Implementation Framework for Sustainable Facilities Management in Indian Context

By G. K. Grover

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The worldview of the concept of sustainability in its present form is a concern of recent origin resulting from the adverse impact of excessive use of natural resources leading to global warming and climate change. However ancient civilizations such as India understood the relationship between nature and humans in a more holistic way. In India, "Fundamental Holism" was defined by its holy books—the Vedas and Upanishads—as a concept that pervaded everything in the universe, "existing in each subsystem in the same form that it exists for the universe as a whole."[1] The existence was perceived as a complementarity of two opposites; that which we can observe or measure from a distance, and that which we can only experience directly from within. Both were considered equally real and complete together.

Whereas the material view of nature based on a dualistic separation between subjects and objects allows us to see nature separate from us and to analyze it in terms of independent mechanisms, the ancient view was more a view from the inside of nature, where we are integral components. If we could understand the principles by which material essences and the mind-body relation related to each other, we could then understand holism and sustainability.[2]

The Indian way of life was "*aparigraha*" (minimum possession), conservation (minimum consumption) and recycling (minimum waste). In Chinese civilization the Taoists and Confucians advocated an approach to life in accord with an ordered and balanced world which showed a deep respect for nature. The Hebrew Scriptures also contained the idea of human righteousness involving right relationship with God and a careful stewardship of the earth.[3]

Sustainability, thus, was considered a way of life in ancient India and other civilizations. The following examples demonstrate that sustainable buildings have been the way of life in India:

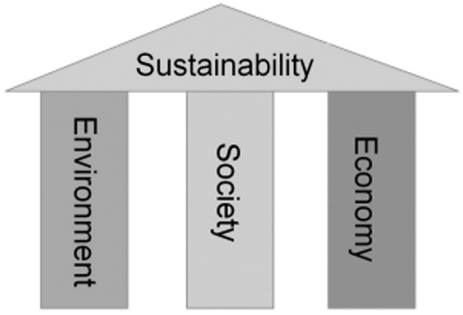
- The *Taj Mahal* built more than four hundred years ago, can accommodate 10 000 people with no suffocation, as the stone *jalis* in the facia induces air movement and enables natural ventilation.
- The fort in *Mandu* has elaborate rain water harvesting techniques.
- *Havelis* in northern India were invariably built around a central courtyard, which brought day light in all the nooks and corners, but kept the heat out.
- Many forts and *havelis* have elaborate provisions for evaporative cooling, using *khas*-screens and rain water stored at higher plateaus.

However, industrialization, electronic advancement, and rapid urbanization in the recent past have created a situation where economic considerations are paramount. The environment, occupational health, safety, and social aspects have been given a backseat. The universal poverty levels have rendered these as luxuries a common man can ill afford.

SUSTAINABILITY

The Brundtland Report defines sustainability as "development that meets the needs of the

EXHIBIT 1



The Three Pillars of Sustainability (Adams, *infra* n.4, p.2)

present without compromising the ability of future generations to meet their own needs."[4] The three pillars of sustainability as defined by Adams are Economy, Environment and Society. (*See* Exhibit 1.) Adams further talks of the "balance between the dimensions of sustainability." (*See* Exhibit 2.)

The Australian National Strategy for Ecologically Sustainable Development defines Ecologically Sustainable Development (ESD) as: "Using, conserving and enhancing the community's resources so that ecological processes on which life depends, are maintained, and the total quality of life, now and in the future, can be increased."[5]

FACILITIES MANAGEMENT

The definition of facilities management (FM) has evolved over a period in consonance with its maturity. In 1983, the International Facilities Management Association (IFMA) defined FM as "the practice of coordinating the physical workplace with the people and the work of the organization. It integrates the principles of business administration, architecture, and the behavioral and engineering sciences." In 2013, the definition of FM progressed to "a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology."[6]

The Facilities Management Association of Australia added the aspect of "safe, healthy, productive environments, protecting the well-being of the Australian community" by defining that FM involves "the management, operation and maintenance of buildings, precincts and community infrastructure. In all cities and regional areas facilities management provides safe, healthy, productive environments, protecting the well-being of the Australian community."

British Standards (BSI) defines FM as "the integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities" the basic concept being to provide integrated management on a strategic and tactical level to coordinate the provision of the agreed support services (facility services). This requires specific competencies and distinguishes FM from the isolated provision of one or more services.

RICS guidance notes, Global-Strategic Facilities Management 1st edition, 2013 defines FM as: The effective management of place and space, integrating an organization's support infrastructure to deliver services to staff and customers at best value whilst enhancing overall organizational performance.

FM now covers "real estate management, financial management, change management, human resources management, health and safety, contract management, in addition to building and engineering services maintenance, domestic services and utilities supplies."[7]

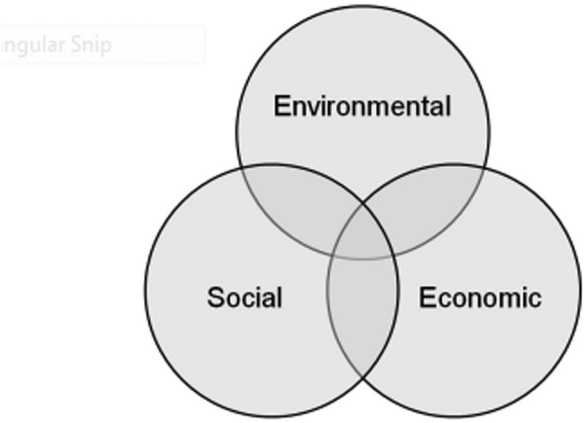
A chronology of how FM has transformed is provided below:[8]

1. 1970s: Managed services, outsourcing, total facilities management, CAFM— Operational
2. 1980s: Quality management, management agency, benchmarking, FM process, FMIS—Tactical
3. 1990s: Partnering, re-engineering processes, knowledge management, product innovation, sustainable facilities management—Strategic
4. 2000s: Business processes, open innovation, usability, service excellence transformational, outsourcing—Transformational

FM in India

With a global market of $394.69 billion and Indian Market of $19.4 billion by 2020, FM as a profession has immense opportunities and is likely to grow exponentially. Approximately 700–900 million square meters of commercial and residential space is being built each year in India. There are major players in FM, such as the International Property Consultants (JLL, Cushman & Wakefield, CBRE, Knight Frank, Colliers); the Indian property consultants (Vipul, Novel, Clean India, A La Concierge); the Corporate Real Estate firms (Vestain Global, IBM); Developers (Unitech, Hiranandani Group)

Exhibit 2



The Three Interlocking Circles of Human Experience Interconnected through Sustainability (Adams, *infra* n.4, p.2)

and the Banks (HSBC, JP Morgan, Barclays, Standard Chartered Bank).

The Indian FM services market is in its early growth stage and is evolving rapidly, fueled mainly by the high pace of growth in the construction sector. Increased awareness levels among different vertical markets are expected to take this market to a mature growth phase in its life cycle. But, in terms of market maturity and understanding and accepting of such services by end users, India has a long way to go. (*See* Exhibit 3.)

Role of Facilities Manager

The role of a facilities manager is variously defined considering the country, region, and the maturity of FM itself. Where FM has matured as a profession, the role of a facilities manager is overarching covering the entire life cycle of a property/facility. On the other hand, wherever FM is itself in an embryonic and early stage of maturity, the role of facilities management is confined to operations and management of the facility.

RICS Guidance—Strategic Facilities Management has given a list of roles and responsibilities of a facility manager under three heads—Services, Management, and Real Estate based on BS EN-4 Taxonomy which contains 121 Headings and Sub Headings. IFMA, USA carried out a survey across 62 countries and created a global task analysis leading to 11 competencies enumerated by them.

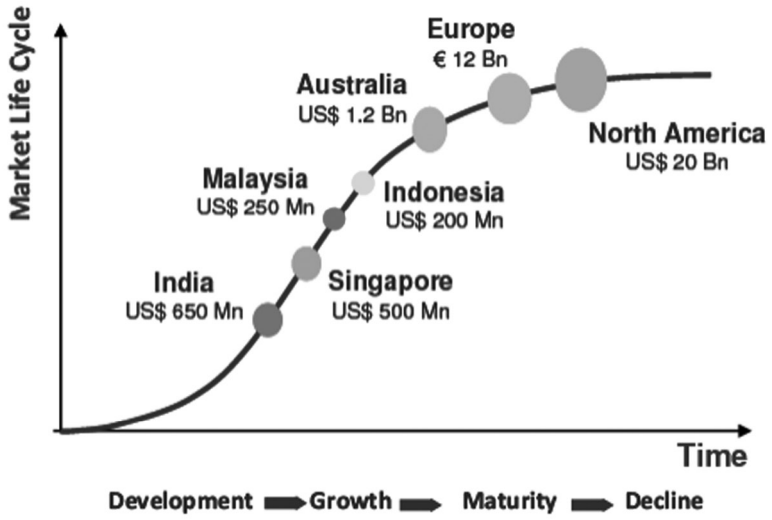
In the paper, "Positioning of Facilities Manager's role throughout the building life cycle,"[9] the Royal Institute of British Architects (RIBA) Plan of Work stages initially evolved in 1963 and subsequently updated (RIBA 2013b), has been taken as the basic framework to map the facilities manager's role in each of the stages. The mapping of the Facility Manager's role has been aligned to the eight stages: (1) Strategic Definition, (2) Preparation and Brief, (3) Concept Design, (4) Developed Design, (5) Technical design, (6) construction, (7) Handover, and (8) Close Out.[10] A detailed examination of these reveals that various sustainability aspects of FM are covered at each stage. The sustainability aspects influenced by FM" are shown in Exhibit 4.

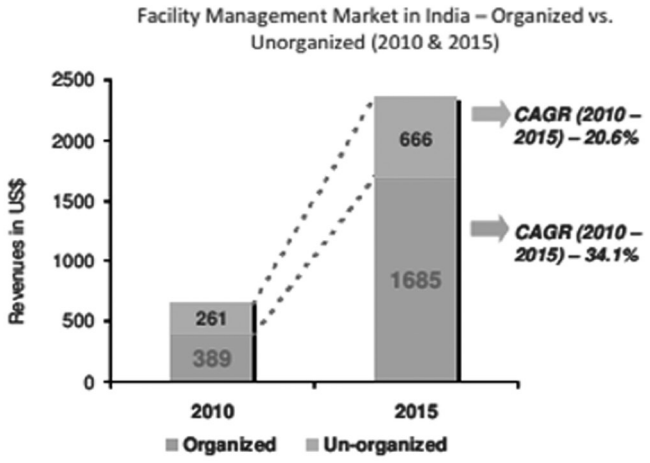
Pilanawithana concludes that the Facilities Manager must be engaged with the project right from the beginning and work closely with all the stakeholders fulfilling his role at each stage during the building life cycle and contributing to the sustainability aspects resulting in great value addition optimization of the building performance.

Discussion in Indian Context: FM professionals have been in the forefront of most organizations to promote, plan and implement sustainability aspects in the built environment but their role is restricted to operational levels. By virtue of their primary role in management of mechanical, electrical and plumbing (MEP) services, waste management, transportation, housekeeping, security and surveillance, fire and life safety, their work directly impacts on major elements of sustainability.

The managerial and technical competence of FM professionals is by and large lacking as most of them have meandered to FM from other professions such as engineering,

EXHIBIT 3





Source: Indian Facilities Management Market: Growth Opportunities and Challenges Ahead; A White Paper by Frost & Sullivan; © 2011 Frost & Sullivan.

architecture, hotel management and administrative disciplines. Most of them are not specifically qualified in FM and their expertise largely depends on ground experience and on the job training.

CURRENT STATE OF SUSTAINABILITY IN INDIA

Legislation and Acts promulgated by Indian governments from time to time are treated with disdain and compliances are considered necessary evils that are met but grudgingly.

Buildings/complexes more than 20 years old cannot be expected to be compliant, those built in the last 20 years may be partially compliant and only those buildings that have been constructed in the last five to ten years may be compliant.

The Indian government initiatives are confined mostly to infrastructure development and providing basic services such as electric supply, water supply, and city/town sewerage systems etc. The government has been highly conscious of environmental aspects and has promulgated an Air Act, a Water Act, and an Environment Protection Act, etc. to establish an environmental control regime. This includes obtaining Consent to Establish, Consent to Operate under the acts and subsequent submission of Quarterly/

EXHIBIT 4—SUSTAINABILITY ASPECTS INFLUENCED BY FM

RIBA stages	Core objective of the stage (RIBA, 2013a)	Extracts: "Sustainability Aspects Influenced by Facilities Management
Strategic Definition stage	Determine client's business case and strategic brief and identify core project requirements	…decision to build a new facility or to expand or modernize an existing old facility to expand production or reduce **distribution cost, operation and maintenance costs and energy cost** (Lewis and Payant, 2007)
Preparation and Brief stage	Develop initial project brief, conduct feasibility analysis and establish project outcomes, quality objectives, sustainability aspirations, project budget and other parameters or constraints	Facilities Manager ensures a **sustainable building design**, clear specification and provide a framework around which the design can be developed (Shah, 2008)
Concept Design stage	Prepare developed design, including updated proposals for structural design, building services systems, outline specifications, cost information and project strategies	….. to ensure the **health and safety, accessibility, space arrangement and maintenance requirements** (Singh et al., 1999)
Technical Design stage	Prepare technical designs including all architectural, structural and building services information, specialist subcontractor designs and specifications	develop a series of **engineering evaluations**, which will specify the feasibility and cost of each of the possible alternate courses of actions (Lewis and Payant, 2007)
Construction stage	Offsite manufacturing and onsite construction according to construction program and resolution of design queries from site as they arise	…. **quality aspects** during the construction phase of the building (RICS, 2015); … collect the as-built information for the proper **operation and maintenance of a facility by Facility operators/ maintainers** (Liu et al., 1994)
Handover and Close Out stage	Handover of building and conclusion of building contract	…**operation and maintenance** work should be performed on **facilities, equipment and systems** (Lewis and Payant, 2007)
In Use stage	Undertake in Use services, utilize building services, conduct post-occupancy evaluation and review building performance	…..**maintenance management requirements** of a building in relation to the areas such as **statutory and regulatory requirements, maintaining record systems, management reporting and supply chain management** (RICS, 2015) Post-occupancy evaluation (POE) is a diagnostic tool, which allows Facilities Managers to **systematically identify and evaluate critical aspects of building** Table I. performance (Preiser, 1995)

Half Yearly, and Yearly Environment Progress Reports on environment surveillance, monitoring, compliance status in terms of environmental clearances that are accorded. Environmental Impact Assessments (EIA) are a process appraisal and approval of projects in four stages: (1) screening, (2) scoping, (3) public consultations, and approval in a time bound manner.

Smart development has been identified as a sustainable world-wide solution to the existing urban planning problems. Green affordable housing is still marginal in urban India.

Sustainable FM

The concept of sustainable FM is best described in terms of an organization's economic profitability, environmental responsibility, and social awareness. Various Studies on the drivers for sustainable FM have listed the following drivers:[11]

1. Environmental
   a. Reduction in energy consumption
   b. Waste reduction
   c. Increase productivity

   d. Elimination of oil and air pollution
   e. Sustainable urbanization
   f. Reduction of deforestation
   g. Reduction of carbon dioxide emissions
2. Social
   a. Legislation/ Government regulation
   b. Corporate image
   c. Organization ethos
   d. Service management /Director's leadership
   e. Pressure from clients
   f. Pressure from employees
   g. Pressure from stakeholders
   h. Pressure from senior management
   i. Enhance relation with stakeholders
   j. Job creation for local communities
   k. Market competition [corporate image]
3. Economic
   a. Lifecycle cost reduction
   b. Financial gain
   c. Investment drive
   d. Life cycle cost reduction
   e. Profitability
   f. To remain competitive

Unless there is an appropriate Environmental Management System (EMS) in place to monitor, review, check, and improve such policies and practices, sustainable policies and operational practices are bound to fail.[12] For this, organizations must implement sustainable FM through implementation of EMS with the FM function. At the operational level, considerations for sustainable FM delivery are:

a. Sustainable cleaning and reducing water usage—automated toilets, waterless urinals, low flow taps/ spray taps, use of low VOC and non-toxic cleaning compounds, etc.
b. Sustainable catering—use of locally grown food, reusable, compostable or recyclable dinnerware, intelligent cooking, composting, etc.
c. Sustainable travel—implementation of car sharing within organization's fleet, provision of bicycles, electric vehicles, etc.
d. Waste disposal and recycling–provision of central printing zones, bin color coding, paper shredding onsite, digital media [CDs and DVDs], dry cell batteries recycling, etc.
e. Space management—hot-desking, flexible workplace, etc.
f. Reducing energy from mechanical and electrical [M&E] services—use of energy rated appliances, implementing shut-down periods and zones for say lifts, recovery of energy, eco lifts, etc.

FM currently is seen as the champion for sustainability in built environments from various studies.[13] Most of the processes are owned by FM and FM also has the most influence over resource utilization and waste generation. FM services hold a key role in minimizing the total environmental impact of a corporation with their direct and indirect influence on building environmental performance metrics and the data which is needed for green management.

Sustainable FM deals with cutting down facility related carbon emissions while enabling optimal facility productivity.[14] Green Facilities Management (Green FM) strives to reduce carbon emissions while creating a comfortable, healthy working environment; considering life cycle sustainable practices including efficient resource utilization, energy management, and waste minimization. FM's contribution is of paramount importance for design and operation of more resource-efficient sustainable buildings that are maintainable. Knowledge in maintainability of building systems is therefore of paramount importance to FM to cater for sustainable asset management throughout the life cycle of the built environment.[15]

Barriers and Drivers for Sustainable FM

In a literature survey followed by interviews and workshops with stakeholders, Marit *et al*. concluded what the barriers and drivers for sustainable FM are, and their confirmation in theory and in practice as shown in Exhibit 5.[16]

They further found that **"**the major barriers to sustainable refurbishment projects were:

- Lack of knowledge and information,
- Paucity of cost-effective actions and
- Low level of understanding of the FM and user role.

The survey results[17] show that time constraints, lack of knowledge and lack of senior management commitment are the main barriers for the implementation of consistent and comprehensive sustainable FM policy and practice. The study concludes that the diversity of the FM role

EXHIBIT 5

Barriers		Theory	Practice
Business Organization	• Cost-effectiveness (F)*	Yes	No
	• Lack of consensual understanding and focus on individual and organizational understanding of sustainability (S)**	Yes	Yes
	• Concise decision-making framework due to complex processes (S, E,*** and F)	Yes	Yes
	• Conflicting stakeholder requirements and agreement of sustainable goals for retrofit (S, E and F)	Yes	Yes
	• Lack of distribution of power, empowerment and capacity building (S, F)	Yes	Yes
	• Lack of information and knowledge about the building—at a strategic level (S and F)	Yes	Yes
	• Lack of understanding of contextual issues (S)	Yes	Yes
	• Lack of integration of stakeholder knowledge (S)	Yes	Yes
	• Lack of strategic leadership and responsibility of driving essential change (S)	Yes	No
	• Lack of information and communication between the FM organization and client/user at tactical and operative level	Yes	Yes
Users	• Awareness of the behavior of different users of space (S, E and F)	Yes	No
	• Lack of understanding of contextual issues (S)	Yes	No
	• Lack of commitment to project goals, as well as enhanced process legitimacy through transparency and credibility of the decision-making process (S)	Yes	Not explicit
	• Lack of competence and knowledge about the building (S and F)	Yes	Yes
	• Perception that a certified building is the same as a sustainable building	No	Yes
Competences	• Awareness of the behavior of the building's users (S, E and F)	Yes	No
	• Lack of FM professional competence and information (S and F)	Yes	Yes
	• Lack of competence and information about the building	No	Yes
	• Lack of strategic leadership and responsibility of driving essential change (S)	Yes	Yes
Policies and instruments	• Lack of incentives for private investors (also called the landlord/tenant dilemma; (S, F)	Yes	Yes
	• Lack of funding for private owners (F)	Yes	No
	• Reluctant stakeholder commitment due to low energy prices (S and F)	Yes	Yes
*financial (F), **social (S), ***environmental (E)			

and the traditional undervaluation of the contribution it makes to the success of organizations are partially responsible for lack of success in achieving sustainable facilities. The overwhelming barriers for sustainable FM practice are the lack of understanding, focus and commitment of senior executives in appreciating the opportunities, threats and need for strategic leadership and direction in driving essential change, and hence further the sustainability agenda.

On the other hand, in the same study, various stakeholders (FM suppliers, FM operators, FM managers, public and private owners, researchers, consultants) identified the Drivers for sustainable operations from practice as:

- Digitization and interoperability of ICT
- Commissioning
- A proactive FM provider in dialogue with the user
- Policy and regulations
- Social sustainability increases with user involvement
- Industrialization—reduced construction costs when the construction is based on standardized components
- New competences and education

Penetration of Technology and Information Systems in FM

As of now, in the context of India, the building management is being done using In-house Teams using Log Sheets/Books based on formats provided by equipment and plant manufacturers for monitoring operations and the data is captured manually by technicians. The standard operating procedures (SOPs) may exist for some of the processes in Facilities Management Manuals. Use of computers is being introduced for certain applications for compliant management etc.

Building Management Systems (BMS)/Building Automation Systems (BAS) were not provided in most of the earlier complexes but are finding favor in the newly constructed high rise commercial and residential complexes in Tier I and some Tier II cities.

Accounts software and in the case of larger organizations, Enterprise Resource Planning (ERP) software, may be in use for business process management including procurement. However, there is hardly any maintenance management and facilities management software in use except for the Information Technology (IT) and ITES Sector. Use of software is beginning to appear in inventory management, Computerized Maintenance Management Systems (CMMS), and Computer-aided Facilities Management (CAFM) Systems.

FM is largely working at operational level only. For FM to be strategic, the FM role within organizations will need to be upgraded. The FM should not get restricted to "here and now" but also should be a part of the future environment, both within the business and the FM environment, in terms of the way the business will be conducted, the competition, the transformations in technology, and resultant impact on the workplace. The projected changes in the legal and regulatory regime particularly from the point of view of sustainability will be important as those will be initial steps/the beginning of implementation of sustainable FM.

AUDITS

ISO Audits

The standards set by the International Organization for Standardization (ISO) standards that relate to FM are under the following:

- ISO 9001: Quality Management System Standard
- ISO 14001: Environmental Management System Standard
- ISO 18480-1 (41011): FM Terms and Definitions
- ISO 20121: Event sustainability management systems
- ISO 22301: Societal Security – Business Continuity MSS
- ISO 27001: Information security management
- ISO 41001(developing): Facilities Management System Std
- ISO 45001: Occupational health and safety management systems
- ISO 55001: Asset Management System Standard
- ISO 18480-2 (41012): Guidance on strategic sourcing and the development of agreements
- ISO 50001: Energy Management System Standard

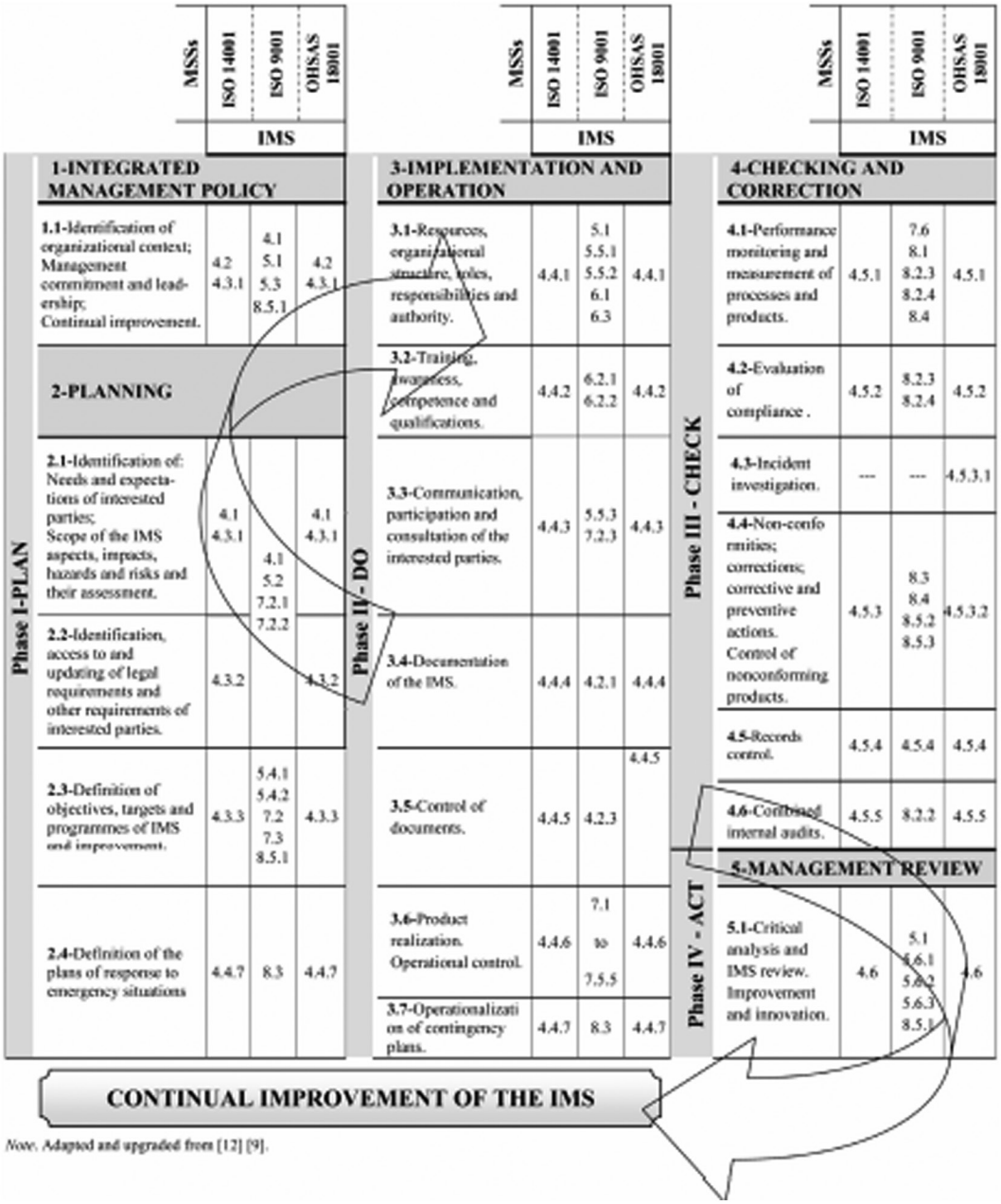
A Quality Management System enables an organization to establish systems and procedures for continual improvements in quality. The focus of ISO 9001 Quality Management System Requirements is Customer Satisfaction. ISO 14001 Environment Management System helps in establishing environmental management processes and its certification enables the organization/facility to improve and demonstrate environmental compliance as well as performance. Occupational Health & Safety OHSAS 18001/ISO 45001 enable an organization/facility to set up a safe working environment, protecting their health and preventing accidents and exposure to workplace hazards.

While implementing ISO 9001, all legal compliance must be ensured that cover various labor legislations and environment acts. This facilitates progression from ISO 9001 to ISO 14001 and ISO 45001. It is thus possible to take up integrated implementation of Quality, Safety, Occupational Health & Environment (QSHE), that is, ISO 9001, ISO 14001 and ISO 45001 particularly since the clauses of these standards have now been aligned after issue of ISO 9001:2018. The matrix of compatibility of requirements and of support to the integration of the individual standardized: EMS, QMS, OH, and SMS is given in Exhibit 6.[18]

ISO 41000 Facility Management Systems

Those working within the FM profession are responsible for managing the built environment along with the efficiency and effectiveness of its use by those who occupy it. To do so, it was necessary to establish international standards that will enable the sector to evolve in a coherent and coordinated manner. With this objective, ISO/TC-267 was set up to make a valid contribution to this process, at a strategic level, in a manner that will be acceptable and relevant to all

EXHIBIT 6



Note. Adapted and upgraded from [12] [9].

countries who are members of ISO and beyond. Within the ISO Framework, a series of Standards has been created that:

- Introduces the general requirements for an FM organizational strategy,
- Articulates the requirements for an effective and efficient management regime, and
- Provides guidance to achieving benefit from an FM Management Systems Standard (MSS) ISO 41001.

Launched in 2018, ISO 41001 is foremost among a set of new standards designed and developed to provide a framework for global FM.

- ISO 41001—*Management Systems—Requirements with Guidance for Use*—aims to improve Facility Management awareness, and the development, implementation, and maintenance of effective FM regimes in all sectors of industry and commerce.

- Facility Management Systems Standard ISO 41001 helps facilitate efficient, appropriate FM structures and resourcing, and confers criteria for assessing if suppliers are fit for purpose.
- ISO 41001 also provides global businesses and markets with the template they need to develop a world class FM regime. It enables professional training and certification, and supplier benchmarking for public and private sectors.

Energy Audits

The Government of India set up the Bureau of Energy Efficiency (BEE) to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001, with the primary objective of reducing energy intensity of the Indian economy.

The Government of India had identified certain energy intensive industries labelled as "designated consumers" and made it compulsory for them to conduct Energy Audits following the Bureau of Energy Efficiency Regulations, 2010. Annual audits of Designated Buildings with load ≥ 600KVA OR 500KW were mandatory. Energy Conservation Building Code (ECBC), 2017 was launched by the Government in June, 2017, and is applicable for large commercial buildings with connected load of 100 KW and above or 120 KVA and above. ECBC focuses on building envelope, mechanical systems and equipment including heating, ventilating, and air conditioning (HVAC) systems, interior and exterior lighting systems, electrical systems and renewable energy.

There is significant potential in the existing residential and commercial buildings. From various studies, it has been observed that there is potential of 30–40 percent in the existing commercial buildings. The Bureau is taking up various tasks for notification of energy intensive buildings as Designated Consumers, notification by the State authorities for mandatory energy audits and implementation of energy efficiency upgrades in existing buildings. It is widening the scope of the Star Labeling program for commercial buildings to cover multi-story residential buildings as well, preparing guidelines for the Public Works Department and other owners of public buildings to implement energy-efficiency upgrades, guidelines for the design of low-income housing so as to optimize thermal comfort, and an outreach program for building owners and tenants about energy-saving opportunities. Buildings with 500 sq. m or more of conditioned area are likely to fall under the load of 100 KW and above or 120 KVA. The ECBC deals with mandatory and prescriptive requirements of new and existing buildings related to this specified threshold area. These buildings constructed earlier are not ECBC compliant and consumption in different levels may not be as per the standards. The BEE has laid down a benchmark of energy consumption for different categories of buildings in different levels. The ECBC defines norms and standards for the energy performance of buildings and their components based on the climate zone in which they are located. Existing buildings are to be retrofitted by BEE recommended equipment to reduce the losses in different levels.

Audits for Building Rating Systems

There are many building rating systems available that stipulate audits of multifarious aspects including energy audits such as the Building Research Establishment Environmental Assessment Method (BREEAM), which is followed in the United Kingdom and many other countries; Leadership in Energy and Environmental Design (LEED), which is followed by the United States; Comprehensive Assessment System for Built Environment Efficiency (CASBEE), which is followed in Japan; Green Globes, which is followed in Canada and North America; Green Star in Australia; Green Mark in Singapore; Three Star System in China; and India's very own national rating system for green buildings—Green Rating for Integrated Habitat (GRIHA) in India.

Developed by The Energy and Resources Institute (TERI), it is endorsed by the Ministry of New and Renewable Energy (MNRE), GRIHA describes a green building as one in which demand for electricity, water, and other natural resources (in construction, operation, and demolition) is optimized, it generates all its electricity on site through renewable means, it caters to all its water demands through sustainable processes such as rain water harvesting, grows its own food on site and recycles and reuses all its waste on site and its burden on the environment is reduced to the minimum.[19]

This process of design often is referred to as "closing the loop." In other words, striving to generate and utilize on-site resources to construct and operate the building and then ensuring that all the waste material is managed on-site itself, thereby leaving nothing (if possible) to be put into the municipal systems.[20]

National Building Code of India

The National Building Code of India, 2016 (NBC), a national instrument providing guidelines for regulating the building construction activities in India, serves as a Model Code for adoption by all agencies, be they Public Works Departments, other government construction departments or private construction agencies. The NBC mainly contains administrative regulations, development control rules, and general building requirements; fire safety requirements; stipulations regarding materials, structural design and construction (including safety); building and plumbing services; approach to sustainability; and asset and facility management.

An exclusive chapter, "Approach to Sustainability" has been included covering guidelines for making buildings and built environment energy efficient and environmentally compatible. This chapter covers new and energy efficient options of air conditioning, heating and mechanical ventilation, such as variable refrigerant flow system, inverter technology, district cooling system, hybrid central plant using chilled beams, radiant floor components, and geo-thermal cooling and heating. It has emphasized envelope optimization using energy modeling, daylight simulation, solar shade analysis and wind modeling software to optimize the air conditioning load. It also has covered HVAC provisions considering adaptive thermal comfort conditions for energy efficiency, HVAC requirements for data centers and healthcare facilities, building automation systems to include the latest practices for Web-based monitoring and control of performance parameters, rainwater harvesting, solid waste management, promoting sustainability in buildings and built environment in tandem with relevant sustainable development goals, asset and facility management to cover provisions relating to management of building assets and associated services, also covering responsibilities of occupants for maintenance of facilities, such as structures, equipment and exterior property. Compliance to NBC provisions is mandatory and will go a long way in achieving sustainability.

A building is "green" when it is designed using an integrated approach (as mentioned in NBC, Part 0), it provides its users with an "optimal" level of comfort catering to local needs (as per NBC-Part 8), it uses minimum resources, sourced locally (as per various IS codes and other local materials), it consumes minimum energy and water (as per ECBC and NBC), and it generates optimum waste, processed locally (as per CPCB, and Ministry of Environment & Forest norms) during its construction, operation and demolition (*i.e.*, over its entire life cycle).

Sustainability is ALWAYS local (context specific). The minute designs, technologies, products or materials are imported, the environmental impact increases multi-fold, defeating the very purpose of designing a green building.

The design of a green building involves integrating resource-efficient features into a building's design from the pre-design stage itself, and by ensuring that the architects, engineers, and contractors follow established environmental principles addressing local needs, designing a green building is easy and fun, and may cost less than a conventional building.

The following are steps for Implementing GRIHA:

1. By adopting the integrated design approach such that the client, architect, engineers, and consultants design the building in a coordinated manner with a common goal –sustainability.
2. By following regional development plans (such as the UDPFI guidelines, master plans) and local building by-laws
3. By following India's national codes and standards
4. By optimizing site conditions (trees, water bodies, wind flow, orientation, etc.) and harnessing them to cater to the thermal / visual comfort requirements of the building
5. By adopting sound architectural practices and taking examples from India's traditional architecture
6. By adopting locally available construction materials and giving impetus to local arts, crafts, architecture and artisans
7. By designing precisely-sized energy systems and not basing them on broad thumb-rules.
8. By reducing the resource consumption of the building and its inhabitants so that the waste generating therefrom is reduced
9. By adopting energy efficient technologies (EETs) and equipment

Sustainability Audit

Whereas implementation of quality, environmental, occupational health and safety standards enable basic minimum requirements to be met, energy management system enables one of the most important elements of sustainability,

to be effectively managed. Asset and FM systems further strengthen FM in a holistic manner.

ISO 26000 Guidance on Social Responsibility emphasizes the needs for and benefits of socially responsible behavior. The core subjects and issues of social responsibility include organizational governance, human rights, labor practices, fair operating practices, social investments, consumer issues, and community involvement and deployment.[21]

AA1000 AS Standard is the only internationally recognized standard that provides sustainability assurance. The AA1000 Framework is the initial foundation and general management framework. Social Accountability SA 8000 is a certifiable, auditable standard on UN Declaration of Human Rights, national labor laws and international human rights norms. The standard requires audit of child labor, forced labor, health and safety, freedom of association and collective bargaining, protection against discrimination, disciplinary practices such as treating staff with dignity and respect, working hours, remuneration and management system.

The Global Reporting Initiative (GRI) has a framework of principles and guidance together with disclosures that can be used for voluntary disclosure of corporations using sustainability performance. It is the most widely used reporting framework for corporate social responsibility (CSR). The categories and aspects in G4 Guidelines—Sustainability Reporting Guidelines—Reporting and Standard Disclosures are economic, environmental, and Social. (*See* Exhibit 7.)

SURVEY RESULTS

Analysis of Survey Questionnaire on FM and Sustainability

Based on the literature survey above, a comprehensive survey questionnaire was prepared with a view to ascertain the status of sustainability in the Indian context with particular reference to sustainable facilities management (SFM) practices covering the life cycle of an organization/facility.

During the months of May and June 2019, the questionnaires were addressed to a group of facilities managers holding independent charge/senior positions who understood FM practices and belonged to organizations such as Johnson & Johnson Pvt. Ltd., L&T Financial Services, Embassy group, DAG Pvt. Ltd., Accelya Solutions India Limited, and Multiplex Services.

Various aspects covered in the survey included:

- Status of understanding and implementation of sustainability issues in vision, mission, and goals of the organization and the aspects of environmental, social and economic aspects covered in sustainability policy.
- Aspects of sustainability covered during design and construction stage.
- Sustainability practices covered during operations and management stage.
- Compliance status in respect of social and environmental legislations.
- Audits and ISO certifications
- Green Certifications

The survey also sought information on barriers and drivers for sustainability implementation in Indian context.

Sustainability and Facilities Management

The extent to which sustainability issues had been embedded in the vision, mission and goals of the organization/facility was rated at 3.6 on a scale of 1 to 5. Ninety percent of the organizations had a sustainability policy. Their coverage of social, environmental, and economic measures is given in Exhibits 8, 9, and 10.

Various aspects considered by the organization during design and construction included: Energy Conservation/Material Conservation (*see* Exhibit 11), and Water Conservation/Land Conservation (*see* Exhibit 12).

Facilities Management Sustainability

Energy: The measurement, monitoring, and analysis of energy consumed by the facility's core building systems metering is being carried out by 90 percent of the organizations/facilities by installing energy meters for various systems using smart meters (80 percent) and analog meters (10 percent). Eighty percent of them are using an Energy Management System.

The following measures are being taken by the facility to optimize its energy performance:

- Consumption reading as against described parameters.
- Installation of LED lighting fixtures.
- Installation of occupancy/motion sensors in Cabins, Meeting Rooms, and washrooms.
- Installation of timers for outdoor lighting fixtures.
- VAVs/VFDs are installed for HVAC systems.

EXHIBIT 7

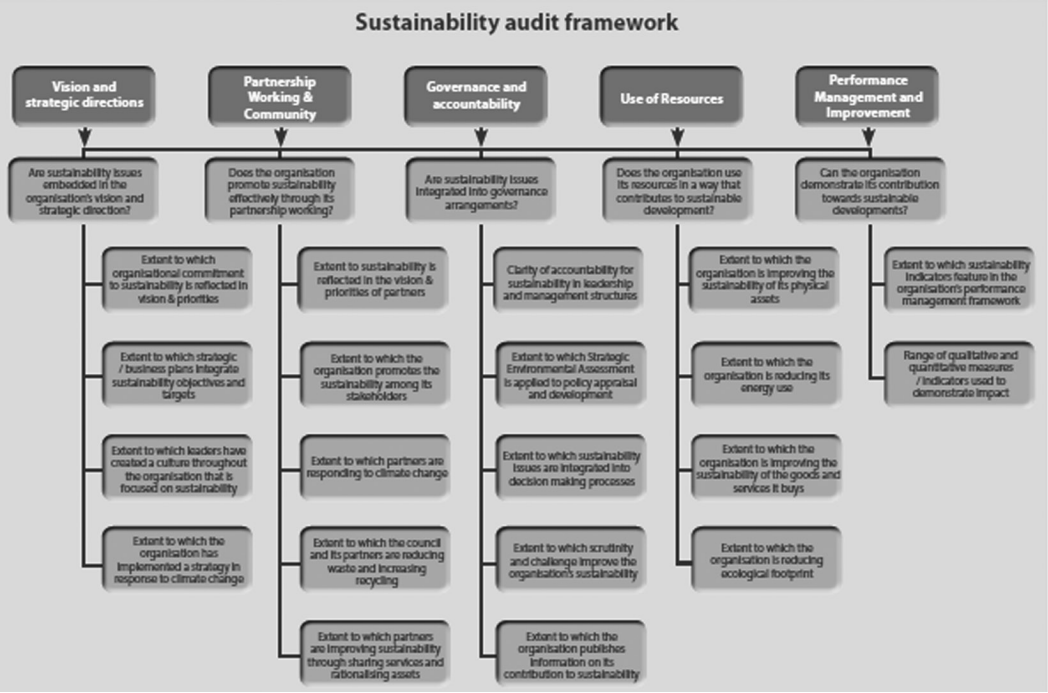


EXHIBIT 8—SOCIAL

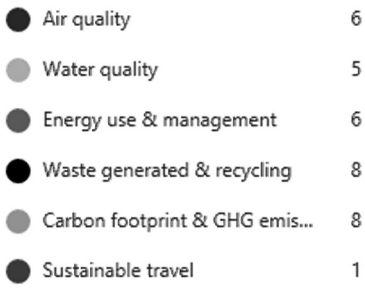
- Conducted Energy Audits to identify energy saving opportunities.
- Replaced all plumbing fixtures with water saving fixtures.
- Retrofitted current HVAC equipment with more energy efficient equipment.
- Installed efficient HVAC and lighting systems.
- Reduced load by deploying renewable energy sources (solar power panels) and usage of occupancy sensors for efficient energy management.
- Use of LED lights, natural daylight and HVAC power regulator.

The following measures are being taken by the facility to improve the efficiency of equipment and appliances:

- Checking the health and life cycle of equipment.
- AMC's in place.
- Use of preventative and productive maintenance system for all critical equipment.
- Use of only star rated electrical appliances.
- PPM, regular AMC and usage of energy efficient equipment.
- Use of low power consumption equipment.
- Installation of energy meters.

Only 40 percent of the organizations had a plan to become Net–Zero energy.

Exhibit 9—Environmental



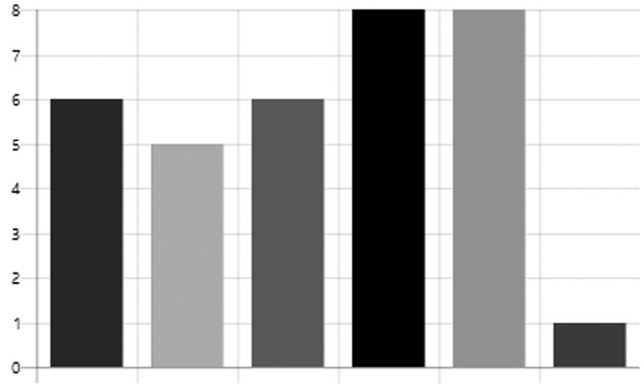


Exhibit 10—Economic

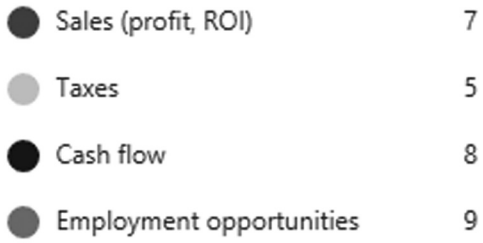
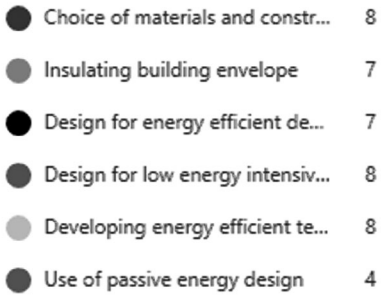
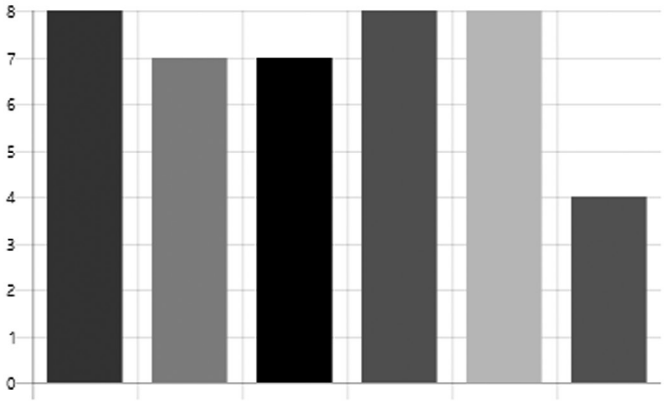


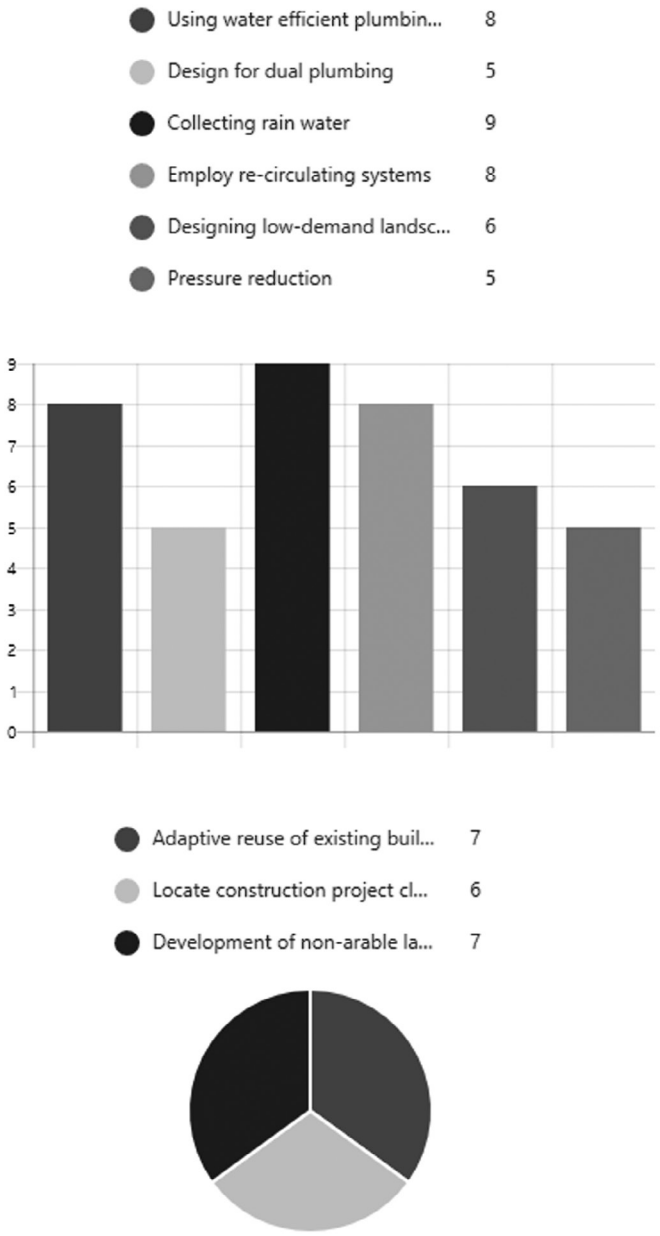
Exhibit 11— Energy Conservation/Material Conservation





Water: Only 60 percent of the organizations had a system of measurement, monitoring, and analysis of water used by the facility. Ninety percent of the organizations had measures in place in the facility to recycle and reuse water. Eighty percent of the organizations had water meters installed to capture the water consumption for different purposes. Seventy percent of the organizations carried out regular monitoring of water consumption through water balance diagram. Eighty percent of the organizations had a plan to become Water/Waste Net–Zero; while 60 percent of the organizations foresaw their building/facility

Exhibit 12—Water Conservation/Land Conservation



becoming a Water/Waste Net–Zero in the next three years, 30 percent in the next three to five years and 10 percent in more than five years.

Materials and Resources: Ninety percent of the organizations had procedures for monitoring and controlling the use of various resources, 80 percent of them had in place a procedure for management of recyclable materials and for making purchases in a sustainable manner.

Workplace Management: All the organizations had a system for measurement and review of the space utilized by the facility. Forty percent did it monthly, 10 percent on a quarterly/half yearly basis, and 40 percent on a yearly basis. Seventy percent implemented the measures to encourage and support working virtually.

The records of measurement of workspaces vis-a-vis productivity were maintained by 60 percent. Various measures have been implemented to decrease the facilities' impact on the environment, such as:

- Installation of CO2 monitoring system, which introduces fresh air into the office environment.
- Design of building facade and furniture layout in such a manner that maximizes natural light.
- Installation of STP Plant that recycles 100 percent of waste water for flushing and gardening purposes.
- Proper recycling of waste and water.
- Pollution and noise control from equipment, directing the drains properly.
- Implementation of awareness programs on energy conservation to make occupants aware of Zero Carbon Emission.

Indoor Environmental Quality: Eighty percent of the organizations measured indoor air quality and maintained records, and 70 percent measured and maintained records for occupant comfort.

Site Impact: Ninety percent of the organizations carried out Storm Water Disposal as per local regulations. Only 60 percent of them had implemented rain water harvesting (RWH) schemes and checked their serviceability regularly. Eighty percent of these organizations/Facilities implemented measures to achieve sustainable transportation in the facility.

Quality of Services: Almost all the organizations had implemented procedures for the following:

1. Management of mail services in the facility
2. Management of documents in the facility
3. Management of meeting services in the facility
4. Maintenance of exteriors

    a. Site features (windows, walls, roofing) and grounds
    b. paved and unpaved areas

c. exterior facility amenities
d. landscape and amenities

Waste: Almost all organizations had implemented procedures for following:

1. Management of collection and disposal of waste
2. Measures to reduce the amount of waste it generates
3. Measures to create or better utilize a recycling program
4. Disposal of hazardous waste

Barriers and Drivers for Sustainability Implementation

The four major barriers to implementation of sustainability are: (1) lack of consensus at CEO level; (2) cost of sustainability measures and economic conditions; (3) lack of sustainability standards and appropriate regulations; and (4) misalignment of short term and long term strategic goals. Opinion on these barriers in FM were divided (*see* Exhibit 13).

Government regulation was seen as greatest driver for implementation of sustainability in FM followed by involvement of Top Management, competitive management, and customer demand (*see* Exhibit 14).

Compliances and Certifications

By and large, the organizations complied with most of the labor and safety legislation (*see* Exhibit 15). Environmental legislation and Water and Air Acts were complied with by 70 to 90 percent of the organizations (*see* Exhibit 16). All organizations conducted social audits to exercise control over the policy developers and implementers (*see* Exhibit 17).

While all organizations were aware of different International Standards Organization (ISO) Certifications, certifications for ISOs 9001, 14001, and 45001 were 30 to 50 percent and ISOs 50001, only 10 percent were compliant with ISOs 55001 and 41001 (*see* Exhibit 18).

Green Building Certifications: There was an awareness of Green Building Certifications but only 20 percent had LEED certification.

Integration of Sustainability, Technology, Green Certifications and International Standards: Forty percent of the organizations see the integration of Sustainability, Technology, Green Certifications, and International Standards implemented over the next three years, another 40 percent in three to five years and the remaining 20 percent in the next seven years.

Maturity Models, Frameworks, and Sustainable FM

In the Business Process Maturity Models (BPMMs) recommended at the 23rd International Conference on Production Research—"A maturity framework for sustainable operations management"[22]—maturity has been expressed in the evaluation and continuous improvement of the capabilities of business processes and requirements so that the company can reach a higher performance in isolated capabilities or in overall performance. The sequence of levels and specifications (a roadmap), with objectives and practices, gradually lead the company through the process of searching for excellence.

According to Capability Maturity Model Integration (CMMI), a maturity model should contain components to facilitate the interpretation of the processes:

- *Maturity levels*: An evolutionary path to improve the processes used to develop products or services.
- *Process areas*: A set of practices in an area that need to be implemented collectively to improve the area.
- *Generic goals*: Necessary characteristics for institutionalizing processes.

EXHIBIT 13

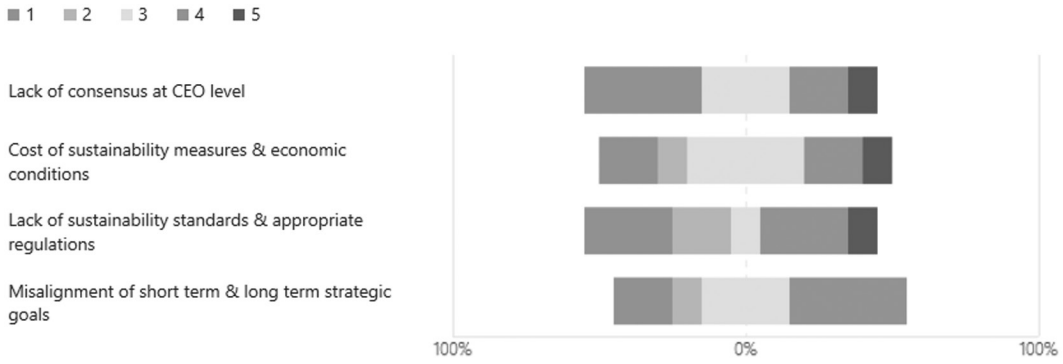


Exhibit 14

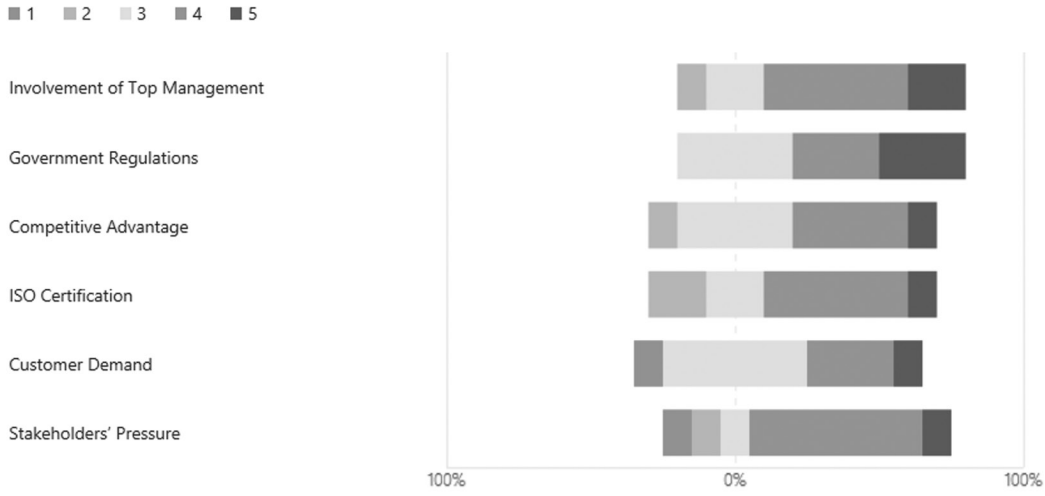


Exhibit 15

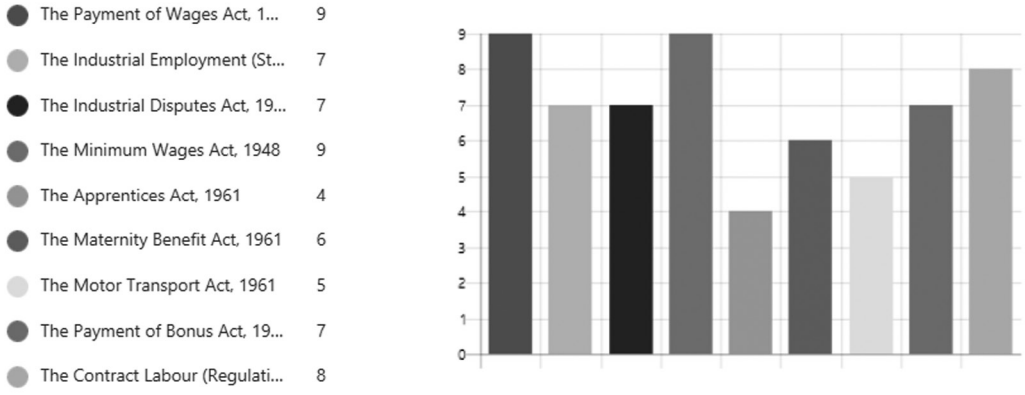
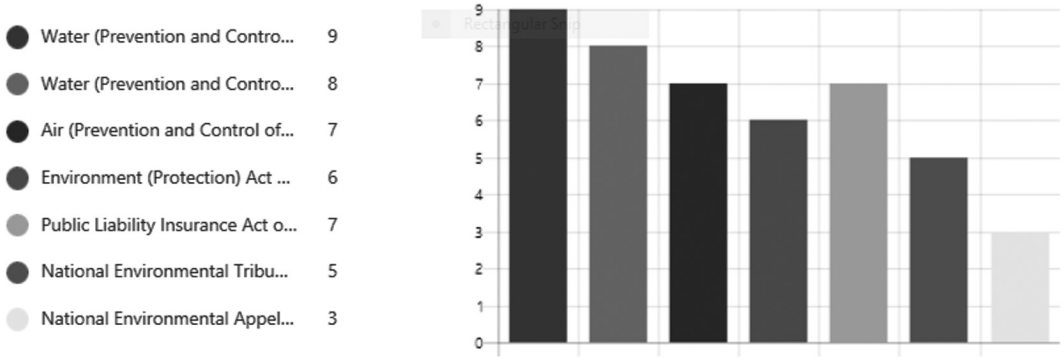


Exhibit 16



- *Generic practices*: The important activities for achieving the generic objectives and supporting the institutionalization of the process of change.
- *Specific goals*: Unique characteristics to satisfy the process areas.
- *Specific practices*: Important activities for achieving the specific objectives of the process areas.

Also, according to CMMI, reaching a certain level of maturity means that all the processes have been completely

Exhibit 17

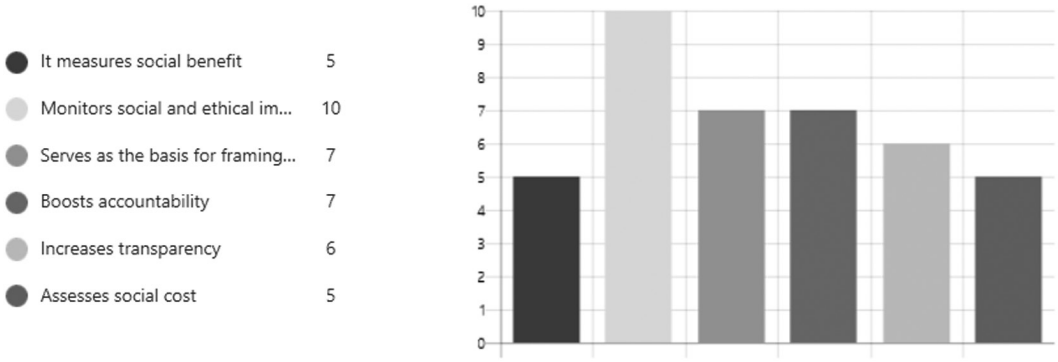
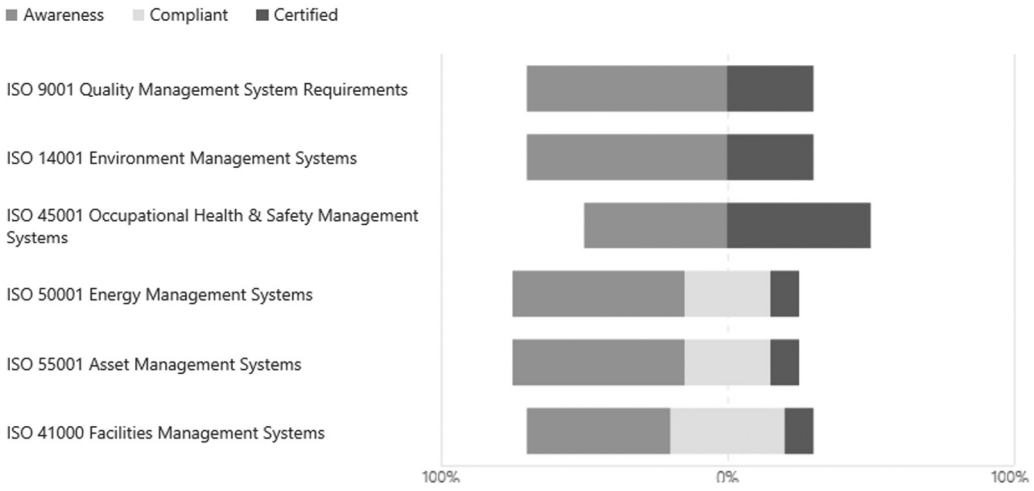


Exhibit 18



institutionalized and added to the processes of the previous levels. (*See* Exhibit 19.)

The following are the content analysis insight steps a company will go through to achieve maturity:

1. Company recognizes its obligations and responsibilities.
2. Company needs to ensure its efficiency and productivity in accordance with socio-environmental requirements.
3. Socio-environmental capabilities become formalized, defined, and managed by continuous improvement and optimized processes.
4. Sustainability principles and processes are integrated across the value chain.
5. A wide sustainability net is defined.

The CMMI further covers Content Analysis and Team networks as shown in Exhibit 20.

A paper by Jefferson Hynds, *et. al*, discusses a new assessment tool that allows companies to benchmark progress toward sustainability goals and drive new product development (NPD) growth (*see* Exhibit 21).[23]

In the article "Conceptual Maturity Model for Sustainable Construction,"[24] five domains are identified as key metrics in developing the maturity model for sustainable construction: (1) performance, (2) management capability and capacity, (3) culture, (4) long-term framework development, and (5) research and development. Exhibit 22 provides a table of model maturity characteristics.

A case study by Masalskyte and others[25] summarizes and systemizes the present sustainable commercial real estate (CRE) practices and proposes a generic Sustainability Maturity Model, for CRE. The initial model has been constructed based on findings from literature review and tested in interviews with 10 companies. The model considers

EXHIBIT 19

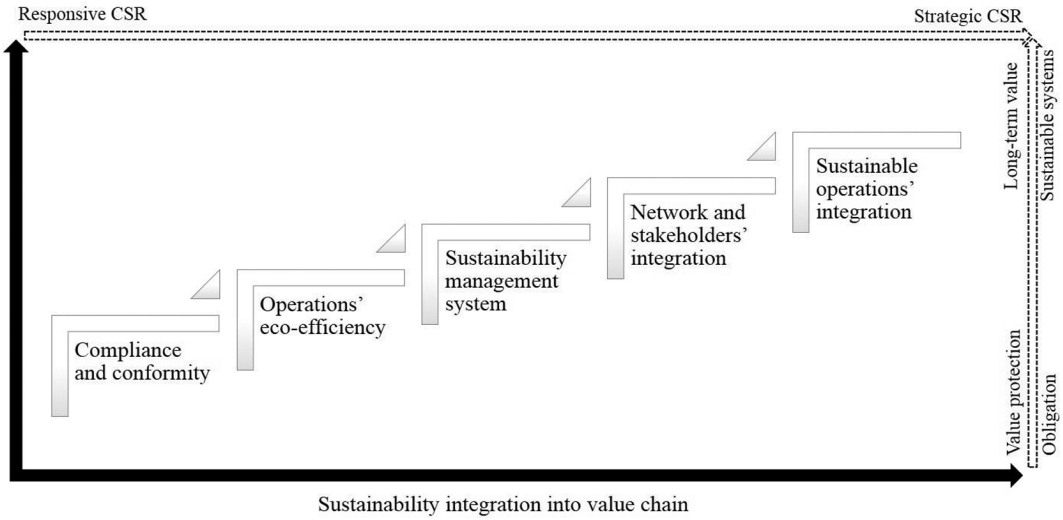


EXHIBIT 20

Level	Content Analysis	Team Networks
1	Compliance with regulations and conformity in internal operations, defining policies, and identifying trade-offs in key supplier processes for compliance with regulations.	Focus on reducing pollution and waste generation, in addition to aspects related to occupational health and safety.
2	Focus on operations (internal and external) efficiency and productivity, ensuring compliance with customers and regulatory requirements, and integrating into operations environmental, social, and governance principles. Reducing impacts related to materials and natural resources in product design and defining sustainability goals and policies for inbound and outbound suppliers.	The focus of reducing environmental impacts develops into the concept of eco-efficiency. Quality, environmental, and OH&S management systems are established, supported by knowledge management and performance management. Data from LCA studies are now used in development processes and new products, and to reduce the environmental impact of production.
3	Operations driven by standards and sustainability gains formal structures and processes, and linked with economic results. External operations are driven by GSCM principles, and the supply chain is included in the performance management system and continuously audited. Customers are engaged in new types of collaboration (*e.g.*, new product design and reverse logistics).	New product design guided by the principles of D4S and LCM, using eco-friendly materials. Operations based on principles of continuous improvement and process optimizations are extended to supply chain management. Eco-efficiency is focused on energy efficiency and the use of renewable resources. Extended to the supply chain, eco-efficiency focuses on risk management, reduction of the carbon footprint, and the viability of closed production systems. Customer engagement becomes part of the strategy.
4	Sustainability is considered a key business strategy and CSR principles are established. Full sustainability integration into the value chain, with new values defined across the value chain and the knowledge shared with suppliers. Suppliers are also engaged in the eco-design process based on LCA studies.	LCA and cradle-to-grave principles integrated across value chain. Products with environmental certifications. Information systems support customer and supply chain engagement, and process activities as well as controlling multiple activities. Energy matrix exchange with focus on renewable resources.
5	New business model defined. Sustainability integrated into all aspects of the business and managed through change management and process improvement.	Full customer and supplier engagement establishing a wide sustainability net. Integrated Management System established with qualitative metrics for social dimensions. LCA inventory validated by a third part.

Exhibit 21

Assessment	Scores	Primary Focus
1. Beginning	0-10	Regulatory compliance
2. Improving	11-20	Sustainability considered in NPD, for suppliers, and in reporting metrics
3. Succeeding	21-30	Sustainability included throughout much of the enterprise, including NPD, marketing, public metrics, reporting, and used as a competitive advantage in some markets
4. Leading	31-40	Sustainability fully integrated throughout enterprise, viewed not as an initiative, but rather as the way the company does business

Exhibit 22

Model	Maturity Characteristics
1. Initial	The organizations or the projects are characterized as ad hoc and occasionally chaotic. The structure of organizations and projects are ill defined, and individual efforts are emphasized for success.
2. Repeatable	Certain processes are established to track and monitor the cost, time, and functionality. The necessary process discipline is applied for similar projects.
3. Defined	The processes are documented, standardized, and integrated into organization practices. Rather than fixed, the processes can always be tailored to address individual project needs.
4. Managed	Detailed measures of process and products are clearly specified. Organizations can quantitatively understand and control the process and products.
5. Optimizing	Continuous improvement is enforced by monitoring feedback from the process. Innovative ideas and technology will be developed. Note: Adopted from Paulk et al. (1993).

five maturity levels, six dimensions, and the eighteen most typical sustainable practices and demonstrates how CRE contributes to an organization's sustainability. The model was modified based on inputs from interviews. The study concluded that the real estate industry was still not ready for advanced practices and generally adopted business case approach. Sustainability must be beneficial and the practices that are not beneficial tend to be postponed. (*See* Exhibit 23.)

Maturity Model for Sustainable Facilities Management

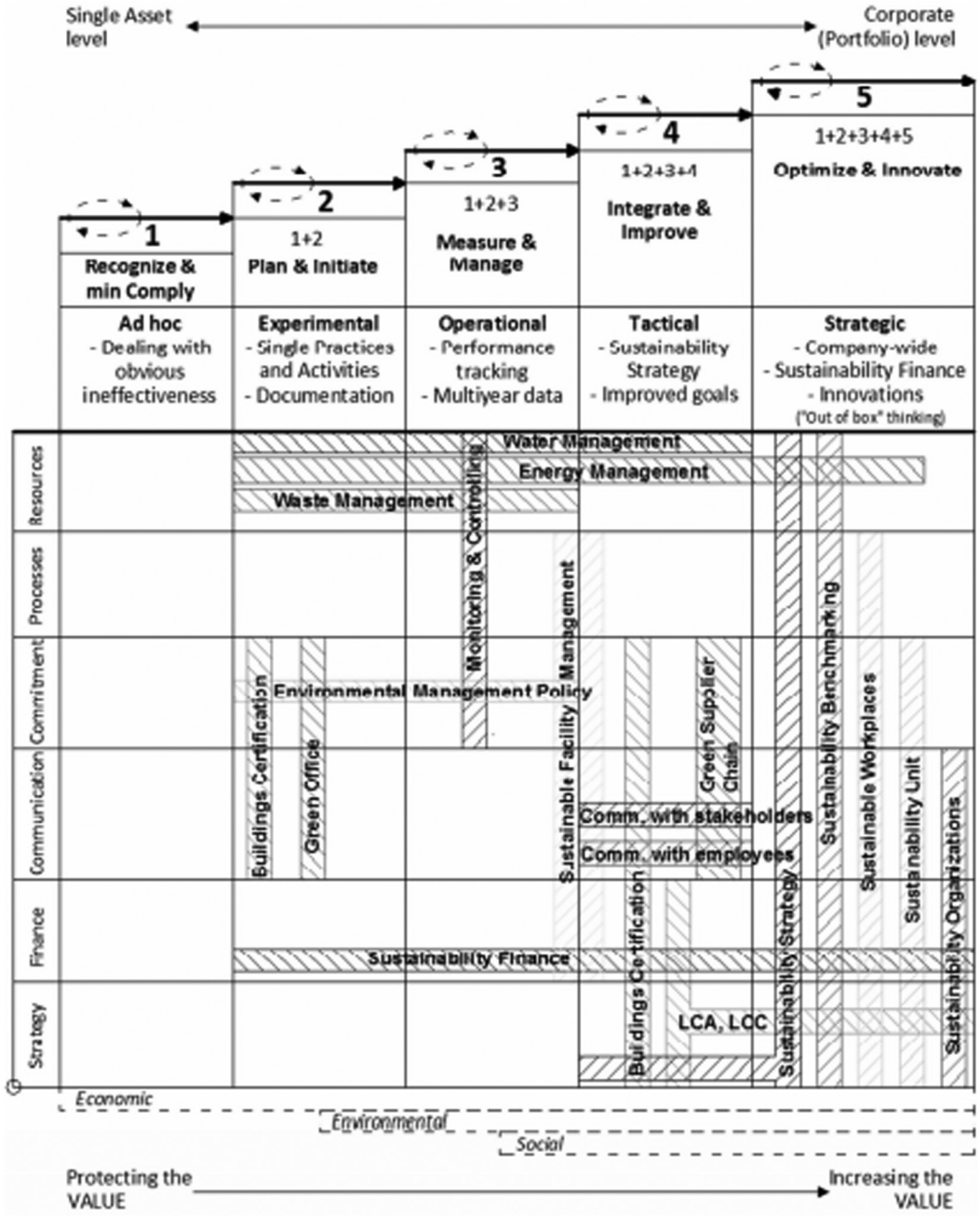
Based on the concepts of models discussed above, maturity model in the context of sustainable facilities management (SFM), has been conceptualized. It is envisioned that a company can reach maturity in the sustainability integration process through the development and maturation of FM sustainability competencies/capabilities.

Further, implementation of SFM, International Standards, and FM technological aspects have been aligned to present an Integrated framework for Sustainable FM Implementation Model.

The model envisions a multi-pronged approach to Implementation of SFM by an organization/facility in the following five stages:

1. **Initial/Inactive stage—**the organization/facility is aware of Legal Compliances and is partially compliant. Its perspective is economic and short term and the FM is at operational level.
2. **Reactive stage—**the organization/facility is legally compliant and continues to have an economic and short-term perspective, and the FM is still at operational level.
3. **Proactive—**the organization is fully legally compliant including with the provisions of NBC 2016, it adopts an economic and environmental approach, a medium-term perspective, and FM is practiced at both the operational and Tactical level.
4. **Development—**the organization is not only fully legally compliant including the National Building Code of India 2016 Compliant, adopts an economic, environmental and social approach, has a long-term perspective and practices FM at the strategic, tactical, and operational level.

EXHIBIT 23



5. **Integrated and Continual Improvement**—the organization is fully legally compliant including the National Building Code of India 2016 Compliant, adopts a long-term and life cycle perspective, and considers social aspects in addition to the economic and environmental aspects. This is the stage of "Sustainable FM."

To implement the quality and legal compliance aspect, the organization/facility may at the initial stage plan for implementation of ISOs beginning with ISO 9001 Quality Management System. Moving on to reactive stage, ISO 9001 implementation will facilitate compliance of most environmental and safety compliances too. At the Proactive stage, ISO 14001 EMS and OHSAS 18001/45001

EXHIBIT 24

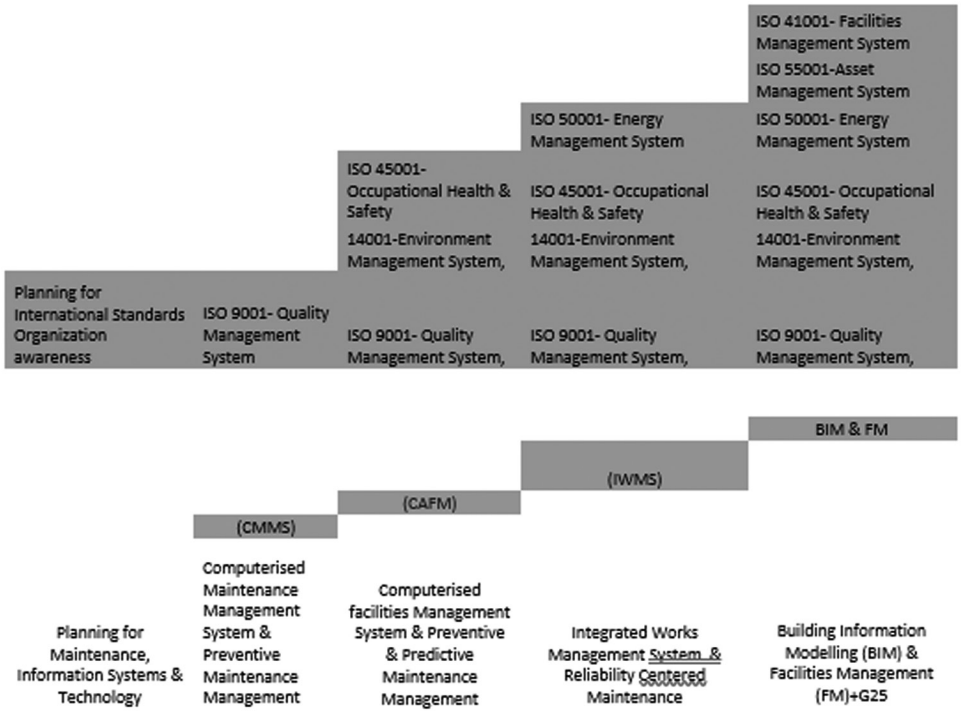
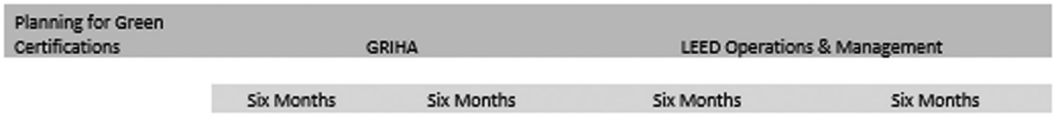


EXHIBIT 25



Occupational Health and Safety Management Systems will enable the organization/facility to become fully compliant and provisions of NBC 2016 also can be implemented at this stage. At the Development Stage, implementation of ISO 50001 will enable value-add in terms of complete streamlining of energy use. Finally, the implementation of ISO 41001 Facilities Management System and ISO 55001 Asset Management System would take the organization/facility to the Integrated and Continual Improvement Stage. (*See* Exhibit 24.)

The model further envisions implementation of maintenance, information systems and technology starting with planning for these at the Initial/Inactive stage and successively implementing at each stage CMMS, CAFM, Integrated Works Management System (IWMS), and finally adopting Building Information Modelling (BIM) and FM at the final stage.

The organization/facility also could commence planning for green certifications starting with GRIHA and adopting LEED concurrently or progressively (*see* Exhibit 25).

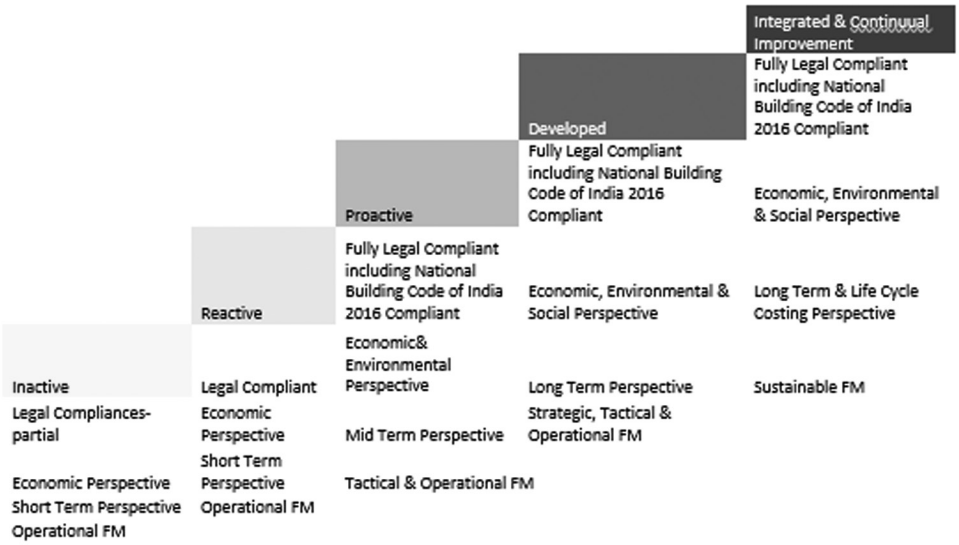
It is important to mention that these stages in the model are not sequential but only facilitate understanding as to where an organization/facility stands today and to assist in planning for reaching the Integrated and Continual Stage, that is, SFM. Implementation of each stage could take up to six months (notional) but can be telescoped. Exhibit 26 shows the SFM Maturity Progression Model Encompassing Management Systems, Technology, Certifications and Continual Improvement

CONCLUSION

A literature review of the sustainability, role, responsibilities and maturity of facilities management and the Sustainable FM in the context of India reveals that while facilities management is still way behind the US and European countries, in India, in commercial/office sectors in major cities where multi-national companies and the international property

EXHIBIT 26

Sustainable Facilities Management (SFM) Maturity Progression Model Encompassing Management Systems, Technology, Certifications & Continual Improvement



consultants are playing a major role, there is a fair understanding of Strategic FM.

In other sectors, penetration of Sustainable FM concepts and technology will need to catch up quickly in which FM professionals will play a leading role.

As the FM progresses from an operational to Strategic role in organizations, the FM professionals will be "at the forefront of organizational behavior change and will be in a position to influence individuals working in business; government departments and public services." The FM profession is presented with this need because of the negative impact of existing buildings over the environment, and the increasing demand for technical knowledge required of facilities managers to understand the complexities of intelligent buildings and their operation.[26]

An effort has been made to propose a framework for implementation of SFM using a multi-pronged approach, that is, beginning with compliances, the present short-term approach can be progressively taken to an integrated and continual improvement stage, implementing various ISOs and imbibing technology in a graduated manner. Depending on the maturity level of each organization, it could adopt successive approaches progressively as illustrated in the proposed framework.

Further work needs to be done to explore the penetration of sustainable FM concepts and processes in other than commercial sectors, such as residential, warehousing, retail sectors, and regions, that is, Tier II cities and fine tune the suggested framework.

NOTES

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21. Refer to schematic view of ISO 26000.
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