% of the GDP out of which 0.84 % is public expenditure and 3.32 % private and the remaining from other sources including external flow. About 25 to 35 percentage of the Government hospital budget in India is spent on drugs and other pharmaceuticals. Purchasing of medicines starts with the framing of buying policies and ends with receiving, stocking and payment. The requirement of medicines by the Central government and its agencies is much larger and it is estimated to be more than Rs. 20 billion annually.²⁰

Procurement of medicines, vaccines, contraceptives, medical equipment, etc. for various disease control programs of the Central and state are required for millions of employees of the Central government and for health departments of state governments such as railways, defence department, public sector oil companies, etc. For the Central government, most of the purchases are made under the Central Government Health Scheme of the health ministry apart from the direct purchases by undertakings like Railways, SAIL, Coal India, etc.²¹

2.2.3 Defence

The Union Budget 2012-13, has allocated US \$40.3 billion for the Defence Services that include the three armed forces (Army, Navy and Air Force), the Defence Research and Development Organization (DRDO) and Ordnance Factories. India's defence budget is broadly divided into two categories: Revenue Expenditure and Capital Expenditure.

- **Revenue Expenditure:** It is the 'running' or 'operating' cost of the defence services. The major items include pay and allowance, transportation, stores (such as ordnance

¹⁸ Public Procurement- a case study of the Indian Railways (Bodhibrata Nag Associate Professor, IIM Calcutta, D. H. Road, Joka P.O., Kolkata 700 104 India)

¹⁹ http://articles.timesofindia.indiatimes.com/2012-09-20/india/33976415_1_free-medicines-health-centres-platelet-drugs

²⁰ <http://aims.amrita.edu/school-of-pharmacy/pdfs/Emerging%20trends%20in%20medicine%20procurement%20in%20government%20sector%20in%20India.pdf>

²¹ <http://pharmabiz.com/ArticleDetails.aspx?aid=68328&sid=3>

stores, supplies by ordnance factories, rations, patrol, oil and lubricants, spares, etc.), and works (which include maintenance of buildings, water, electricity charges, rents and taxes, etc.). In the new budget, the Revenue Expenditure has increased by 19.5% to \$23.7 billion, primarily due to increase in the manpower cost of the armed forces.

- **Capital Expenditure:** For procurement of big items such as tanks, aircraft and aero-engine, ships, submarines etc. The Capital Expenditure has increased by 15% to \$16.6 billion.²²

2.2.4 Telecom

India's 787.29 million (including 752.20 million of wireless telephony) strong telephone network is the second largest wireless network in the world. India is also the fastest growing telecom market in the world with an average addition of about 10 million connections every month during 2011-12 in the network, this is down from 18 million 2010-2011. This rapid growth in the telecom network has resulted in an overall tele density of 77.57% at the end of January 2012.²³

The Government of India approved a project for the creation of a National Optical Fiber Network for connecting 2.5 lakh Gram Panchayats with support from the Universal Service Obligation Fund (USOF). The proposed National Telecom Policy, under finalization in consultation with various stakeholders, is a step forward for bringing rapid and equitable growth of this sector.

Similarly other schemes being implemented are:

- Optical Fiber Network Augmentation, Creation and Management of Intra-District SDHQ-DHQ OFC Network in NE-I Circle (comprising states of Meghalaya, Mizoram & Tripura).
- Optical Fiber Network Augmentation, Creation and Management of Intra-District SDHQ-DHQ OFC Network in NE-II Circle (comprising states of Arunachal Pradesh, Manipur & Nagaland)
- Rural Wireless Broadband Scheme
- Satellite Broadband connectivity for Rural & Remote Areas
- Scheme for Mobile Communication Services in Uncovered Villages

For all these activities, Government of India has allocated an amount of Rs. 30 billion in the Budget Estimate (BE) 2012-13 out of which an amount of ` Rs. 25.46 billion has been allocated for creation of National Optical Fiber Network (NOFN) for Broadband connectivity to 2.50 lakh Village Panchayats of the country which has been approved by the Cabinet. Government is also going to provide Broadband connectivity at a cost of approx. Rs. 200 billion to all 250 thousand Gram Panchayats. The plan is to extend the existing optical fiber network up to Panchayats.²⁴

Therefore, in the coming years, the Public Procurement in all these sectors is going to cost a huge amount in India. The huge amount for procurement can be used to mitigate the problems like poverty and environment in India. With the help of programs like E-

²² <http://www.defencereviewasia.com/articles/169/India-s-Defence-Budget-2012-13>

²³ http://www.dot.gov.in/finstatus/Outcome_Budget_2011-12_.pdf

²⁴ <http://india.gov.in/budget-department-telecom>

education, E-health, E-governance the issues of poverty and environment can be addressed in the future. Promotion of Green Products by the Government will also help in reducing the environmental problems, e.g. Indian Railways are now fitting Eco toilets in the coaches for hygienic and clean toilets for all the people. It will also reduce the maintenance cost of the tracks damaged by the waste from railway toilets.

2.3 Public Procurement Reforms by Indian Government

Government has done many reforms for the Public Procurement system which will reduce corruption and will give transparent and accountable procurement processes such as:

Public Procurement Bill 2012: The Union Cabinet on 12 April 2012 approved the Public Procurement Bill, 2012 for introduction in the current session of the Parliament. The Bill seeks to regulate procurement by Ministries/ Departments of the Central Government and its attached/subordinate offices, Central Public Sector Enterprises (CPSEs), autonomous and statutory bodies controlled by the Central Government and other procuring entities with the objectives of ensuring transparency, accountability and probity in the procurement process, fair and equitable treatment of bidders, promoting competition, enhancing efficiency and economy, safeguarding integrity in the procurement process and enhancing public confidence in public procurement.

At other points (eg Clause 21) the Bill permits contracting authorities to have regard to factors such as “environmental characteristics”.²⁵ There is no direct reference to or mention of procurement of transformative solutions. Nevertheless, there are many ways for those responsible for public procurement to use the procurement rules in order to support transformative solutions. The Bill is based on broad principles and envisages a set of detailed rules, guidelines and model documents. The Bill builds on national and international experience and best practices, as appropriate for the needs of the Government of India.²⁶

Central Procurement Agency: India's Planning Commission has approved the establishment of Central Procurement Agency (CPA) with a one off grant of Rs. 500 million (US\$11.1 million). The CPA will be responsible for the procurement, storage, and distribution of health-sector goods for the various national health programs under the Ministry of Health and Family Welfare (MOHFW). The agency is expected to implement changes to the procurement rates, a new supply chain, quality control, and monitoring systems.²⁷

Defence Procurement Procedure 2006 (DPP 2006): DPP 2006 has been developed for reasons such as:

- Enhance the research development and production facilities in India,
- Enlarge the Defence Offset Implementation policy benefiting the domestic private sector firms.
- Introduce vendor registration through internet to facilitate the participation of Indian industries, maintain transparency in performance of field trials.
- Pre-contract integrity pact and level playing field for Indian industry along with DPSUs and ordnance factories (OFs).²⁸

²⁵ http://www.ijetae.com/files/Conference%20ICERTSD-2013/IJETAE_ICERTSD_0213_83.pdf

²⁶ <http://pib.nic.in/newsite/erelease.aspx?relid=82204>

²⁷ <http://www.ihs.com/products/global-insight/industry-economic-report.aspx?id=106599661>

²⁸ http://www.researchandmarkets.com/reports/544643/indian_defence_industry_report.pdf

2.4 Existing green procurement

India’s first steps towards green procurement legislation started in the 1980s with the Environment Protection act in 1986. The act was a blanket legislation that laid the foundation for the establishment of many agencies and subsequent norms and legislations, which form the core of the country’s environmental strategy. Most of these impact the green procurement space in one way or the other. There is also separate legislation aimed at specific industries. Examples of this include the vehicular emissions norms which primarily impact the automotive industry, but have repercussions for almost any industry due to its impact on transport and logistics.

The eco-labelling scheme by the government, EcoMark, is an example of a scheme that has a more generic impact on industry, as is the Energy Conservation Building Code which came out in 2006. Implementation of all these is also distributed among the various ministries and government arms, and there is no single body which has full jurisdiction over all environmental or green legislation.

The main legislative roadmap on green procurement in the country is dependent on the various Five Year Plans. The recently concluded 11th Five Year Plan, from 2007-2012 is no exception. The Plan laid greater emphasis on energy efficiency and green energy. The result has been a greater level of synergy with existing legislative and “green” energy goals. The increase in solar energy in the last five years is an example.

The main legislation, which covers most environmental initiatives in the country, is the EPA. Most of the other legislative efforts either come under the aegis of this or are offshoots from previous EPA initiatives.

Exceptions from the EPA can be made to the Energy Conservation Act of 2001 which resulted in the creation of the BEE (Bureau of Energy Efficiency) in 2002 and the ECBC (Energy Conservation Building Code) in 2007. The Act was derived independently from the Five Year Plans based more on energy savings considerations rather than environmental considerations. Together the Five Year Plans, the EPA and the ECA (more specifically the ECBC) are the backbone of all major legislative efforts for green procurement in the country.



Above structure does not imply hierarchy of legislations and agencies

Illustration 6: Schematic diagram of environmental policies in India

Environmental and therefore green procurement legislation in India is under the purview of several ministries and other government bodies, often with significant overlap in responsibility and oversight. For instance, public procurement legislation rests with the Ministry of Finance, efforts for green procurement guidelines are led by Ministry of Environment & Forests, whereas energy efficiency labelling is an effort of the Ministry of Power. Legislative oversight is often awarded to the ministry most suited to oversee and enforce the areas that a piece of legislation covers, but this too might result in several ministries being involved in a single scheme.

The extent to which ministries are involved in environmental or “green” procurement also depends on the current climate roadmap. New legislation brought about by schemes the National Action Plan on Climate Change has established more independent bodies under ministries and existing bodies to develop, oversee and enforce each piece of legislation. However, it is possible to narrow down the major ministries and government bodies involved in green procurement to a much shorter list than would otherwise be there based on oversight and powers. These major ministries and government bodies involved in the Indian green procurement sector are:

1. The Ministry of Environment and Forests (MoEF)
2. The Ministry of Power (MoP)
3. The Ministry of New and Renewable Energy (MNRE)
4. The Ministry of Commerce and Industries (MCI)
5. Bureau of Energy Efficiency (BEE)
6. Central Pollution Control Board (CPCB)
7. Bureau of Indian Standards (BIS)

Procurement for greener products tends to have incremental impact. That is because procurement is typically done for a technically specified product that is supposed to get a certain job done. The result is getting the same task done repeatedly with the same specifications or with improved specifications that have efficiency gains. Green public procurement does the same. It makes technical product specifications “greener” as compared to prevalent specifications. By no means is this process of replacement redundant. Significant portions of money and natural resources are spent on repairs and replacements. Aggregated quantum of incremental benefits is substantial. However, specification based procurement for transformative solutions will not work in most cases as a broader assessment of the needs is necessary to identify new ways to provide the service required.

2.5 Existing procurement for innovation

The current focus of public procurement in India is on replacement or replenishment of current solutions. That is also how public procurement across the world is currently organized. However the aggregate demand that public procurement generates mainstreams specific solutions in society as well as shapes underlying infrastructure. The same demand that currently is holding new solutions back can induce market shifts resulting in creating accelerated uptake of new innovations alongside economic value creation. For any innovation to become mainstream, a certain market transition guided by public procurement can lead to faster adoption, quicker improvements, and short innovation cycles between different solutions.

Though public procurement in India is focused on regular business, there are instances where public procurement has helped mainstream innovations. In the remaining part of the report, three sectors – telemedicine, street lighting, and mobility - are discussed. Each case is a success story where public procurement has created or has the potential to create social and environmental value. Huge economic gains are identified as new markets are created by mainstreaming solutions.

2.6 Transformative solutions in India

There are sporadic and ad-hoc instances of smart / efficient / green public procurement. Some of these can be considered as initial transitional steps towards “transformative solution”. Luckily, some of the biggest buyers in the Indian public procurement space – such as railways, healthcare, defense and telecom – have pioneered this trend.

Indian Railways	Indian Railways has taken several measures to improve energy efficiency. It ranges from adoption of 3 phase locomotives (saving 15% - 18% of energy) to 3 phase EMU (saving 35% - 40% of energy). Along with this procurement of static converter of higher efficiency, power factor correction equipment for traction substations, CFL and T5 florescent lamps have added onto the energy efficiency promotion measures of Railways. Application of solar energy for manned level crossings, roadside stations and use of biodiesel for traction have been some of the significant initiatives of Railways in addressing energy efficiency. The Ministry of Railways is in the process of issuing a directive of applying 3 star energy appliances for saving energy. ²⁹
Indian Railways	Indian Railways is installing green toilets on its coaches to overcome the problem of waste from the coach toilets on the tracks. These measures are being taken by the Indian Railways as a part of its green initiatives and also to reduce the cost of cleaning the tracks which is currently over Rs. 3.5 billion per year.
The Bureau of Energy Efficiency India	The Bureau of Energy Efficiency India (BEE) has been providing grants to Indian municipalities to undertake pilot trials of LED street lamps since 2009. Currently, 13 LED projects have been completed in cities in Arunachal Pradesh, Assam, Maharashtra and Nagaland.
Delhi Transport Corporation	Delhi Transport Corporation (DTC). DTC (Delhi Transport Corporation) is planning to run its buses on fuel obtained from wastes such as vegetable waste and sewage sludge. Delhi Jal board’s Kehopur plant has been selected as the pioneer site for setting up a biofuel plant. The project is to be carried out with the help of Sweden and will try to keep the costs effective and competitive with CNG. ³⁰

²⁹ <http://www.indianrailways.gov.in/>

³⁰ <http://greencleanguide.com/2011/10/20/dtc-buses-to-run-on-biofuel-from-sewage-sludge/>

3. Transformative cases

Putting transformative solutions to immediate use is one of the few and effective ways to solve in one generation the chronic ecological and social challenges. At the current pace of political movement on challenges and incremental policy change in most countries, the world is anything but on the fast-track to being sustainable.

In this section, we present three cases to demonstrate the potential of transformative solutions. Each solution is a presentation to transform the sector with substantial positive impacts on environment and society (reductions of CO₂ and poverty reduction).

3.1 Lighting: From old street lighting to smart LED lighting³¹

3.1.1. General background

According to an estimate by Government of India³², inefficient energy consumption patterns by most government buildings alone result in a financial loss of about Rs. 1.5 billion (USD40 Million) a year as they waste 20-25 per cent of the total electricity.

As a first initiative to achieve energy efficiency, the Government of India is committed to set an example by implementing the provisions of the Energy Conservation Act in all its establishments.

The Indian LED market is anticipated to grow by 54% till 2014 based on the industry estimates. The growth factors can be attributed to issues such as:

- Government support for promoting investments in energy efficient lighting. Development of national standards for testing and performance evaluation.
- Transfer and improvements in existing technology for new applications. Global mandate to address GHG emissions, and decline in average prices of LED.

It is expected that by 2021, the LED technology will penetrate 57 percent of the lighting market. This penetration may be accelerated by the demonstrated leadership by the government procurement and large scale penetration by the public sectors. Private sector by its cost economics will be early adopters in LED market.

Recognizing the benefits of this technology, the Bureau of Energy Efficiency (BEE) is working with lighting associations to define standards, and is testing protocols and certifying parameters for different lighting applications. Star rating labels are being made mandatory for luminaires/lamps for indoor commercial and outdoor lighting applications.

Artificial light is an essential element of our lives. It is as much a matter of lifestyle as it is of livelihoods. Lighting accounts for 19 percent of all electricity consumed. One-third of the world's roads are still lighted by technology dating back to the 1960s. The installation of new street lighting solutions can save up to €10 billion in energy per year.³³

A well-designed, energy-efficient street lighting system should permit users to travel at night with good visibility, in safety and comfort, while reducing energy use and costs

³¹ Authors are grateful to Jan-William Scheijgrond, Philips to contribute to this section. All references to Philips are attributed to Mr Scheijgrond and the point of view paper quoted below.

³² <http://www.teriin.org/index.php>

³³ Crowther James, Herzig Christoph, Feller Gordon, The Time Is Right for Connected Public Lighting Within Smart Cities, Cisco Internet Business Solutions Group (IBSG), 2012

and enhancing the appearance of the neighbourhood. Conversely, poorly designed lighting systems can lead to poor visibility or light pollution, or both. Quite often, street lighting is poorly designed and inadequately maintained (e.g., there are large numbers of burned-out lamps), and uses obsolete lighting technology - thus consuming large amounts of energy and financial resources, while often failing to provide high-quality lighting. The Bureau of Energy Efficiency at the Indian Ministry of Power, based on Central Electricity Authority statistics, has estimated gross energy consumption for public lighting to be 6,131 million kWh in India for the years 2007-2008.³⁴

Philips estimates that a complete switch to LED technology can generate savings of approximately €130 billion - an enormous sum equivalent to the elimination of 640 medium-sized power stations globally.

Furthermore, an independent, global trial of LED technology in 12 of the world's largest cities found that LEDs can generate energy savings of 50 to 70 percent - with savings reaching 80 percent when LED lighting is coupled with smart controls. The program also indicated that citizens of pilot cities prefer LED lighting, citing the social and environmental benefits, such as a greater sense of safety and improved visibility. The LED lighting revolution is gaining traction: worldwide, 10 percent of new public streetlights installed are currently LED-based - a figure expected to rise to 80 percent by 2020.

India's LED street lighting, estimated to be about \$55 million (Rs 290.41 crore) in 2011, is projected to grow at more than 47 per cent annually, according to a study by Frost & Sullivan. The LED lighting market is expected to grow to \$478.62 million (Rs 2527.25 crore) by 2015. By replacing the entire street lighting to LEDs, India could establish three sizeable power plants that could produce the entire electricity requirement of 16,000 villages.

Replacing a typical 250 watt streetlight with LED can save more than 50 per cent of the energy consumed by the conventional lightings like GSL. A 5-watt LED can replace an 18 watt CFL. The payback time for a LED is pegged at three years, while it comes with a five-year warranty and the maintenance cost is very low as no maintenance is required during the first five-six years. However, companies need to localise products to cope with the Indian climate.

An isolated policy to shift from old lighting to LED lighting in streetlights, even if they are also part of a smart control system, is only a technology shift. However, with a transformative strategy the development of smart controlled PV charged street lighting can become part of a broader lighting strategy that also includes rural lighting.

With such an integrated transformative approach, lighting on a local, city, national and international level can help promote smart lighting in a way that provides lighting to those in need. This could for example happen by assessing what kind of LEDs are needed and how the process can be brought down, but also encourage system solutions with LED, solar PV and batteries in order to support clusters that can deliver lighting in multiple areas

³⁴ Energy efficient street lighting guidelines, Bureau of Energy Efficiency, 2010

LED- links to fibre-optics and architecture should be included so we open up for new clusters.

India's power ministry intends to install about 25 million LED bulbs over the next 3-4 years to electrify Below Poverty Line (BPL) households. This initiative under the government's Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY) - the rural electrification program - is to promote LED bulbs under the Super Efficient Equipment Program (SEEP) in the 12th Five Year Plan (2012-16).³⁵

3.1.2. Public procurement of street lighting

LED street lighting is fast catching up in India. Initiated by BEE's pilot programmes in 2009-10, municipalities across the country are now following procurement systems as suggested by BEE.³⁶ The BEE had in 2010 developed street lighting guidelines for municipalities that suggested procuring energy efficient lighting solutions rather than materials. BEE has been providing grants to Indian municipalities to undertake pilot trials of LED street lamps. Public lighting in India requires approximately 4400 MW of connected load, so targeting street lighting makes sense, if 50-70 percent energy reduction can be achieved through installation of LEDs.

In Kolkata trial installation of the first group of 273 Philips Lumec luminaires took place in October 2010, with 180W and 150W LED models replacing the existing 440W and 250W high-pressure sodium (HPS) lamps, respectively. The LED luminaires are meeting India's IS 1944 Group A1 roadway-lighting standard, which mandates an average luminance of 30 lux. The LED luminaires are also providing more luminance than the baseline HPS luminaires, while achieving nominal savings ranging from 40% to 59% for replacement of the two HPS wattage types.³⁷

Chennai Corporation's new programme to improve lighting in the city will focus on replacement of around 60,000 old streetlights in eight added zones.³⁸ The initiative of the civic body is likely to be a stepping stone for replacement of tube lights with energy-saving lights such as induction lamps, LED lights and compact fluorescent lamps. All the new 60,000 streetlights will be LED lights, as they last five times longer than sodium vapour lamps. The initiative is expected to bring down the level of energy consumption by 25 per cent and save Rs 360 million units in the coming year. The actual target of the civic body is the installation of 0.1 million such energy saving lights. The civic body also chose the LED streetlights for their aesthetic merit.

The street lighting system in the 426 sq km of the city has just 0.22 million streetlights, and the expanded areas have only 88,000 old streetlights. After expansion, the Chennai Corporation claimed to have brought down the percentage of streetlights that are not burning in the eight added zones to less than 5 per cent. Most of the new streetlights in key stretches are expected to be commissioned by March 2013.³⁹

³⁵ http://www.ledinside.com/news/2012/12/indian_led_bulbs_bpl_household_20121217

³⁶ Energy efficient street lighting guidelines, Bureau of Energy Efficiency, 2010

³⁷ <http://ledsmagazine.com/features/8/10/5>

³⁸ Added zones to get 60,000 LED streetlights, Reported on 20 December 2012, <http://www.thehindu.com/news/cities/chennai/added-zones-to-get-60000-led-streetlights/article4218663.ece>

³⁹ Added zones to get 60,000 LED streetlights, Reported on 20 December 2012, <http://www.thehindu.com/news/cities/chennai/added-zones-to-get-60000-led-streetlights/article4218663.ece>

Gujarat Power Corporation Limited (GPCL) in September 2012 invited Expressions of Interest for Supply, Installation and Maintenance of 20,000 Solar LED Streetlights in various rural areas of Gujarat.⁴⁰ GPCL is a nodal agency for implementation of solar energy projects such as the Solar Park at Charanka, Patan, and the Gandhinagar Photovoltaic Rooftop Programme.

3.1.3. Transformative clusters

From the success of pilots, LED manufacturers are wooing governments and municipalities for LED street lighting projects.⁴¹ Lighting companies such as Philips Electronics, US-based Bridgelux, GE, home-grown NTL Electronics, are trying to woo the state governments and municipalities to convert conventional street lighting to LEDs. However, it may not be easy to convince the governments as cost of implementation is much higher than the conventional lighting, as luminaries are expensive, with a price range of Rs 3,750 to Rs 50,000 each. Companies, thus, are banking on energy savings and environment concerns, including minimum emission of carbon dioxide and no radiated heat to bag the government projects.⁴²

Possible lighting cluster:

1. Providers of different kinds of lightings (e.g. traditional, CFL, LED etc)
2. Providers of integrated solutions (e.g. LED, solar PV and batteries)
3. Service providers that sell the service and not the products.
4. Providers of sustainable energy for lighting
5. City planners/architects

3.1.4. Lessons learnt

Application of LED technology can result in reducing a significant quantity of carbon emission, lowering by more than half (60 to 70%) of consumption of electricity. LED technologies have potential to impart sustainability due to important features such as low power consumption, environmental friendliness, product availability, increasing competitiveness, cost effectiveness, hazardousness, durability, and all weather usage.

The adoption of energy saving technologies like LEDs in street lights, commercial lights, traffic lights, signage and display boards has reduced the level of energy consumption by more than 50%. Saving of 100,000 kWh power with use of LED can result in reducing 100 tons of carbon emission.⁴³

With the Indian Government Initiatives such as “Bachat Lamp Yojana”(BLY) aims to replace 400 million incandescent with CFL lamps. This is expected to save 6000 MW of electricity (potential cost savings of US\$ @4 billion /annum), and an estimated CO₂ reduction of 20 million tonnes.

According to the studies conducted by TERI in 21 municipalities in India for Street Lighting (AP, Karnataka, Maharashtra & Delhi) with a total population of 55.14 lakh. The

⁴⁰ GPCL Request for Expression of Interest <http://www.germi.org/downloads/solar-instalation-maintenance.pdf>

⁴¹ http://www.business-standard.com/article/companies/philips-bridgelux-ntl-compete-to-switch-on-leds-for-street-lighting-112101400021_1.html

⁴² http://www.business-standard.com/article/companies/philips-bridgelux-ntl-compete-to-switch-on-leds-for-street-lighting-112101400021_1.html

⁴³

http://www.academia.edu/331185/LED_technologies_a_way_to_create_sustainability_in_energy_sectoral_system_of_Innovation_of_NICs_A_case_of_India

Energy saving potential varies between 15 to 40%. GHG potential per annum is about 50,000 MT per annum.

The Energy Efficient Street Lighting Guidelines 2010 of the BEE illustrate energy-efficient street lighting project cycle (figure below). The diagram marks departure from a typical procurement of materials to procurement of solution, in this case street lighting by municipalities.

STEP ONE: Technology shift

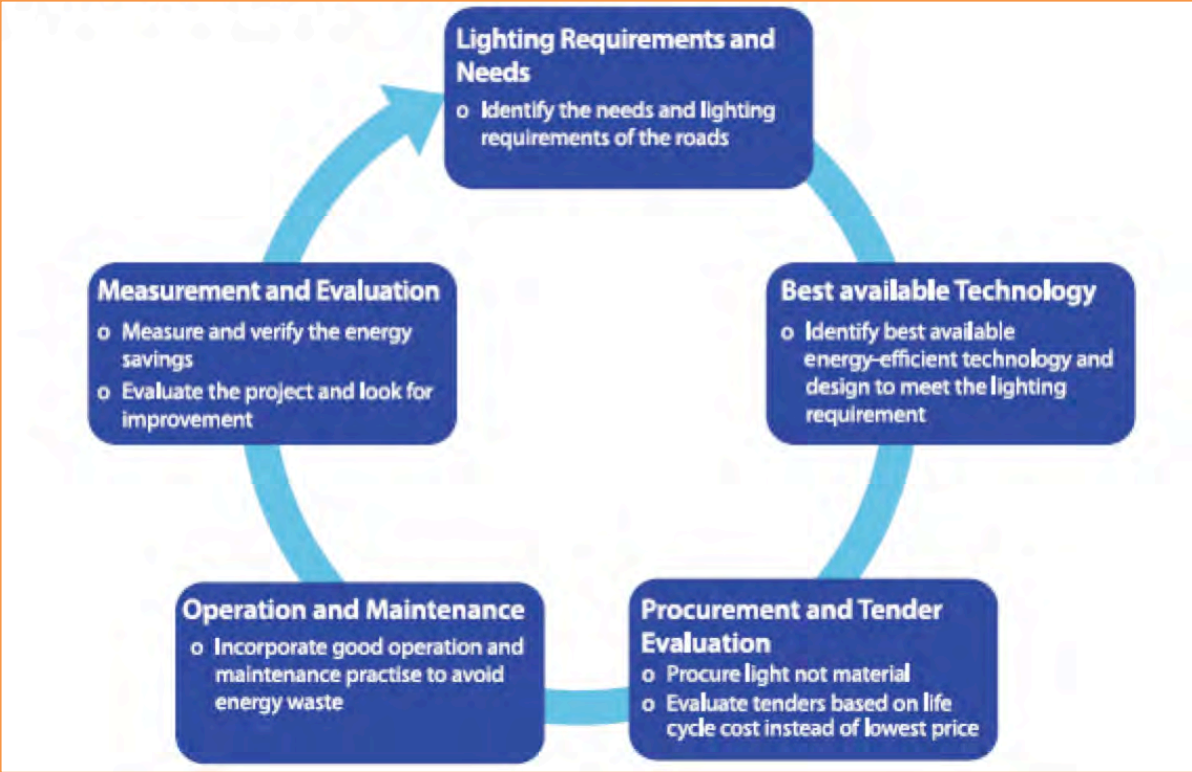


Illustration 7: Energy efficient street lighting project cycle

Switching to LED street lighting alone, however, will not be enough to meet cities’ energy consumption and cost reduction targets. Adaptive, interoperable lighting solutions are needed to bring savings to a next level. Urban leaders now face a dilemma: cities are complex entities where inefficiencies arise because systems are not interconnected and have no way to “talk” to one another. A joint effort is required to realize the vision of smart connected cities, enabling meaningful innovation for years to come.

The future of public lighting will transit from analogue to digital, from fluorescent light bulbs to solid-state lighting - all connected to an energy grid through a variety of last-mile access technologies (see Figure 1).

Additional savings can be achieved by incorporating connected controls to the Internet. And even greater value can be derived by using the lighting network for other connected services. Ubiquitous wireless connectivity and an “Energy Internet” are recognized by city authorities as enablers of these improvements.



Illustration 8: Moving from “traditional” to “intelligent” lighting networks

With focus on transformative solutions such a shift could also allow for smarter procurements that also ensure that strategic areas like street lighting and urban lighting help support rural lighting as per STEP TWO below.

Some 1.5 billion people around the world and of them 500 million in India live in a state of energy poverty. Disconnected from any power gridlines, these people rely on traditional methods such as firewood or kerosene for their energy needs. In addition to generating millions of tonnes of CO₂, the social costs of kerosene and firewood are enormous. Some social costs include respiratory illnesses, accidental fires and burns, high risk of crime, and virtually no opportunities for health and education in no or dim lights.

Studies indicate the carbon emission of 134 kg per year per kerosene lamp.⁴⁴ Kerosene is not only expensive accounting for nearly 20 per cent of global lighting costs,⁴⁵ it is also hugely inefficient, generating only 0.2 per cent of global lighting output.⁴⁶

The fact is that the poorest are already paying heavily for kerosene oil to the tune of Rs 80-150 per month, that is US\$ 1.78- 3.30 (@ Rs 9/ litre (US\$ 0.2) from the PDS or the public distribution system); while the nation pays almost three times as much per litre amounting to Rs 30,000 crores per annum (US\$ 6.7 billion) in kerosene subsidy. This amounts to a spend of up to Rs 2000 (US\$ 44) per annum on kerosene alone, without considering the additional costs of black-marketed kerosene owing to leakages in the PDS, cost of batteries for torches, and cost of damage to health from polluting smoke and eyesight from dim kerosene oil lamps.

⁴⁴ E. Mills, Data for hurricane kerosene lamp (wick), ‘Spectre of fuel-based lighting’, 2005

⁴⁵ <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=504&ArticleID=5570&l=en>

⁴⁶ E. Mills, ‘The \$230 billion global lighting energy bill’, International Association for Energy-Efficient Lighting’, June 2002

Studies indicate the carbon emission of 134 kg per year per kerosene lamp.⁴⁷ Kerosene is not only expensive, accounting for nearly 20 per cent of global lighting costs,⁴⁸ it is also hugely inefficient, generating only 0.2 per cent of global lighting output. In addition to generating millions of tonnes of CO2, the social costs of kerosene are enormous. Some social costs include respiratory illnesses, accidental fires and burns, high risk of crime, and virtually no opportunities for health and education in no or dim lights.

Given that 83 million people in India are dependent on oil-based lamps and annual kerosene subsidy is approximately \$5 billion and contribute to two per cent of India’s CO2 emissions, smart lighting would not only be an important poverty reducing measure, it would save 14-28 million tonnes of CO2 only in India and among the poor. This compares with Sweden’s direct CO2 emissions of approximately 50 million tonnes.

Obviously such a lighting approach would have significant poverty reducing potential as well as a big global CO2 reduction potential if extended to other poor regions of the world as well as the affluent populations.

STEP TWO: Overall lighting strategy with street/urban lighting together with rural lighting.

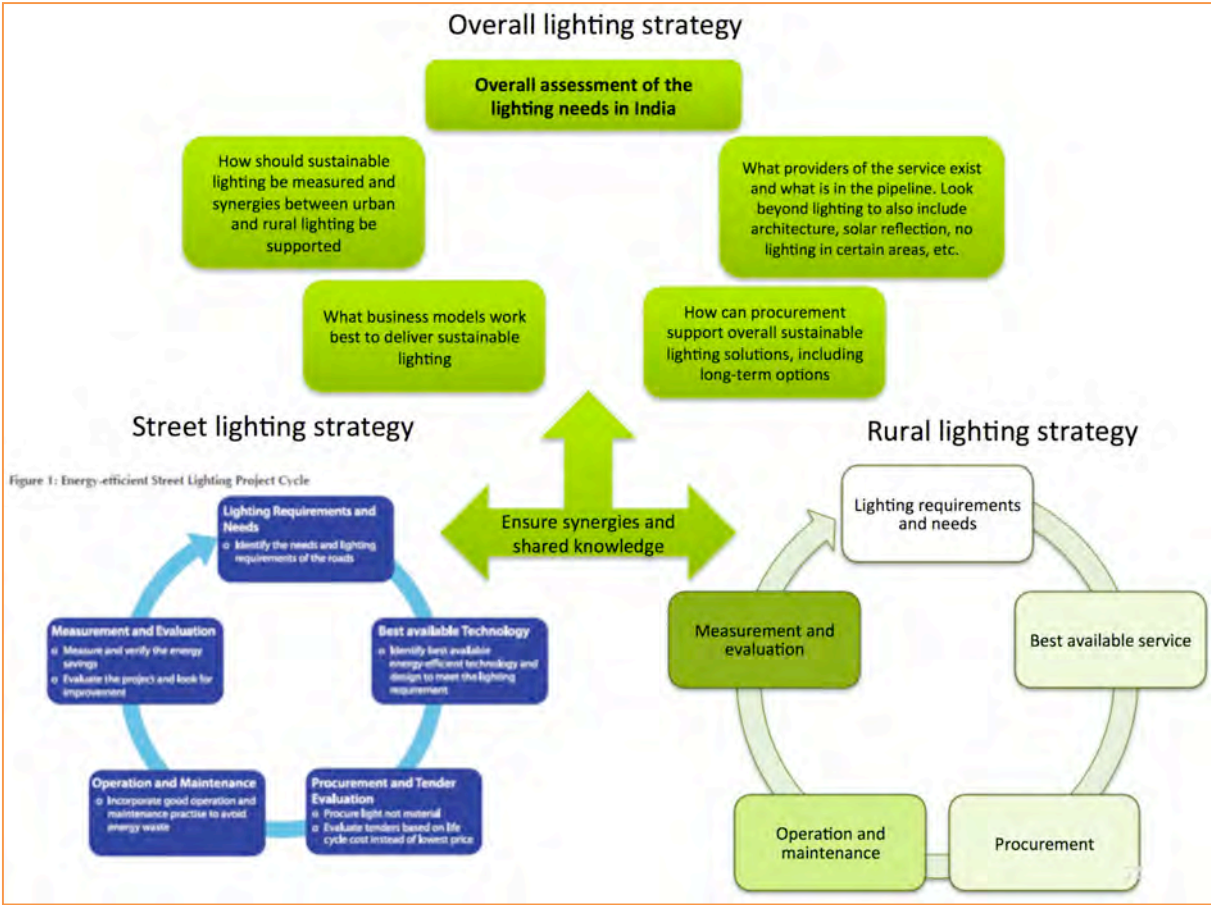


Illustration 9: Overall lighting strategy

⁴⁷ E. Mills, Data for hurricane kerosene lamp (wick), 'Spectre of fuel-based lighting', 2005
⁴⁸ <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=504&ArticleID=5570&l=en>

To ensure that procurement of street lighting is part of an overall lighting strategy where rural lighting is included, an overall lighting strategy is needed for India. This does not have to be run by any central body, but rather be a process where the different initiatives have the opportunity to identify synergies and share knowledge.

3.2 Mobility – shift from transporting people and goods to moving services

3.2.1. General background

Mobility has come to be understood as movement of people and goods in most policy strategies. For any job that needs to get done the format is that people go to point of delivery to get the job done. In the industrial era disruption of mobility got a new meaning through Ford and Volkswagen. The car become so affordable that it became the standard way for people to think about mobility.

More cars raised demands for wider roads, more autobahns, and ever more parking space. Neighborhoods were redeveloped to accommodate more cars. Soon, the automobile industry’s growth became a barometer for economic health. In every slowdown or economic crisis in the last 150 years, governments gave stimulus to the auto industry to revive their economies.

Large cities around the world are choking with cars. New York to New Delhi, traffic congestion adds to economic costs. Typical solution is to build more roads. Interestingly, that only aggravates the problem. Researchers, from the University of Toronto and the London School of Economics, determined that the number of vehicle-kilometers travelled (VKT) increases in direct proportion to the available lane-kilometers of roadways. The implication is that building new roads and widening existing ones only results in additional traffic that continues to rise until peak congestion returns to the previous level.⁴⁹

GHG and CO2 emission data is however very poor in India. The baseline position and future projections are all uncertain. From the available data, the transport sector produces around 10% of India’s total CO2 emissions. Road transport contributes to 95% of this. A BAU projection has been developed for India and Delhi using the Long Range Energy Alternatives Planning (LEAP) software.

Passenger road transport CO2 emissions in India are projected to rise from around 20 MtC in 2004 to 235 MtC in 2030. Growth is also experienced in Delhi, from around 1.3 MtC in 2004 to 7.5 MtC in 2030. Much of this is driven by rapid mobility growth, including rises in vehicle ownership and use.

	2005	2010	2015	2025	2035
Vehicles (millions)	49	80	121	246	328
Fuel consumption (Mtoe per year)	72	104	143	272	482
CO2 emissions (MtC per year)	60	86	118	225	400

India’s urban population is currently around 30% of its total population. Experience across the world has been that as economies grow, rapid urbanization takes this

⁴⁹ Gilles Duranton, Matthew A. Turner. "The Fundamental Law of Road Congestion: Evidence from U.S. Cities". American Economic Review, Volume 101, Number 6, Pages 2616-52, October 2011

proportion to over 60% before it begins to stabilize. As such, it is projected that India's urban population would grow to about 473 million in 2021 and 820 million by 2051, as against only 285 million in 2001.

Hence, cities must not only meet the mobility needs of the current population but also provide for the needs of those yet to join the urban population. In this context, the Government of India has launched the National Urban Renewal Mission (NURM) that inter-alia seeks to bring about comprehensive improvements in urban infrastructure, committing substantial funds for this purpose and requiring a series of reforms that would make the investments sustainable.

India's current transport emissions are 7.5% of the country's total emissions which are forecast to grow to 15% by 2025, increasing at 4.5% Cumulative Annual Growth Rate (Source: IPCC). With 87% of current transport related GHG emissions coming from road transportation, the road transportation becomes the key area to target for emissions reduction for India to achieve its voluntary emissions reduction goals.

Despite the seriousness of India's projected growth in CO₂ emissions and the perceived difficulties in breaking BAU trends, no serious attempt has been made to formulate targets for India's (or Delhi's) future transport sectoral emissions. Although starting from a low per capita base (much lower than the so called developed countries) there is still a requirement to contribute to global CO₂ emission reduction aspirations. Government of India has stated some initiatives such as:

- **Policy - National Urban Transport:** Policy (NUTP) launched mid-2006 by the Ministry of Urban Development (MoUD) was created to motivate the building of people centric urban transport solutions instead of focusing on improving the conditions for private motor vehicles. The launching of the Government of India central assistance fund, the JnNURM provided a timely platform for providing significant financial support for investments in urban transport infrastructure. The NUTP policy provides a meaningful policy guiding central financial assistance towards improving urban mobility and consequently quality of life in cities across India.
- National Action Plan for Climate Change was launched in mid-2008 and provided additional support and solidified India's commitment to a sustainable transport solution. A sub clause called "A National Mission to Sustainable Habitat" will be launched to make habitat sustainable through a modal shift to public transport, by promoting energy efficiency as an integral component of urban planning and renewal as well as facilitating the growth of medium and small cities in ways that ensure efficient and convenient public transport.
- In 2003 a policy directive from the Government of India stated that petrol sold in the nine states of India should introduce a 5% blend of ethanol.⁵⁰
- In spite of broadband penetration in India, Teleworking or telecommuting has not been introduced at the government level. Most of the initiatives to reduce carbon emissions are regarding transport. An integrated transport system could become a

⁵⁰ <http://environmentportal.in/files/258905.pdf>

means of lowering the carbon emissions. These will include introduction of Metro in urban areas and a Rapid bus transport system. Similarly measures have been taken to introduce CNG as fuel in public transport buses, especially in Delhi.

Mobility clusters:

1. Providers of different kinds of vehicles (e.g. cars busses, trains)
2. Providers of virtual ways of commuting/meeting (
3. Traditional providers of mobility services (rental car providers, travel agencies only offering physical mobility)
4. New providers of services (video-meeting/tele-commuting companies, decentralized production)
5. Providers of sustainable energy for mobility (both physical and virtual mobility)
6. City planners/architects

Car-based economies come at a huge price. Making and using a car in itself is a drain on the environment. Despite all advancements in production technologies, most cars in the world are still material-intensive. Not amusing at all, in its use, a car usually does not move for 90 percent of its life. The remaining 10 percent is used to move people from point A to point B. For the 90 percent it occupies land space that fetches a premium in most cities across the world. During the 10 per cent of its life time that it moves people from point A to point B, it damages the environment by burning fossil fuels.

Delhi government is trying or considering various options to contain traffic congestion and pollution. Everything from congestion pricing to increasing diesel prices and covering more of Delhi and suburbs with Metro, to considering a ban on diesel cars in the city is on the table. Environment Pollution (Prevention and Control) Authority (EPCA) has recommended that there is a need to ban diesel vehicles in Delhi to prevent emission of high smoke particles.⁵¹ The Bureau of Energy Efficiency has also come up with fuel efficiency standards for cars in India.⁵²

The proposed standards are expected to help the country save (in cars) about 3 million metric tons of oil equivalent per year by 2015; 11 million metric tons in 2025 and 20 million metric tons by 2030. That translates to savings of \$2.5 billion per year (Rs 13,835 crore) in 2015; \$9 billion per year (Rs 49,806 crore) in 2025 and \$16 billion per year (Rs 88,544 crore) in 2030. The Bureau of Energy Efficiency (which is authorized to notify the standards) has proposed to do a star-based labeling reflecting the efficiency levels, similar to power-saving electronic gadgets. Under this, car models will be ranked according to one to five stars based on their fuel efficiency. This is expected to influence the consumers' choice.

At present, Indian cars on an average are consuming about 6 liters per 100 km. The current official proposal for the standard is to improve this to 5.1 liters per 100 km by 2020, almost a liter less per 100 km. In smaller weight categories, the margin would be bigger.

⁵¹ <http://www.indianexpress.com/news/ban-diesel-cars-in-delhi-govt-informs-lok-sabha/1046494>

⁵² <http://businesstoday.intoday.in/story/govt-mulls-grading-cars-for-fuel-efficiency/1/187316.html>

These solutions may sound radical, but they will have incremental benefits. There is a danger of lock-in unless a transformative thinking of mobility is thoughtfully implemented.

Mobility is about solutions moving from point A to point B, and not necessarily people. This isn't anything new. Mobile- and Internet-banking, e-retailing are examples of solutions reaching people. But these activities are not large enough to solve mobility challenges. Office commute and business travel are the biggest reasons for daily mobility of people.

Telecommuting has gained increased attention across the world in recent days. A survey conducted by Global Research Company IPSOS for Reuters News has found that India being a developing country topped the list with around 56 percent of telecommuters in the country.⁵³ Around one in five employees have the access of connecting online to their workplace. These employees who have the access of telecommuting, have reported that they telecommute with their workplace on a regular basis and about 7 percent of the employees reported that they work from home every day, as their home is far from their office, and another 10 percent of the employees told that they work from home on a very constant basis like on evenings and during weekends.

There are pros and cons of telecommuting because around 65 percent of the respondents of the survey were of the opinion that telecommuters are more productive because the flexibility of time helps them to focus on either side of their life by which they are able to gain both job satisfaction and happiness. According to a Cisco commissioned global telecommuting survey of 2,600 workers, over 65 percent of respondents were willing to work for less pay if telecommuting was an option.⁵⁴

Telepresence is another solution with the potential to transform the way people conduct business. According to a 2010 Frost & Sullivan report, telepresence is expected to grow to a \$4.7 billion market globally by 2015. The report cites the Asia-Pacific region as a major growth market for telepresence, with it expected to account for over a third of the market, i.e about \$1.7 billion in revenues. The Indian market for telepresence is estimated to grow at a CAGR of 53 percent and was estimated to reach \$40 million by 2012.

3.2.2. Public procurement of transport/mobility

Central and state governments in India have demonstrated various initiatives that could be considered as the new perspective of mobility where services reach people instead of people going to access services. According to Frost & Sullivan, the government in India has been at the forefront of leading video conferencing deployments and actually using the technology. The government is extensively deploying immersive telepresence solutions at central ministries, state governments and defense organizations. A significant amount of them are deploying HD video conferencing, say, room-based telepresence systems as well. There is extensive use of video conferencing bridging equipment, infrastructure, management applications, recording and streaming services etc.

Procurement of urban or city infrastructure is typically done by Public Works

⁵³ <http://jobs.siliconindia.com/career-news/India-Tops-with-Most-Telecommuters-nid-104054.html>

⁵⁴ <http://www.cio.in/article/indian-cios-realize-thrills-telecommuting>

Departments, municipalities or urban development authorities. Most of these bodies are structured into different infrastructure verticals such as roads, bridges, drainage, waste management, each working on its own. Often their approach to infrastructure development is devoid of overall strategy that provides scope for transformative solutions. That might change in India with the construction of two new smart cities in the next ten years but is otherwise virtually non-existent today.

Currently on the drawing board as part of the \$90 billion Delhi-Mumbai Industrial Corridor (DMIC), two smart cities will test smart technology intensive solutions. Renewable energy is expected to power a substantial portion of the new cities, with far more decentralisation than is being done in Indian cities now. Current blueprints include solar photovoltaic and solar thermal plants, biomass plants, charging stations and so on. Such an infrastructure would make a smart grid mandatory. Charging stations, however, could disappear within a decade as roads become capable of wirelessly charging cars as they move. DMIC cities are expected to use modern waste management techniques like separation, incineration, water recycling and so on. Some of the larger cities could use underground vacuum-driven conveyer belts for waste transport, called pneumatic waste collection systems. They remove the need for foul-smelling waste to go through the roads.

Indian Railways: Railway Management System (RMS) and online ticketing system that is within easy reach of the common man is another example of how physical mobility is becoming more efficient with smart communication technology. The Indian Railways provides:

- Reservations can be done from anywhere instead of going to the railway station.
- Electronic Booking of tickets on select sectors.
- Online Information on Railway reservation on Internet.
- Apart from providing reservations there are numerous important customer utilities on the railway web portal such as: Pnr Status, Trains between important stations, Seat availability, Fare inquiry, Refund, Luggage, freight information and Tenders regarding railway contracts⁵⁵

The online working of Indian railways is pretty efficient and fast. Even the smallest town in India now has the accessibility of online reservation⁵⁶

3.2.3. Transformative clusters

Many companies in India already promote telecommuting, but often without a broader approach to mobility. These are pre-dominantly ICT and outsourcing companies. These include AT&T, IBM, HP, Intel, Cisco, Nokia, Infosys, Wipro, and TCS. Many start-ups encourage telecommuting as it reduces the high rental costs.

Telepresence is widely used by companies including Tata Consultancy Services, Tata Teleservices, Tata Steel, GE India, Reliance World, Wipro Technologies, Maharishi

⁵⁵ <http://unpanelearning.wordpress.com/2011/11/15/learners-submission-e-governance-in-india/>

⁵⁶ <http://www.indianrail.gov.in>

University, ANZ IT and Accenture.

The adoption of telepresence is happening across a wide sphere of verticals, outside of the traditional IT companies and MNCs. Increased adoption within government, education, healthcare, manufacturing, retail, banking and financial services, and SMB (small and medium business) verticals.

There is increased usage of telepresence solutions for interviewing candidates, interaction with relatives settled abroad, reviews and meetings, product launches and press conferences, in addition to business meetings. Among enterprises, there is continued adoption of telepresence solutions to facilitate communication between their knowledge workers and increase collaboration with their customers across the globe.

Telepresence equipment is largely provided by Cisco, Lifesize, and Polycom. Telecom companies such as Reliance, Airtel, and Tata Teleservices, provide voice and data infrastructure.

In order to ensure transformative solutions it is important to acknowledge that a shift from only physical mobility to also include virtual will require active participation of companies from sectors like city planning, architecture, conference arrangement, human resource management and software developers.

3.2.4. Lessons learnt

It should be clear by now that mobility needs to be thought of as much more than physical movement of people to get a certain job done. Mobility also extends much beyond transportation. Transportation of people or goods and services is just one part of mobility. Mobility also includes city planning, new business models, teleworking, virtual meetings, decentralized production, etc.

Smart connectivity and support for virtual movement has many positive aspects ranging from improved rural education and health to improved productivity and less congestion in cities.

Some practices such as e-health, e-education, e-governance, m-payments, m-banking are successful and in state of replication and scale across the world, including India. The fundamental shift here is to service orientation in a way that allows citizens and customers to be more efficient. The overall benefit to citizens and the poor in particular is to improve accessibility of essential services.

Instead of looking at a particular mode of transportation (like cars or busses) or only one geographical area (a city), a transformative strategy leaves room for an overall mobility assessment that includes both physical and virtual mobility.

Best practices can already be found (e.g. in areas such as health kiosks, e-education and e-government) where the service is now provided virtually in a way that allows citizens and customers to be more efficient.

The use of smart mobility solutions depends on other kinds of public procurements related to infrastructure, such as roads, city planning, and broadband connectivity,

Future prospects for the transport sector provide a good illustration of the forces that give rise to both dynamism and resistance at the micro level. What were, almost a century ago, the automotive sector's great contributions to technological dynamism – the semi-automated assembly line and the vision of the automobile as a mass consumption item – are some of the primary constraints on transformational change.

Realizing the potential to reconfigure where and how people work and live in order to greatly reduce overall environmental carrying costs such as those incurred by current transportation systems will, in all likelihood, require fairly decisive breaks with past socio-technical patterns such as commuting to the workplace and driving to the shopping center.

In contrast, the broadband connectivity can help pioneer a significantly different vision of work and society. That vision is rooted in, and hence naturally tends to propagate, a form of organization embodying a more decentralized responsibility and power structure.

As per the report of “Broadband roadmap for inclusive growth”, a very ambitious target of 214 million broadband connections by 2014 is proposed - a 30 fold increase from the current level (~7 mn) for India. This translates to 695 million connected Indians by 2014 allowing an equitable and inclusive growth in both urban (386 mn users) and rural (309 mn users) India.

It is estimated that Telecommuting will reduce Green House Gas (GHG) Emissions by 2mn MT in India due to the penetration of Broadband connections in urban and rural areas.

As per the UNFCCC CDM project of Delhi Metro Corporation, with the use of Metro as a mode of transport the estimated emission reductions of 529'043 t CO₂ per year are achieved by passengers using the metro instead of buses, cars, rickshaws etc. For Rail Based system GHG Emissions per PKM (gCO₂eq/Pkm) are @ 41gCO₂eq/Pkm. Thus, it will reduce GHG emissions of the conventional transportation means.

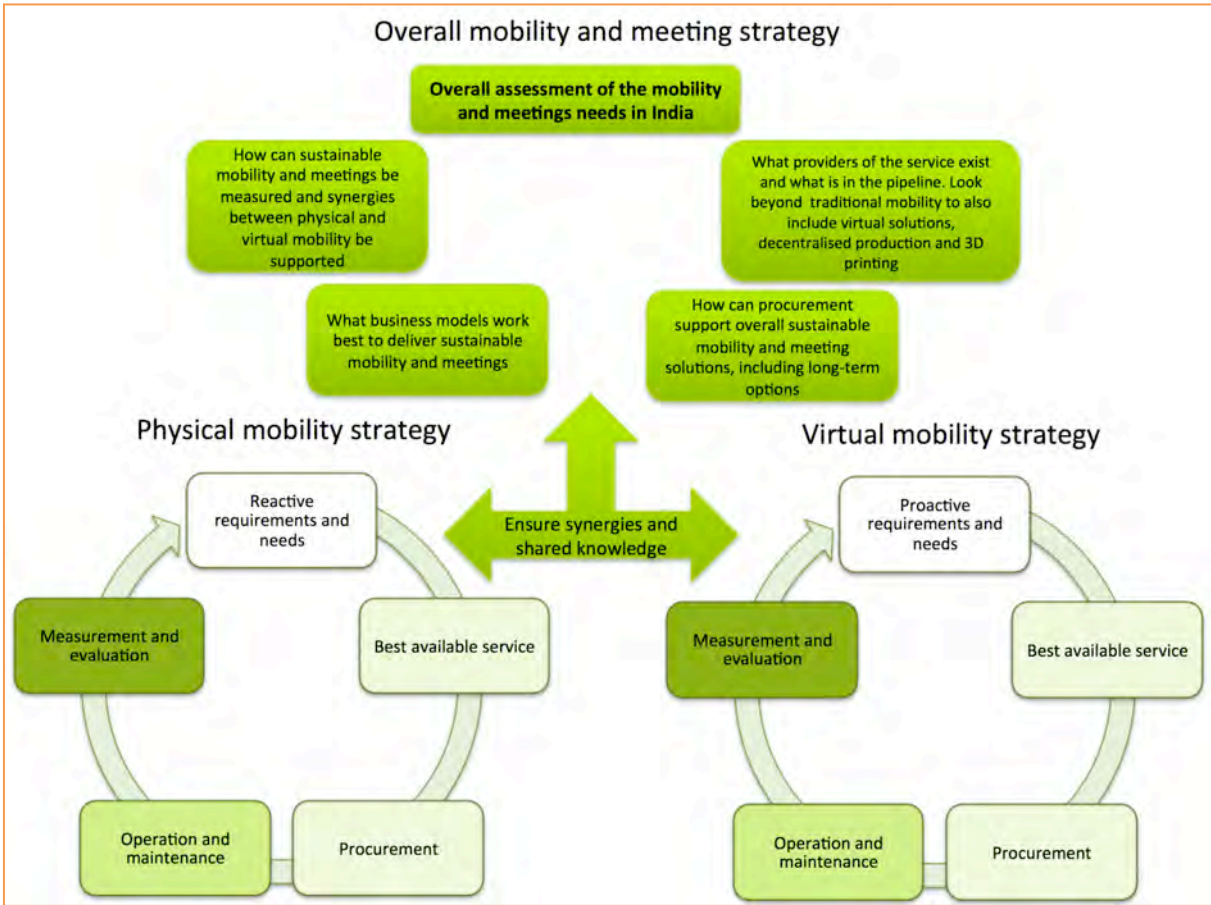


Illustration 10: Overall mobility and meeting strategy

3.3 Health – From industrial to 21st century solutions with telemedicine

3.3.1. General background

Current health systems around the world are basically a reflection of the old industrial society with centralized structure and end-of-pipe solutions. With no connectivity, a lack of understanding of the complexities related to health, low life expectancy and with demographic structures that had few old and many young the creation of such a system is easy to understand. Now tectonic changes are taking place and the question is not if, but when and how major changes will take place.

With the possibility to connect and track vital health statistics 24/7, get access to health support in many different formats, more vital older people that demand more than “end-of-pipe” solutions together with a young generation that expect solutions to be tailor-made, and with pressure from an aging population the current health system will have to undergo radical change.

Telemedicine is one part of a new health system and it can be extremely beneficial for people living in isolated communities and remote regions and is currently being applied in virtually all medical domains. Patients who live in such areas can be seen by a doctor or specialist, who can provide an accurate and complete examination, while the patient may not have to travel or wait the normal distances or times like those from conventional hospital or GP visits. Recent developments in mobile collaboration technology with the use of hand-held mobile devices allow healthcare professionals in multiple locations the ability to view, discuss and assess patient issues as if they were in the same room. Remote monitoring through mobile technology could reduce annual US drug costs by 15 percent by reducing outpatient visits, verifying prescriptions, and overseeing patient drug administration.⁵⁷

There's a huge, unmet health care need in developing countries. The challenge is to make health care affordable for the many people and attractive to the providers at the same time. Conventional centralized systems with brick-and-mortar hospitals will not be able to deliver much of tomorrow's health services. Telemedicine is a good strategy to strengthen the existing human resources available in health care. The scale, however, will come only through effective government intervention.

Telemedicine took off in India based on the lack of proper health-care infrastructure in rural areas. There was a severe shortage of doctors, especially in rural areas; very high patient volumes; widespread availability of mobile networks; rapid growth in the availability of low-power, hand-held medical monitoring devices, and the shift away from the proprietary, local area network-based medical image archiving and communications systems to a networked tele-enabled system. Innovations in telemedicine will accelerate in India, where access and cost are critical issues.

Healthcare is already in transition in most OECD countries. The traditional approach to human health leaned heavily on the industrial mass production and mass consumption model, with the hospital as factory and the patient as passive consumer. The paradigm did lead to tremendous gains in reducing the mortality and morbidity associated with

⁵⁷ Saylor, Michael (2012). *The Mobile Wave: How Mobile Intelligence Will Change Everything*. Perseus Books/Vanguard Press. p. 153

disease and accidents. Recently, however, serious limits have emerged in terms of both cost and effectiveness. Reform is under way, with considerable iterative technological and organisational progress already made and even more expected when it comes to controlling costs and improving delivery methods.

About 80 percent of India's population has no direct, physical access to specialist health care. Estimates suggest that the telemedicine market is at least for 800 million Indians. Even if half of these 800 million need to consult a specialist once a year, that involves 400 million specialist consultations per year. Even if 10 percent of these are enabled through telemedicine we are talking about 40 million consultations per year from rural India alone.

A major driver of telemedicine in India is the dismal state of health care in the country. India's government spending on health as a proportion of the GDP – currently at around one percent of the GDP - is among the lowest in the world. Even in other Asian countries, it is higher. The corresponding amount is 1.8 percent in Sri Lanka, 2.3 percent in China and 3.3 percent in Thailand. Despite the launch of the National Rural Health Mission in 2005, India continues to grapple with a 33 percent shortage of rural hospitals, which are called Community Health Centres (CHCs). Even in the ones present, there is an acute shortage of staff. According to the Ministry of Health and Family Welfare, there is a shortage of 50-70 percent of physicians, specialists, lab technicians and radiographers at the CHCs. And around 10-15% of them lack even basic amenities such as water supply and electricity.

If the vision of "Health for All" is to be achieved by 2020, India will have to pump in 6 percent of its GDP in the health care sector.⁵⁸ At the same time, technology-enabled health care networks can play a huge role by bridging the distance between doctors and patients through Internet and other telecommunication technologies.

To standardize services of different Telemedicine centers a document, "Recommended Guidelines & Standards for Practice of Telemedicine in India", has been prepared by DIT which is aimed at enhancing interoperability among the various Telemedicine systems being set-up in the country. These standards will assist the DIT and state governments and healthcare providers in planning and implementation of operational telemedicine networks.⁵⁹

India is acquiring a sizeable market segment in health care BPO (business-process outsourcing) and KPO (knowledge-process outsourcing) industries. It is now preferred as a healthcare destination for neighboring and far-off countries. Most of these patients are being catered to by the corporate hospitals. At the same time, both short- and long-term travel by overseas citizens is increasing for business and tourism purposes which increases the potential for the use of telemedicine and e-Health tools to facilitate exchange of electronic health information between hospitals across the globe. The so called medical tourism is getting a boost.

Government has allocated 2000 million rupees (about US\$50 million) to telemedicine in year 2007. Most of the funding will be channeled through public—private partnerships.

⁵⁸ Srinivasan R., "Healthcare in India – Vision 2020", Planning Commission of India

According to the Ministry of Health and Family Welfare, the necessary infrastructure in the form of satellite or broadband connectivity is already in place in large parts of the country. In India, telemedicine programs are actively supported by:

- Department of Information Technology (DIT)
- Indian Space Research Organization
- NEC Telemedicine program for North-Eastern states
- Apollo Hospitals
- Asia Heart Foundation
- State governments
- Telemedicine technology also supported by some other private organizations⁶⁰

DIT as a facilitator with the long-term objective of effective utilization / incorporation of Information Technology (IT) in all major sectors, has taken the following leads in Telemedicine:

- Development of Technology
- Initiation of pilot schemes-Selected Specialty, e.g., Oncology, Tropical Diseases and General telemedicine system covering all specialties
- Standardization
- Framework for building IT Infrastructure in health⁶¹

The telemedicine software system has also been developed by the Centre for Development of Advanced Computing, C-DAC which supports Tele-Cardiology, Tele-Radiology and Tele-Pathology etc. It uses ISDN, VSAT, POTS and is used to connect the three premier Medical Institutes of the country (viz. All India Institute of Medical Sciences (AIIMS), New Delhi, Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Lucknow and Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh). Now it is being connected to include Medical centers in Rohtak, Shimla and Cuttack.

In the past three years, ISRO's telemedicine network has expanded to connect 45 remote and rural hospitals and 15 super specialty hospitals. The remote / rural nodes include the offshore islands of Andaman and Nicobar and Lakshadweep, the mountainous and hilly regions of Jammu and Kashmir including Kargil and Leh, Medical College hospitals in Orissa and some of the rural / district hospitals in the mainland states.⁶²

The overall market for healthcare in India is about \$50 billion and if 2 percent of the money is spent on ICT, the ICT spend will be roughly \$1 billion a year. We believe Telemedicine is one of the 5-6 key ICT areas. A growth rate of 25 percent a year for the next 3-5 years is expected.

3.3.2. Public procurement of public health services

The National Rural Health Mission (NRHM) and the 11th Five Year Plan that ended in 2012, have been instrumental in creating demand for telemedicine. NRHM is a Central government scheme to be implemented by state governments and most of the funding

⁶¹ Bedi BS. Telemedicine in India: Initiatives and Perspective, eHealth 2003: Addressing the Digital Divide-17th Oct. 2003.

⁶² Saxena G, Singh JP. E-medicine in India: Hurdles and future prospects, paper presentation at an International seminar organized at The International Institute of Professional Studies. Devi Ahilya University;

comes from central government. Many state governments procure telemedicine services from for-profit as well as not-for-profit private sector. Telemedicine is used to do everything from registering and managing patient data (such as pregnancies, vaccinations, ante-natal care visits and causes of deaths), to integrating medical records with payments, to remotely diagnosing health conditions and managing the supply of medicines. In many cases, the government reimburses almost all expenses of the private sector.

- Orissa Trust of Technical Education and Training (OTTET) takes the lead using modern ICT platform and network in Public Private Partnership (PPP) mode in association with Government of Orissa to provide promotive & preventive healthcare & diseases management. Delivery of healthcare services at the door steps of villagers in 51,000 villages of the state is envisaged.
- Gujarat state government is looking to expand telemedicine network in PPP mode. The state health department of Gujarat is all set to embark on to connect all villages through its telemedicine network.
- National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore and Mysore based K.R. Hospital has established connectivity for their telemedicine project in collaboration with Larsen & Toubro (L&T) Ltd., Bangalore which has gifted telemedicine solutions and equipment worth INR 600,000 to both the medical centers under Corporate Social Responsibility (CSR) initiative.
- Similarly, in April 2006 under the CSR program of Gas Authority of India Limited (GAIL), a telemedicine project was started linking Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Lucknow with District Hospital of Raibareli, located at a distance of 80 kms with fiber optic cable network. GAIL has upgraded the infrastructure by providing advanced videoconference equipment and designing and constructing a board room for eCME in the year 2010.

3.3.3. Transformative clusters

There are many service providers in telemedicine in India. Some of the illustrative ones are Cisco, Wipro, HP,

Naryana Hrudayalaya Hospitals is providing Telemedicine from 10 years. The initiative is managed through satellite connectivity provided free of cost by the Indian Space Research Organization (ISRO). Narayana Hrudayalaya telemedicine network is connected with about 100 telemedicine centers across India. Outside India, as part of the PAN African satellite network, it is connected to 55 cities in Africa. Since its launch, it has conducted around 53,000 tele-consultations in the areas of cardiology, neurology, urology and cancer. Narayana Hrudayalaya gets about 200-300 ECGs daily. These are interpreted by its doctors and then communicated to the local doctors at the remote locations.
(<http://www.narayanahospitals.com/>)

Potential Health clusters:

1. Providers of traditional hospitals
2. Providers of tele-medicine
3. Providers of m-health
4. providers of proactive healthcare
5. City planners/architects

Neurosynaptic ReMeDi, Narayana Hrudayala, Apollo Hospitals, Piramal Healthcare, Aravind Eyecare, and World Health Partners. The first four are mainly technology solution providers, whereas the latter five are telemedicine providers.

Various tertiary level super specialty hospitals in the public and corporate sector have taken initiatives in telemedicine programs with the help of government agencies or on their own, e.g. Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, a premier academic medical institution in the public sector, started telemedicine activities in the year 1999 in project mode with the support of various government agencies. SGPGI Telemedicine network has linked 27 national and international nodes and has been carrying out tele-education and tele-healthcare activities.

All India Institute of Medical Sciences (AIIMS), New Delhi connected with Jammu & Kashmir, Haryana, Orissa, North East states network and PGIMER, Chandigarh connected with Punjab and Himachal state network and Sri Ramachandra Medical College and Research Institute, Chennai connected with Andaman & Nicobar Island Hospital, Amritha Institute of Medical Sciences, Kochi connected with Lakshadweep island, Tata Memorial Hospital, Mumbai, Christian Medical College, Vellore are involved actively in Telemedicine. Some of the companies providing Telemedicine include:

- **Apollo Hospital Group:** Apollo Telemedicine Networking Foundation(ATNF), a not-for-profit organization, is a part of the Apollo Hospitals Group. ATNF has emerged as India's single largest turnkey provider in the area of Telemedicine with over 125 peripheral centers including 10 overseas.⁶³
- **Asia Heart Foundation:** Aim of Asia Heart Foundation is to deliver quality and affordable healthcare to people at their doorsteps. The objective was to especially reach out to those deprived people who live in remote areas with a deficiency in cardiac care, create Coronary Care Units and treat them from specialist ends at Kolkata and Bangalore, should they suffer from any kind of heart ailments.⁶⁴
- **Fortis Hospital:** Fortis is using Telemedicine as a medium to reach out to rural India to provide specialized healthcare services. In a number of these cases the treatment could have been carried out by the local doctor with advice from a specialist which is being provided by some of the Fortis network hospitals. The telemedicine project is supported by Fortis Charitable Trust and the target group is the rural population which doesn't have access to quality medical care.⁶⁵
- **Dr. Balabhai Nanavati Hospital, Mumbai:** Dr. Balabhai Nanavati Hospital Telemedicine center is pioneer in this field and has successfully created a rural health care model through telemedicine. Till date our Hospital has to its credit over 4000 teleconsultation and 500 treatments culminating in saving time, money & efforts for the patients.⁶⁶
- **E-sanjeevani :** e-Sanjeevani is a result of core R&D effort in the area of Medical Informatics and health care at C-DAC Mohali, India. It is an integrated web based

⁶³ <http://www.telemedicineindia.com/>

⁶⁴ <http://www.rtiics.org/telemedicine.htm>

⁶⁵ <http://fortisfoundation.in/rural-outreach.html#telemedicine>

⁶⁶ <http://www.nanavatihospital.org/healthcare/telemedicine.htm>

telemedicine solution that follows the client server architecture. The aim of e-sanjeevani is to provide a world-class telemedicine technology solution for providing multi-specialty healthcare at an affordable cost at the doorstep of the patient. It involves an integration of telecommunications, information, human-machine interface, and medical-care technologies for the purpose of enhancing the delivery of health care.⁶⁷

- **GE Telemedicine:** For managing critically ill patients in small towns, the Fortis Group in a joint venture with GE Health has launched a project called 'CitiNext' in India.⁶⁸
- **Ericsson Tele-health solutions:** It has developed a mHealth (mobile-health) telemedicine solution named as Ericsson Mobile Health 3.0 (EMH 3.0) and aptly positioned it as a solution to provide 'healthcare to all' considering that the solution aims to overcome the geographical reach limitations of healthcare units and enable them to reach out to people even in far flung areas over the mobile medium.⁶⁹
- With the support of ISRO, Shankar Nethralaya at Chennai, Meenakshi Eye Mission at Madurai and four other corporate eye hospitals have launched Mobile Tele-ophthalmology service for early diagnosis and treatment of ophthalmic diseases under National Blindness Control Program. Sir Ganga Ram Hospital, New Delhi and AIMS, Kochi has launched mobile Tele-hospital for rural access of specialty healthcare services.
- **Global Hospitals:** Global Hospitals has telemedicine centers in Ahmadabad, Kolkata, Puducherry and Bhubaneswar. The telemedicine center will help them to reach out to the specialists in Hyderabad and Chennai⁷⁰

New stakeholders are also moving into the personal health arena, from Nike⁷¹ and Jawbone⁷² to Samsung⁷³ and NTT⁷⁴. These new stakeholders often have a broader approach to health where continued wellbeing is the focus, rather than end-of-pipe actions once a person is sick.

3.3.4. Lessons learnt

Public procurement in telemedicine has indeed been transformative in terms of delivering health services to rural India. It created market demand for services that also led to many service providers developing new solutions. However, some private sector organisations have mentioned that governments are too specific and limiting in identifying diseases and treatments or many times telemedicine does not interact with other health delivery channels. While contracts may need to be specific, public procurement of health services should be designed in a manner that various delivery channels interact.

⁶⁷ http://telemed.esanjeevani.in/LoginNew/Home_Main.aspx

⁶⁸ http://www.medicalindiatourism.com/news/2012035827-Fortis_and_GE_Health_Group_Introduced_Tele-ICU_System_in_India.html

⁶⁹ <http://www.telecomtiger.com/fullstory.aspx?storyid=8635>

⁷⁰ <http://medinfo.cdac.in/resources/events/mig-symp-08/pdf/presentation/Ramakrishnan.pdf> Last accessed: 23 July 2011

⁷¹ <http://www.forbes.com/sites/tomiogeron/2012/12/10/nike-tech-accelerator-aims-to-fuel-health-fitness-startups/>

⁷² <https://jawbone.com/up>

⁷³ <http://www.samsung.com/global/microsite/galaxys4/lifecare.html>

⁷⁴ <http://www.nttdocomo.com/pr/2012/001599.html>

Currently, half of the rural households do not have access to primary healthcare. Telemedicine facilities in the Common Service Centers (CSCs) connected to Community Health Centers (CHCs) and Public Health Centers (PHCs) will enable all the 168 million rural households in 2014 to have access to affordable primary healthcare. Currently, half of the rural households do not have access to primary healthcare. Telemedicine facilities in the Common Service Centers (CSCs) connected to Community Health Centers (CHCs) and Public Health Centers (PHCs) will enable all the 168 million rural households in 2014 to have access to affordable primary healthcare.

Telecommuting is expected to reduce GHG (Green House Gas) emissions by 2 mn MT in India. In rural India alone, telemedicine will reduce GHG emissions by 0.28 mn MT by 2014. If a village has a telemedicine facility, then its residents do not need to travel to the nearest hospital for consulting a doctor on their health diagnostic reports. The consolidated impact of lesser usage of vehicles (that emit GHG) means a reduction in the total GHG emissions.⁷⁵

⁷⁵ <http://www.trai.gov.in/WriteReadData/ConsultationPaper/Document/4.pdf>

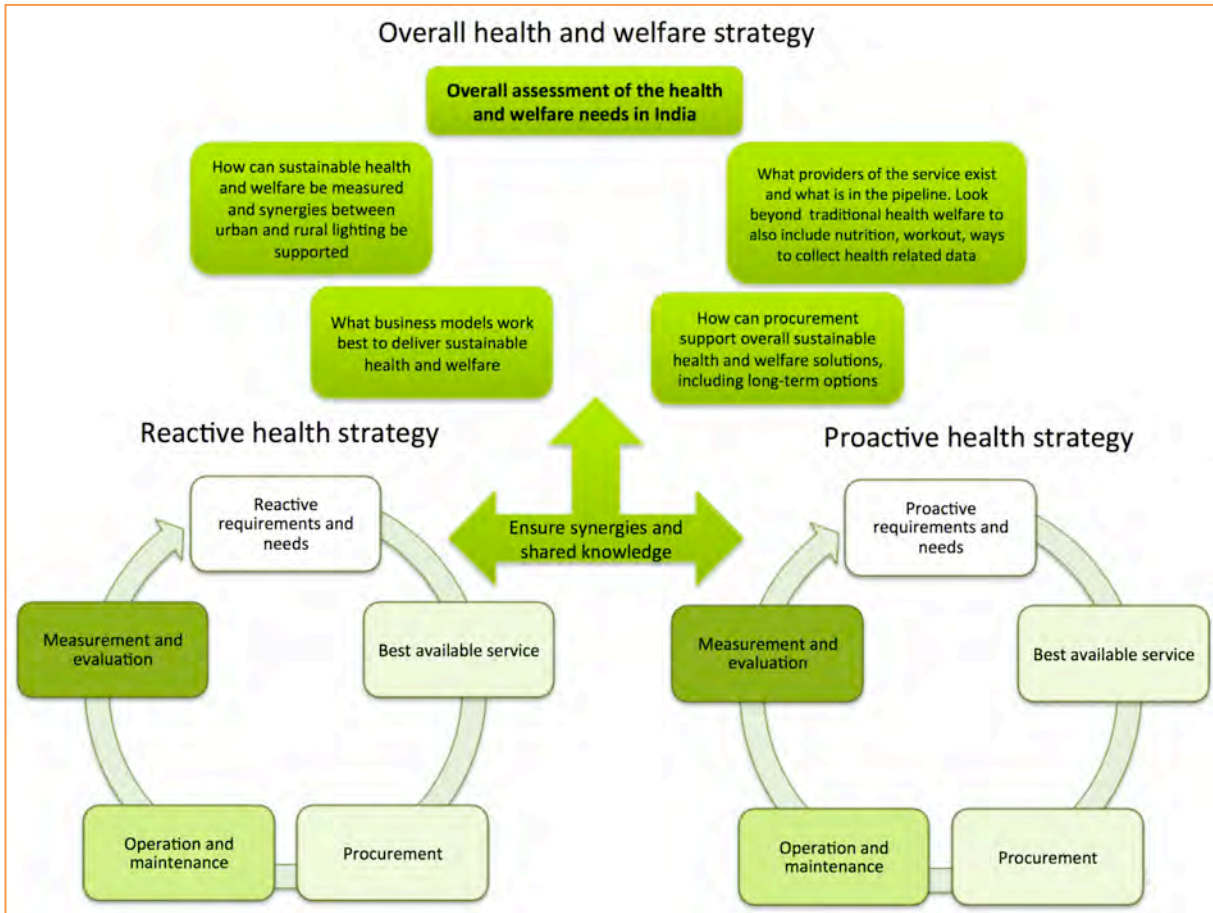


Illustration 11: Overall health and welfare strategy

3.4 Sanitation: From linear sanitation waste to circular resources

3.4.1. General background

An estimated 2.6 billion people lack access to adequate sanitation globally. If the current trend continues, by 2015 there will be 2.7 billion people without access to basic sanitation. The regions with the lowest coverage are sub-Saharan Africa (31%), southern Asia (36%) and Oceania (53%). Underlying issues that add to the challenge in many countries include a weak infrastructure, an inadequate human resource base and scarce resources to improve the situation.

Lack of sanitation facilities forces people to defecate in the open, in rivers or near areas where children play or food is prepared. This increases the risk of transmitting disease. The Ganges River in India has 1.1 million liters of raw sewage dumped into it every minute, a startling figure considering that one gram of faeces may contain 10 million viruses, one million bacteria, 1000 parasite cysts and 100 worm eggs.⁷⁶

About 2.5 billion people use unsafe toilets or defecate in the open. Poor sanitation causes severe diarrhea, which kills 1.5 million children each year. Smart investments in sanitation can reduce disease, increase family incomes, keep girls in school, help preserve the environment, and enhance human dignity.

In the wake of disasters as much as in everyday life, public health interventions that secure adequate sanitation in communities prevent the spread of disease and save lives. They raise the quality of life for many, particularly women and girls who are often in charge of domestic tasks, and can face personal risks when they have to relieve themselves in the open.

Historically, capital intensive and centralized sanitation won out over labor intensive and decentralized systems. For the future, we need know of design systems that are less capital intensive, more information intensive and that aren't labor intensive. Toilets have a long way to go.⁷⁷

The financial and environmental cost of providing industrial-era designed sanitation systems is beyond the means of the 21st century sustainability era. The 2.5 billion people yet to be connected to such a system provide opportunities to pilot transformative sanitation solutions.

Getting sanitation right can have a positive effect on economic growth. In parts of Africa, half the hospital beds at any one time can be filled with people suffering from diarrheal diseases. Because of the high financial burden of poor sanitation, on individuals, businesses and healthcare systems, adequate investments in sanitation could provide an estimated additional 3% economic growth in sub-Saharan Africa.

The Millennium Development Goals target 75% global sanitation coverage by 2015. The cost to reach this milestone is estimated at US\$14 billion annually through the period.

⁷⁶ <http://www.who.int/features/factfiles/sanitation/facts/en/index.html>

⁷⁷ Phlush, an all-volunteer advocacy group based in Portland, provides arguments for and against flush toilets and sewers that are the same now that they were when construction really got going in the 19th century. <http://www.phlush.org/2012/11/27/a-rough-history-of-sanitation-in-the-west/>

Among other health gains, sanitation is estimated to reduce diarrhea cases by 391 million worldwide each year.

According to India Human Development Report 2011, brought out by Institute of Applied Manpower Research of the Planning Commission, about half of Indian households lacked access to sanitation facilities in 2008-09 resulting in outbreak of diseases like diarrhea, cholera and typhoid.

Government-led Total Sanitation Campaign (TSC) aims to bring toilets to every corner of India, and whose main approach in this effort is to build conventional toilets at a subsidized rate. The TSC doesn't seem to grasp the many dimensions of toilet use, which encompasses infrastructure, to be sure, but goes much further into the behavioral, attitudinal and aspirational levels of being as well.

Government of India initiated an incentive scheme for fully sanitized and open defecation free Gram Panchayats, Blocks, and Districts called the Nirmal Gram Puraskar. The incentive pattern is based on population criteria and it varies from Rs.50,000 to Rs.50 lakh.

Manual scavenging has been banned under the Employment of Manual Scavenging and Construction of Dry Latrine (Prohibition) Act, 1993.

To eradicate dry toilets from urban areas, the government has decided to provide financial support to states under a centrally sponsored scheme to the tune of about Rs 367 crore in next two years. According to the Housing and Urban Poverty alleviation Minister, the total cost of this project is estimated at Rs. 481.45 crore of which the central share will be of Rs. 367.33 crore. The rest will be borne by state governments and beneficiaries. States are also encouraged to initiate innovative schemes for setting up eco-friendly toilets in urban areas.⁷⁸

E-loo, a toilet developed by DRDO: The Bio-Digester technology was originally developed at the DRDO lab in Gwalior to decompose biological waste generated by soldiers deployed in high-altitude regions such as Siachen and Ladakh. The DRDO has already transferred it to 49 private firms for them to build the eco-friendly toilets, named 'E-LOO', all over the country as per market demand.

The technology uses a process wherein bacteria help in the production of methane gas and water by breaking down human excreta. The generated gas can then be utilized for energy, cooking and water for irrigation purposes. It was then customized by DRDO for civil people. The ELOOs can effectively function in extreme conditions and temperatures ranging from - 6 degree C to 50 degree C. The toilets cost only Rs. 15,000 each and are cheaper if built for clusters.

Ecosan systems enable a sustainable, hygienic and safe recovery of nutrients and water from household wastewater, thus minimizing the consumption and pollution of water resources. Nutrients are reused in agriculture, preserving soil fertility and safeguarding long-term food security. Furthermore, ecosan solutions minimize the introduction of pathogens from human excrements into the water cycle, reducing the risks of infections.

⁷⁸ <http://indiasanitationportal.org/15907>

Ecosan solutions are modular, locally adopted, decentralized partial-flow systems, which makes them more cost-efficient than centralized solutions. As it is possible to integrate on-plot systems into houses, the security for women and girls is also ensured, as is the user comfort.

Ecosan was said to be especially suitable in areas where open defecation sites were not easily available. This was the case on the banks of river Cauvery in Kaliapalayam Village, Tamil Nadu, where ecosan toilets were reportedly doing well. Also it was more popular in rural areas because there were more opportunities to recycle compost and urine. Besides NGOs, the Government of India had started promoting ecosan under the Total Sanitation Campaign, as had UNICEF in its programs. Ecosan based community urinals have been tried in Tamil Nadu and Maharashtra, involving reuse of urine in agriculture. Green Sanitation Foundation has developed Bio toilets. The Uniqueness of Bio-Toilet is:

- Completely Environment Friendly
- Odor free and does not produce any foul smell
- Uses Nature's products to clean human waste
- Water positive solution
- These multi chamber biodigester toilets don't need a sewage system and thus eliminate load on existing Sewerage Systems
- Virtually maintenance free
- In community bio-toilets, the bio-gas can be reused

They treat solid waste and convert it to liquid form, which is harmless and does not contaminate groundwater, soil, etc. The discharge is being used in Gulbarga, Karnataka for irrigation. One toilet costs Rs.25 - 30,000, which includes training on O&M, communication efforts, etc. Multiple toilets will thus cost more. Rs.60-70 thousand for solar powered community bio-toilets.⁷⁹

3.4.2. Public procurement of sanitation

- To prevent open defecation along the Dhamra coast, DRDO has taken up a project of installing 1,000 bio-toilets. Initially, the DRDO has decided to set up the bio-toilets in 1000 GPs across the country and Ministry of Rural Development (RD ministry) would spend nearly Rs. 4 billion for the purpose.
- Musiri Panchayat in Tamil Nadu, decided to build ecosan toilets at a community level in Musiri. The first toilet came up on Saliyur street in 2006. It cost Rs. 800 thousand but needs little maintenance. The toilet has separate blocks of seven rooms each for men and women. About 250 people use the toilet with a capacity for 400 users a day. Decomposed faeces are yet to be collected from the Saliyur toilet, but urine and wastewater are being reused. The wastewater is filtered with sand and charcoal and used to dilute the urine. The diluted urine is transported to nearby paddy fields and banana plantations. The administration also installed a biogas plant to trap the gases produced during treatment. The trapped gas is supplied to households for cooking.⁸⁰

⁷⁹ <http://indiasanitationportal.org/16297>

⁸⁰ <http://southasia.oneworld.net/features/eco-friendly-toilets-in-rural-india>

- The Ecosan toilet project formulated by Centre for Water Resources and Management (CWRDM), here, to curb groundwater pollution due to the unscientific treatment of septage, is scripting a new story in ecological sanitation in the district.
- As a pilot project, the CWRDM established Ecosan toilets at four locations in Chathamangalam Grama Panchayat last year and owing to the huge success of the project more panchayats have come forward to set up these toilets which are very eco-friendly.
- Green Sanitation Foundation has put up 81 green toilets in Gulbarga.

3.4.3. Transformative clusters

E-Loo Toilets: E-Loo toilets were developed by Defence Research and Development Organisation (DRDO).⁸¹ As part of a FICCI interface program, DRDO is commercializing the technology so that bio-toilets can reach every nook and corner of the country. The DRDO has already transferred it to 49 private firms for them to build the eco-friendly toilets, named 'E-LOO', all over the country as per market demand.

The supplier of Ecosan Toilets in India is Prakash Ceramics, Gujrat.

3.4.4. Lessons learnt

Initiatives like E-Loo Toilets and Eco San can transform the way the toilets are designed, built and used. These toilets are not only designed to use much less or no water, but also separate the urine from solid waste, and then process it to create fertilizer. Considering that much of India is still agrarian, this is an obvious benefit for farmers all over the country, and Eco San toilets have been slowly but surely increasing in presence around India.

The use of EcoSan or E-Loo toilets will be beneficial for the society which does not have access to clean sanitation. The benefit of this technology can bring a major change in the quality of life and help people lead a healthy life across the world.

Assuming that one person generated 250 gm of soil per day, it is estimated that the methane generated from one person per day is 0.000162272 kg from a Toilet Linked Biogas Plant (TLB). This methane emission is attributed to the leakage from the digester which is 15 % (IPCC values) of the total methane generated. This also includes the emissions from the incomplete combustion of the Methane.

The use of TLBs compared to open defecation results in methane avoidance as the decomposition of the night soil takes place in a closed system and the resulting biogas is directly transferred for domestic use in households through pipes. The only methane emission is the leakage which is around 15 % and happens from the digester, valves etc. and incomplete combustion of CH₄.

The shift from linear sanitation waste to circular resources is different from the earlier cases as it moves from one model to another (from linear to circular) instead of incorporating a traditional perspective in a broader perspective e.g. including a physical

⁸¹ <http://biotoilet.in/news/Bio-toilets-developed-by-DRDO-today-earned-praise-from-Prime-Minister-Manmohan-Singh>

mobility into a broader mobility perspective where physical mobility still exists, but is only a part.

But it is not only about shifting from linear to circular, it is also about linking two areas that traditionally are not seen as part of the same system: waste and energy.

This dual shift makes this transformative change challenging, but also very rewarding. It is however important to ensure that the system is not built on excessive use of waste that is unsustainable. As long as it is based on sanitation this is not much of a problem, but if household waste is used there is a significant risk for unsustainability lock-in where the system depends on unsustainable high waste flows.

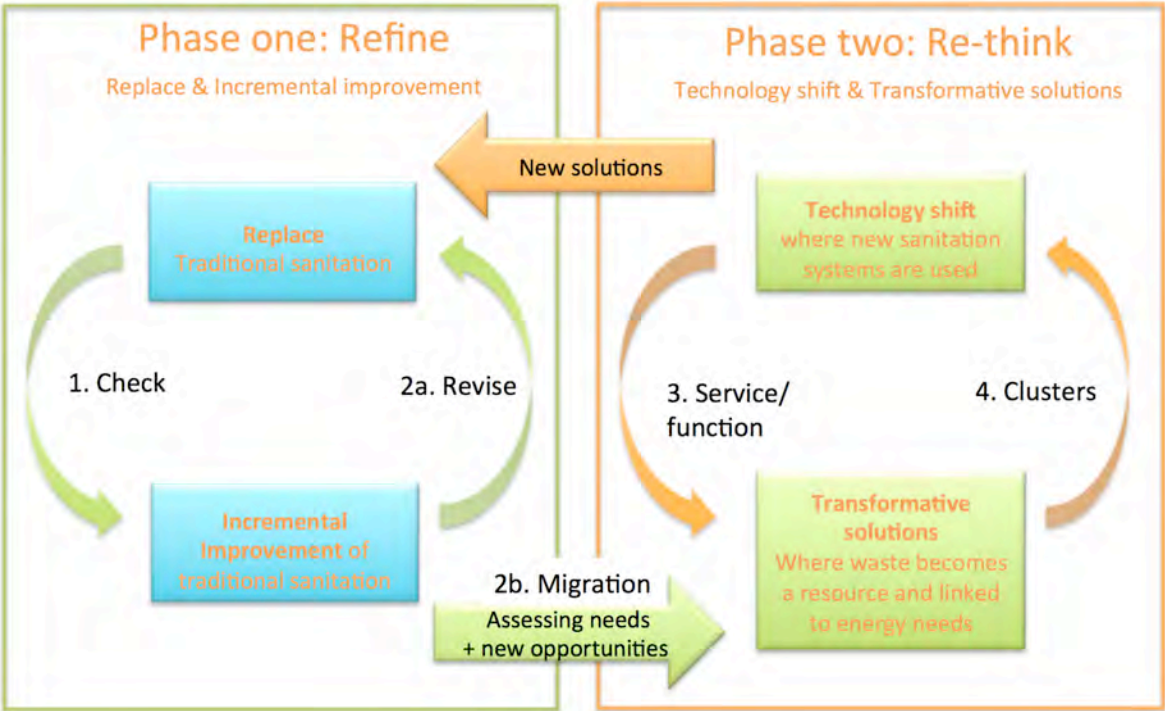


Illustration 12: Migration structure from linear waste to circular resources

4. Migration strategy for procurement of transformative solutions

There is certainty that the world needs transformative solutions for sustainable development. There is a definite urgency to mainstream transformative solutions. Public procurement is an unmatched demand aggregator necessary to advance mainstreaming.

Public procurement of transformative solutions requires a shift in procurement of products with technical specifications to procurement of solutions for a certain need. It is only at the beginning of the procurement of transformative solutions that the process is slightly different from a prevalent public procurement process. Once the solution is in place, a regular public procurement process comes into action.

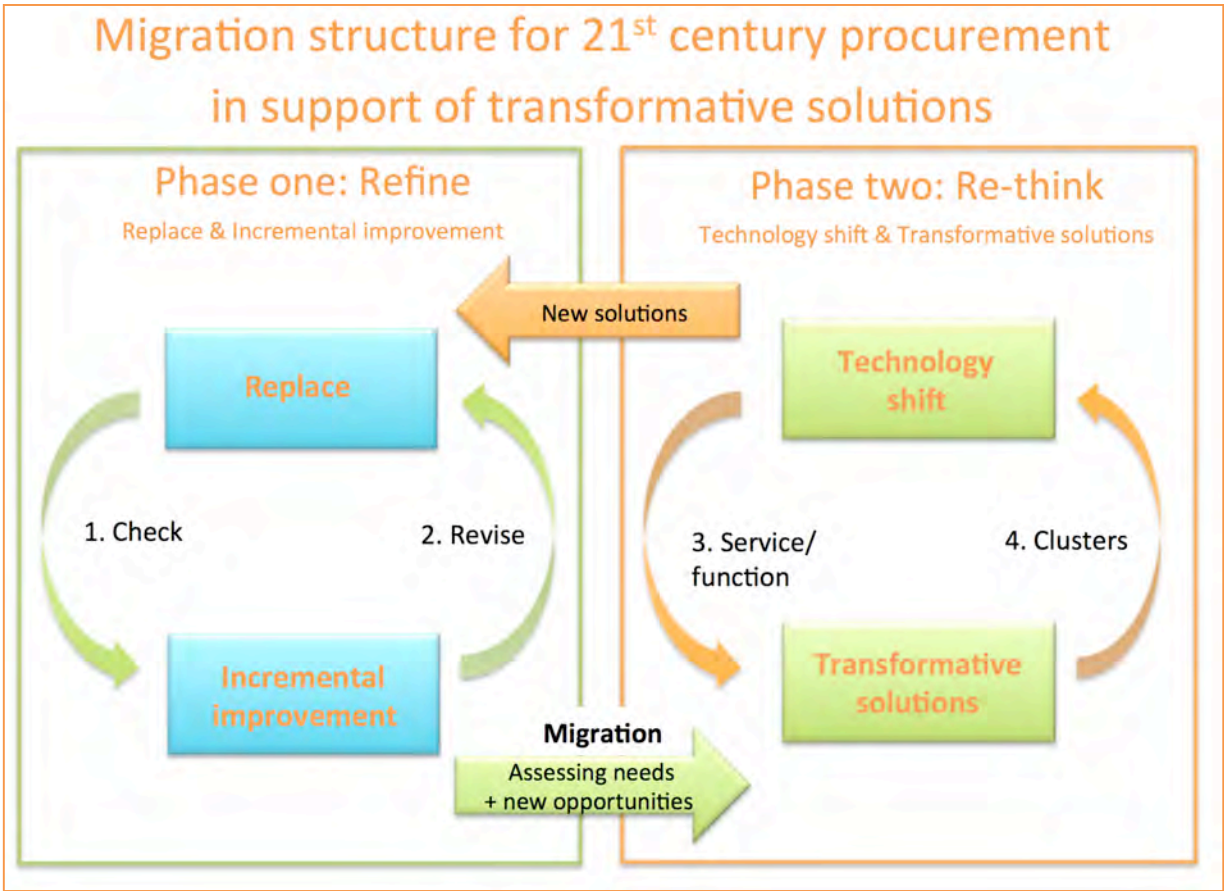


Illustration 13: General migration structure for 21st century procurement

Prevalent public procurement has two main approaches, replacement and incremental improvement. These help improve the products, but only marginally. What is needed is an additional phase where the needs and new opportunities are reviewed. During this second phase possible technology shifts are explored, but even more important is to include a part where the questions “what is it that is really needed and what new opportunities exist” are explored.

4.1 From re-financing to re-thinking

Most procurement is only replacement, but increasingly green procurement and procurement for innovation help incrementally improve different products. When procurement is reviewed in order to see how it can be improved, a “bridge” between the first phase and the second phase could be established as an option

It is important to note that the process very seldom will include using the “bridge” and get to the second phase. In most cases the second phase will probably only be part of the process on an annual, or even less frequent, basis. This is important to clarify as this makes it obvious that much of the current work will go on as usual and once the new solutions are introduced the first phase will again be the one where most work is done, and often within current structures.

The second phase includes two approaches that require more analytical work, internal capacity building, understanding of the market, and dialogue with different stakeholders.

The first approach is a more traditional approach where radical improvements in technologies are the focus. Often these new technologies come from smaller companies in the sector challenging the status quo, even though they frequently exist within the large companies as well. As these new technologies, like electric cars or e-books, disrupt the old business models and require a new set of stakeholders to collaborate, the large companies usually don't push them forward.⁸²

The new technologies often are reasonably easy to identify, even if quality and user experience can be hard to assess due to the novelty and small volumes. In most cases the new technologies do not require a lot of change in user behaviour but can require changes in the way the organisation approaches solutions. For examples the total cost might move focus from running costs to ownership costs. Often different parts of the organisation are responsible for different aspects, so an overall perspective is important with support from senior management.

The second approach requires a radical shift of perspective. Instead of the product the focus is the service/function being provided. E.g. instead of a car the reason behind the mobility becomes the focus. If the reason for moving a person bodily from the home to an office is to allow people to be connected and creative in order to deliver a specific result, there might be smarter things that can deliver that than the purchasing of a fossil car.

When analysing the service needed, an inefficient internal combustion engine, designed to move almost a tonne of material, that carries a person that works on a laptop in an office every day at the same time, does not make much sense. All of a sudden it becomes obvious that many of those trips could be avoided totally if telecommuting becomes part of the approach. A shift to telecommuting that depends on a resource efficient underlying infrastructure where bits are moved instead of atoms, makes it possible to create a workplace that both is within the planetary boundaries and increases productivity.

⁸² Why so few large companies are willing to adopt new business models and support transformative change is an interesting question but outside the scope of this text. Difficulty in changing existing structures and corporate cultures as well as a lack of understanding of the importance of the challenge are areas that should be explored further.

In most cases such a shift requires a totally different set of companies delivering the service, and it might also require a cultural shift within the organisations adopting it. Compared with many traditional sustainability measures, which are a compromise between what is needed and the need for sustainability, transformative solutions are often a win-win solution for the user once they become habits. The resistance usually comes from an older generation reluctant to change the way to do things, and sometimes also from a fear of letting a new generation set the agenda. Teleworking, e-reading, videoconferencing and streaming music are all examples of solutions where the technology is here, but old structures and habits, such as the current use of public procurement to support old solutions due to focus on incremental solutions, are stopping them from becoming mainstream.

The two approaches under the second phase require a different knowledge and more resources than traditional procurement. In order to ensure quality and resource efficiency two strategies, not mutually exclusive, can be developed. One strategy where the organisation increases its capacity and understanding of the new opportunities that exist and are emerging. Another strategy would be to include a more central coordination that supports all those involved in public procurement with guidance and best practice.

4.2 From technofix to business models

Much of the current focus is on incremental technical improvements in existing systems, such as increased fuel efficiency in gasoline cars, slightly improved insulation in buildings and better lighting equipment. All these can be important steps towards sustainability, but too often they result in unsustainability lock-in (see 1.4). In order to deliver sustainability and transformative solutions it is not always necessary to have radical technology innovation, but almost always a radical market/service innovation is needed.

In order to differentiate between different kinds of innovation a matrix can be created with the x-axis as technology and the y-axis as market/service.⁸³ Any procurement strategy that wants to support transformative strategy must encourage both disruptive and breakthrough market/service and technology innovation in order to deliver transformative solutions. A mapping of different options should explore possibilities in all four categories. Such a mapping can also help avoid unsustainability lock-in, by ensuring that it is possible to move from the incremental to the radical, even if it does not happen immediately.

Below a schematic matrix is presented where the combinations that result in transformative solutions are orange.



Illustration 14 Innovation matrix:

Different kinds of eco-innovation with focus on technology and market/service innovation

⁸³ The image is a slightly modified version of an image by René Kemp available in the article "Ten themes for eco-innovation policies in Europe", <http://sapiens.revues.org/1169>

Using the innovation matrix for mobility working the following areas can be identified when the initial challenge is the fossil car. One aspect that surprise many is that a breakthrough service solutions often can eliminate not only the current product but also disruptive innovation of the same product. The case bellow is illustrated by a service innovation that allows staff to work from home, or plan cities so they can walk. This eliminates the need for a car for commuting.

It is however important to also note that when smart new technologies are combined into a system earlier problems can become part of solutions. An electric car can become a storage unit for a home that is a net producer of renewable energy. Analysing opportunities and lock-in situations are therefore very important.

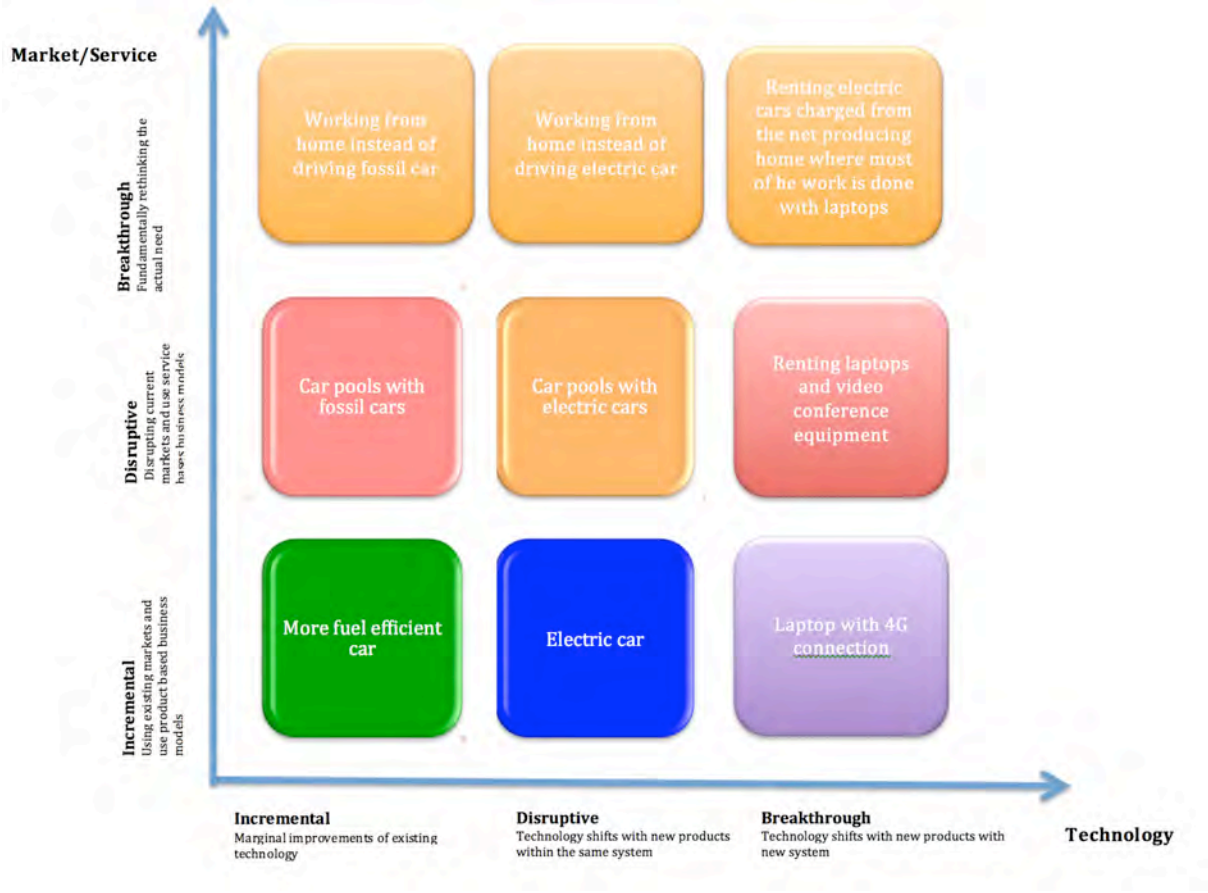


Illustration 15 Innovation matrix:
Examples of different kinds of eco-innovation related to mobility/working

4.3 From upfront costs to total value of ownership

In order to move away from traditional public procurement, which has focused on initial cost, new procurement policies now consider the entire lifetime cost of product, or total cost of ownership (TCO). The notion of TCO takes into account all costs linked to a new product: from the initial investment to the operating costs, such as costs of maintenance, part replacements, disposal, and so forth.

Within a transformative solution context, however, the solution will become dynamic enabling continuous innovation. It thus needs to be looked at from the point of view of *total value of ownership (TVO)*. Only then will governments be able to induce market demand for transformative solutions.

Transformative procurement with a total value of ownership approach includes:

- Linking the solution to the procurer's vision in terms of sustainable growth and development.
- Working actively with stakeholders such as officials, retailers, shop owners, ISPs and citizens to create meaningful use cases.
- Investing operational cost savings in the solution to enable new functionalities.
- Measuring the total value generated year-over-year in terms of savings and revenues, jobs created, and sustainability improvements.

However, despite these obvious benefits, rapid adoption of transformative solutions remains hindered by two barriers:

- **Upfront cost:** Many transformative solutions are already economically attractive in cases when Total Cost of Ownership is high. But they face a particular economic disadvantage in their high upfront costs. At a time of serious global economic slowdown and severe recession in developed countries, the tendency of governments is to avoid "expensive" purchases.
- **Lack of awareness:** Major governments and corporations are important drivers for the transformative solutions. But their awareness levels are really low. Hence, keeping up to date information can be a challenging task.

Some of the necessary changes that will enable transformational change are:

- Investing in inter-disciplinary innovation is critical. Only few of the key innovations that are aimed at addressing environmental and social challenges actually come from related areas such as energy or process improvements. Innovations in fields such as bio-chemistry, material sciences, engineering, and business models are much more critical sources of transformative solutions.
- Disrupting green revolution. Green technologies need to become affordable and accessible. The success of information and communication technologies needs to be replicated in green technologies. Only when green technologies are disruptive also in the sense that they are affordable adoption will increase.
- Green taxes are not enough to stimulate green innovation. Putting a price on ecological impact is very important for incremental improvements to green

technology. But it is not sufficient to lead to transformative innovations. Public and private investment in inter-disciplinary innovations is also needed to create long-term sustainable value.

- Radical policy change is required. Removing regulatory barriers to the growth of new markets will spur entrepreneurship and generate new business models that challenge incumbent firms. The shakeout will increase efficiency, create alternative markets leading to new jobs and competitiveness.

5. Possible ways forward

The possibilities to use public procurement to support transformative solutions are easier now than ever due to technological development as well as new business models that have made such solutions available over the last few years. At the same time many governments are starting to realize that the old incremental approach is failing to deliver what's needed and might even be counterproductive. Ensuring that public procurement will support transformative solutions at every stage in every area is not easy. The recommendations below build on existing work about public procurement including UNEPs Sustainable Public Procurement implementation Guidelines⁸⁴, EU's GPP and procurement for innovation⁸⁵ and The Global Green Growth Forum (3GF)⁸⁶.

However, most of the recommendations in those processes focus on traditional green procurement and linear innovation resulting in incremental improvements of existing systems. Additional inspiration for the recommendation therefore also includes processes that have focused on transformative solutions, such as earlier work by CII⁸⁷ and the UN Global Compacts project "Low Carbon Leaders for transformative solutions"⁸⁸.

For India, efforts for stimulating demand for transformative solutions should be made in a concerted manner rather than ad-hoc individual efforts. A holistic and integrated approach with multi-stakeholder participation will surely yield success.

An umbrella national policy with necessary legislative/institutional frameworks is the essential first step in the efforts to promote transformative Public Procurement in general and stimulating sustainable goods and services in particular. Further, this needs to be translated into the appropriate elements of the 5-year plans. As such, the Planning Commission can be actively involved in this effort.

Subsequently, sectoral programs can be designed at national as well as local levels under which numerous projects can be implemented. To assess the effectiveness of these programs vis-à-vis the policies and plans, transparent and effective monitoring mechanisms should be intrinsically designed at all levels.

An active engagement of various stakeholders is essential for long-term success and sustainability of these efforts. A number of players in the entire supply chain of products and services need to play key roles here, including but not necessarily limited to: industry/manufacturers, retailers, government agencies, academia and R&D organizations, product designers, media, financial Institutions and last but not least consumers.

There are areas where immediate results could be delivered and implementing the recommendations below would help ensure that concrete results are achieved.

⁸⁴ <http://www.unep.fr/scp/procurement/docsres/ProjectInfo/UNEPImplementationGuidelines.pdf>

⁸⁵ http://ec.europa.eu/environment/gpp/index_en.htm

http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/pp-conf2_en.htm

⁸⁶ <http://www.globalgreengrowthforum.com/wp-content/uploads/2012/10/Procurement-Innovation-and-Green-Growth-The-story-continues.pdf>

⁸⁷ <http://www.wfindia.org/?uNewsID=2980>

⁸⁸ <http://transformative-solutions.net>

5.1. Migration strategy:

Implement migration strategies towards transformative solutions

All major government departments and ministries should establish a “migration bridge”. This bridge is nothing more than a specific time where a step back is taken in order to allow for a broader assessment of the needs and new ways that these can be provided for. It is important to communicate when this “bridge” is introduced in order to give companies/clusters with new solutions an opportunity to present their solutions.

This bridge will support a move from current incremental improvement to also include support for transformative solutions. In support of such strategies a national centre for public procurement in support of transformative solutions could be established. The purpose of this centre would be to coordinate, collect best practice and rank different procurement strategies, as well as provide new tools and suggestions for policy changes that will help an accelerated uptake of transformative solutions.⁸⁹

5.1.1 A time and a place for re-thinking:

Identifying who should do what when in the process to allow for re-thinking

One of the main reasons for the lack of procurement that supports transformative solutions, is the absence of an identified process where a broader assessment of what is needed takes place. Both those engaged in public procurement and those with transformative solutions see this as very significant problem.

By not having a specific time and a person assigned as responsible for these broader assessments, it is not clear for most of those engaged in public procurement when and where is the best time to analyse, discuss and buy/sell transformative solutions.

Every organization engaged in public procurement should therefore appoint a person responsible for transformative change in the organization. This position should go beyond procurement in scope, as procurement is only one, even if it is a very important, tool.

All organizations engaged in public procurement should also communicate to potential providers of solutions when and where they will assess the possibility for using new transformative solutions. Smaller organizations could collaborate with organizations with similar needs in order to reduce the amount of work required.

5.1.2 A change of reference point:

Ensuring that the search for transformative solutions is the default action

Today neither leading officials who want to use public procurement to support transformative solutions, nor companies with transformative solutions, experience a support from senior policy makers and relevant ministries. Today’s rules and culture assume that the default action is to repeat the last procurement, and perhaps incrementally improve it. This creates a situation where those exploring the possibilities for transformative solutions are not provided with resources to do so, and if they

⁸⁹ The basis for the different steps within the four different kinds of procurements is a generic “wheel” for the procurement process developed by Fredric Norefjell and Berit Gullbransson at SP within the Ecopol. <http://www.ecopol-project.eu> This model was then modified by Dennis Pamlin to include different kinds of procurements and dividing these into two main categories to highlight the need for a migration strategy.

manage anyway they are often challenged by administrative obstacles and reactive companies challenging them.

In order to make sure that transformative solutions become a mainstream priority the reference point must change. Today the default action among most governmental bodies is to repeat the last procurement and there is a tendency to question those who try new things while those who keep on doing the same unsustainable thing are not questioned. This must change and new government regulation as well as incentives should be implemented that on a regular basis challenge those who keep on purchasing the same thing as before.

All governmental bodies should conduct “re-think-reports” that show how they have analysed their current procurement and strategy in relation to service and the possibility for transformative solutions. The frequency of those “re-think-reports” will depend on the kind of procurement in question, but initially an annual overview of all procurement should be requested.

5.1.2 Cluster support:

Identify and support clusters with transformative solutions

Public procurement that supports transformative solutions requires availability of such solutions. For many services there are many transformative solutions available but it requires clusters of companies to collaborate in order to deliver these. As current incentive structures and regulations are geared towards the 20th century resource intensive and inefficient solutions, initial support to cover the transaction costs might be necessary. This support for clusters could also include the establishment of a platform where those in need of transformative solutions can meet clusters that can deliver these solutions.

For different key areas lists of providers could be provided for those engaged in procurement and as part of increased transparency, it will become mandatory to disclose from what groups the procurement process has been in contact with during the process.

One key challenge is lack of capacity and to make sure there is an efficient use of resources. By using new technologies a crowd developed web/mobile platform could be created that allows those in need of solutions and those with solutions to meet in more efficient ways. By gathering best practice and creating an interface that allows for tailor-made information, such a platform would be able to accelerate the uptake of transformative solutions, increase transparency and contribute to cost savings. Such a cluster platform for transformative solutions would benefit from an international collaboration in order to improve quality and increase user input.

5.1.3 Clear goals:

Ensure transparency in order to learn from and reward leaders

Public procurement today often lacks targets that support sustainable innovations that deliver sustainability. Initially, the most important step is to create transparency and knowledge about the possibilities. The goals do not have to be binding, instead these targets can be used as benchmarks and those that reach the targets with a good margin can be rewarded and used as best practice. Examples of possible targets include:

- At least 1% of public procurement should result in transformative solutions by 2015

- At least 10% of all procurements should encourage transformative solutions by 2015
- At least 1/50th of the national emissions (LCA emissions, not geographical emissions, in order to ensure that problems are solved, not moved) should be reduced by transformative solutions by 2015 and 1/5th by 2020.
- At least one per thousand have been moved out of poverty with the help of transformative solutions by 2015 and 1% by 2020.
- At least 1 per thousand increase in the workforce due to public procurement generating new employees working with transformative solutions by 2015 and 1% by 2020.
- By 2020 export of transformative solutions to key markets will result in a 1% increased export income and strengthen the country's brand as a key provider of transformative solutions.
- 100 cases with entrepreneurs and SMEs that deliver transformative solutions that have received support by public procurement should be gathered and presented on a webpage by 2015. This list of cases should grow to 10 000 by 2020.

5.1.4 A global perspective: International collaboration

Leading governments and companies should collaborate with relevant organizations to establish an international process that helps develop best practice and establish frameworks that encourage collaboration over national boundaries. Such collaboration would help avoid turning public procurement into a protectionist tool that undermines national and global sustainability goals.

In the last few years many international forums have been established that bring together governments and private sectors from developed and developing countries. These forums are set up to identify or develop transformative solutions and also create policy and financing mechanisms to enable development of transformative solutions.

One area where international collaboration would be important is for lifecycle cost assessments. Besides the fact that this is a new area where much work remains to be done, many of the companies engaged in clusters are active in many countries. It would be helpful for all if the systems used around the world were as similar as possible, as it would allow for better comparisons for governments and make it easier for companies, as they would have fewer systems to adapt to.

CII's Centre of Excellence for Sustainable Development is associated with two such forums: the Global Green Growth Forum (3GF was set up by the governments of Denmark and South Korea after UNFCCC COP in Copenhagen in 2009) and the Clean Energy Ministerial (CEM is mainly backed by G20). The Centre is a founding member of the 3GF's initiative on public procurement and finance. The Partnership for Procurement and Green Growth was established at the 3GF 2011 to accelerate implementation of green public procurement and PFI's, validate their evolving business cases and to facilitate projects supporting these endeavours.⁹⁰

As a basis for discussion at this session, the 3GF Partnership for Procurement and Green Growth launches the report "Procurement, Innovation and Green Growth: The story

⁹⁰ <http://www.globalgreengrowthforum.com/3gf-2012/ppp-strategy-sessions/procurement/>

continues...”, which analyses the procurement and green growth business case.⁹¹ The outcomes of the discussion will form the basis of a two year work programme on green procurement and PFIs.

India hosted the fourth Clean Energy Ministerial (CEM4) in New Delhi on 17–18 April 2013. CII was involved in assisting with some background developments and the Centre for sustainable development helped put up an international exhibition of transformative solutions.⁹²

5.2 Flanking support for transformative solutions

As flanking support for transformative solutions and improved public procurement, three initiatives should be considered:

5.2.1 Capacity building

In order to allow decision makers to understand, identify and develop strategies that support transformative solutions, capacity building is often necessary. With new technology this capacity building can be tailor-made and tools, such as the cluster platform for transformative solutions currently being developed based on the work in this project, can be used.⁹³

Allowing for tailor-made support will be crucial as opportunities change and needs are different depending on context.

Capacity building is required on two key themes. One is the transformative thinking, i.e., how a procurer should be thinking of holistic solutions as against conventional practice of procuring a specified product. The other theme is to practice transformative procurement within the existing procurement process with only minor changes in the process.

5.2.2 Life-cycle Cost (LCC), Total cost of ownership (TCO) and Total value of ownership (TVO)

In order to ensure that transformative solutions are not disregarded due to higher upfront costs, it is important to develop methodologies that can estimate the Life Cycle Costs (LCC) and Total Cost of Ownership (TCO). It is important to note that the TCO can differ from LCC depending on what is included. LCC can include externalities and other costs/benefits that could be considered in the procurement, while TCO usually only refers to the actual costs during the ownership.

A more sophisticated version of TCO is TVO or total value of ownership, in which case the procurer looks beyond cost and seeks to enhance value created as a result of the solution.

One challenge faced by procurers is to decide for a certain TCO or TVO based on assumed future performance. This is contrary to the current practice of established low-cost options with performance parameters based on experience. The government will

⁹¹ <http://www.globalgreengrowthforum.com/wp-content/uploads/2012/10/Procurement-Innovation-and-Green-Growth-The-story-continues.pdf>

⁹² <http://www.cleanenergyministerial.org/Events/CEM4.aspx>

⁹³ http://www.transformative-clusters.net/Transformative_Solutions_Platform_Leaflet-EN130309.pdf

need to provide guidance on how TCO or TVO could be applied without running into a future situation very different from the assumption made at the time of purchase.

5.2.3 Revising rules and regulations

Much of current rules and regulations are based on assumptions based on an industrial economy with centralized production and where sustainability was not important. Today the speed of technological development, connectivity, new business models and need for radical efficiency when it comes to use of natural resources require a different set of rules and regulations.

The Indian parliament is currently discussing legislation on public procurement. The Public Procurement Bill 2012 might be tabled in the parliament during one of its sessions in 2013. The Indian Ministry of Finance, which is responsible for the Bill, is of the view that the rules for the potential Public Procurement Act are well suited to provide guidance on transformative procurement given an appropriate supportive framework (that would include capacity building and supporting regulation).



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