The adoption of Industrialised Building System (IBS) construction in Malaysia: The history, policies, experiences and lesson learned

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Purpose Industry and government in Malaysia coined the term industrialised building system (IBS) to describe the adoption of construction industrialisation, mechanisation, and the use of prefabrication of components in building construction. IBS consists of precast component systems, fabricated steel structures, innovative mould systems, modular block systems, and prefabricated timber structures as construction components. Parts of the building that are repetitive but difficult – and too time consuming and labour intensive to be casted onsite – are designed and detailed as standardised components at the factory and are then brought to the site to be assembled. The construction industry in Malaysia has started to embrace IBS as a method of attaining better construction quality and productivity, reducing risks related to occupational safety and health, alleviating issues for skilled workers and dependency on manual foreign labour, and achieving the ultimate goal of reducing the overall cost of construction. The chronology of IBS-adoption in Malaysia goes back a long way, reaching back to the 1960s, when precast elements were adopted in the building industry to address the problem of an acute housing shortage. However, the introduction of IBS was never sustained beyond this period. As a result of the failure of early closed-fabricated systems, the industry is now avoiding changing its construction method to IBS. Some of the foreign systems that were introduced during the late 1960s and 1970s were also found to be unsuitable in Malaysia's climate and not very compatible with social practices. IBS has regained its popularity presently due to problems with construction workforces where the industry has been relying for a long time on unskilled workers from neighbouring countries. **Method** In 1999, the IBS Strategic Plan was launched to promote the system's usage in the industry. This was followed by the IBS Roadmap 2003-2010 and IBS Roadmap 2011-2015; these are blueprints for industrialised construction by 2015. The roadmaps have been developed by the government to chart progress and guide the awareness programmes, incentives, vendor scheme development, training, quality control and research and development programmes. The government also took the lead in 2008, by mandating that all public-sector projects must attain no less than 70% IBS-content under the Treasury Circular SPP 07/2008. This policy aims to build up momentum and to establish demand for IBScomponents, thus bringing the cost down. **Results & Discussion** At present, IBS-construction is widely used as a mainstream method and the implementation has moved from prefabrication towards mechanisation, automation, and robotics applications. This paper highlights some of the history, policies, experiences, and lesson learned in adopting IBS in Malaysia. The outlook for IBS-implementation in Malaysia is bright, but much work is still needed from the government to convince the contractors, manufacturers, and suppliers to adopt IBS-construction.

Keywords: *construction, industrialized building systems, Malaysia*

INTRODUCTION

Industrialised Building System (IBS) is the term coined by the industry and government in Malaysia to represent the adoption of construction industrialisation and the use of prefabrication of components in building construction. IBS is defined as a construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site work (Hamid *et al.*, 2008; CIDB, 2007; CIDB, 2005 and CIDB, 2003). It consists of precast component systems, fabricated steel structures, innovative mould systems, modular block systems and prefabricated timber structures as construction components (CIDB, 2003). Parts of the building that are repetitive but difficult – and too time consuming and labour intensive to be casted onsite – are designed and detailed as standardised components at the factory and are then brought to the site to be assembled (CIDB, 2003). The onsite casting activities in IBS utilise innovative and clean mould technologies (CIDB, 2007; CIDB, 2005 and CIDB, 2003). In the Malaysian context, the classification by the CIDB is widely used and well understood by scholars and practitioners. CIDB has classified the IBS systems into five categories as depicted in Table 1 (CIDB, 2003).

Table 1: IBS classification (CIDB, 2003)

Classification	Descriptions
Precast concrete framed buildings	The most common group of IBS products is the precast concrete elements; precast concrete columns, beams, slabs, walls, 3-D components (e.g. balconies, staircases, toilets, lift chambers, refuse chambers), lightweight precast concrete, as well as permanent concrete formworks.
Formwork System	Considered as one of the low-level or the least prefabricated IBS, as the system generally involves site casting and is therefore subject to structural quality control, the products offer high-quality finishes, and fast construction with less site labour and material requirement.
Steel Framing System	Commonly used with precast concrete slabs, steel columns and beams, steel framing systems have always been the popular choice and used extensively in the fast-track construction of skyscrapers. Recent developments in this type of IBS include the increased usage of light steel trusses consisting of cost-effective profiled cold-formed channels and steel portal frame systems as alternatives to the heavier traditional hot-rolled sections.
Prefabricated Timber Framing System	The system consists of timber building frames and timber roof trusses. While the latter are more popular, timber building frame systems also have their own niche market, offering interesting designs from simple dwelling units to buildings requiring high aesthetical values such as chalets for resorts.
Blockwork System	The construction method of using conventional bricks has been revolutionised by the development and usage of interlocking concrete masonry units (CMU) and lightweight concrete blocks. The tedious and time-consuming traditional brick-laying tasks are greatly simplified by the usage of these effective alternative solutions.

The construction industry has started to embrace IBS as a method of attaining better construction quality and productivity, reducing risks related to occupational safety and health, alleviating issues for skilled workers and dependency on manual foreign labour, and achieving the ultimate goal of reducing the overall cost of construction. Apart from this, it offers minimal wastage, fewer site materials, a cleaner and neater environment, controlled quality, and lower total construction costs (Pan *et al.* 2008, Hamid *et al.* 2008 and Pan *et al.* 2007). Already utilized in Malaysia since 1960s, IBS is the way forward for the industry stakeholders to make leaps and bounds progress in the Malaysian construction industry. Sufficient exposure and incentives are pouring in to encourage industry players to make a paradigm move – from conventional to IBS construction.

THE CHRONOLOGY OF IBS ADOPTION IN MALAYSIA

1. Development of IBS in post-independent Malaysia:

IBS has been introduced in Malaysia since early 1960s when Public Work Department (PWD) and Ministry of Housing and Local Government (MHLG) of Malaysia visited several European countries and evaluate their housing development program (Thanoon *et al.* 2003). In 1963, the government sent a group of architect from PWD to learn industrialised building in some of European countries. The following year, another group of architect from the Federal Capital Commission was sent to France for about 6 month for exposure in industrialised buildings (Sumadi *et al.* 2001). In the same year, Ministry of Housing and Local Government (MHLG) was being set up by the government to concentrate to development of housing. The ministry officers and representatives visited West Germany, Denmark and France to gather more information on industrialised building later that year (Sumadi *et al.* 2001).

2. Development in 1964 to 1970s:

After their successful visit in 1964, the government had started its first IBS project aims to speed up the delivery time and built affordable and quality houses as stipulated under the 2nd Malayan Plan 1960-1965 and the 1st Malaysian Plan 1966 – 1970. About 22.7 acres of land along Jalan Pekeliling, Kuala Lumpur was dedicated to the project comprising 7 blocks of 17 stories flat consists of 3000 units of low-cost flat and 40 shops lot. This project was awarded to JV Gammon and Larsen and Nielsen using Danish System of large panel pre-cast concrete wall and plank slabs. The project was completed within 27 months from 1966 to 1968 including the time taken in the construction of the RM 2.5 million casting yard at Jalan Damansara. In 1965, the second housing project initiated by the government comprising 6 blocks of 17 stories flats and 3 block of 18 stories flats at Jalan Rifle Range, Penang. The project was awarded to Hochtief and Chee Seng using French

Estoit System (CIDB, 2006 and CIDB, 2003). Both projects utilised the large panel system which required large concrete panel cast in the factory and transported to site on trailers for assembly. The speed of construction is much faster although the tendered price was slightly higher by 5% to 8% (Sarja, 1998). Another earliest IBS project was at Taman Tun Sardon in Penang (consists of 1,000 units five-storey walk up flat). IBS pre-cast component and system in the project was designed by British Research Establishment (BRE) for low cost housing (BRECAST system). A similar system was constructed almost at the same time at Edmonton, North London and about 20,000 BRECAST dwellings were constructed throughout UK from 1964 to 1974 (CIDB, 2006). Nonetheless, the building design was very basic and not considering the aspect of serviceability such as the local needs to have wet toilet and bathroom (Rahman and Omar, 2006).

3. Development in 1970s to early 1980s:

In 1978, the Penang State Government launched another 1200 units of housing using prefabrication technology. Two years later, the Ministry of Defense (MOD) adopted large prefabricated panel construction system to build 2800 unit of living quarters at Lumut Naval Base. As one can observed, IBS was engage at first place in the construction of low-cost high-rise residential building to overcome the increasing demand for housing needs. Many construction in at this time utilised precast wall panel system. Nonetheless, the industrialisation of construction was never sustained in this period. Failure of early closed fabricated systems had resultant the industry to avoid of changing their construction method to IBS. Some of the foreign systems that were introduced during the late 60s and 70s were also found not to be suitable with Malaysia climate and social practices. Newer and better technologies were constantly being introduced than in the market since wet joint systems were identified to be more suitable to be used in our tropical climate and it was also better to utilised the bathroom types which were relatively wetter than those in the Europe (CIDB, 2005). At the same time recent innovation the form of precast concrete sandwich wall panels developed in Europe, has received wide acceptability in countries having hot temperature climates due to better insulating properties resulting in a cooler in door environment and has been send in several pilot projects in Malaysia through 1970s to 1980s period (Trikha and Ali, 2004).

4. Development in 1980s to 1990s:

During the period of early 80s up to 90s the use of structural steel components took place particularly in high rise buildings in Kuala Lumpur. The usage of steel structure gained much attention with the construction of 36-storey Dayabumi complex that was completed in 1984 by Takenaka Corporation of Japan (CIDB, 2003 and CIDB, 2006). In the 90s, demand for the new township has seen the increase in the use of precast concrete system in residential buildings. Between 1981 and 1993, Perbadanan Kemajuan Negeri Selangor (PKNS) a state government development agency acquired pre-cast concrete technology from Praton Haus International based on Germany to build low cost houses and high cost bungalows for the new townships in Selangor (CIDB, 2003 and Hassim *et al.* 2009). It was recorded then, around 52,000 housing units was constructed using Praton Haus system (Trikha and Ali, 2004) and the state of art pre-cast factory was set up in Shah Alam (Sarja, 1998). Other than the use of Praton House technology from Germany, PKNS was also embarked in other IBS systems at the same period; Taisei Marubumi - large panel are cast in factory using tilt-up system where one panel forms the base for next panel cast (1,237 housing units and 11 shop lots at PJS), Hazama system (3,222 flat units and 1,112 housing units at Bandar Baru Bangi), Ingeback system which is Swedish system using large panels in vertical battery mould and tilt-up table mould (3,694 flat units) All the project were constructed by local contractor with international technical support from established international firms in joint venture partnership (Hashim *et al.* 2009 and Sarja, 1998).In that period IBS used in Malaysia are large panel system (housing project in Shah Alam and Taman Brown), metal form system in Wangsa Maju, Pandan Jaya and Taman Maluri and modular systems which are heavily promoted by CIDB in government project. Although the system originated overseas, local contractors has made modification to suit local requirement. Instead of steel, high quality film coated plywood shuttering is used in an innovative mould system. The form can be easily dismantled and handled by small crane and can be adjusted to suit architectural requirement (Sarja, 1998). Other systems are framing system, modular system and partially pre-cast system (the Cemlock Built System which is originate in Australia and used by the National Housing Department in Pekan Selama housing project) (Sarja, 1998).

5. Development in 1990s to 1998s

In this booming period of Malaysian construction 1994 -1997, hybrid IBS application used in many national iconic landmarks such as Kuala Lumpur Convention Centre (steel beam and roof trusses and precast concrete slab: Victor Buyck Steel Construction), Lightweight Railway Train (LRT), KL Sentral Station (steel roof structure and precast hollow core: RSPA – Bovis), KL Tower (steel beams

and columns for tower head: Wayss and Freytag), Kuala Lumpur International Airport (steel roof structure: KLIAB – Eversendai) and Petronas Twin Towers (steel beams and steel decking for the floor system – Mayjus JV and SKJ JV). The booming period of construction during that time includes the development and construction of new administration capital of Malaysia; Putrajaya and Cyberjaya. Both cities are the massive development areas consist of new government buildings, business boulevard and residential area, and most of them were built in IBS or a hybrid IBS, combination between IBS and conventional construction.

6. Development in 1998 – 2008

At this state, the use of IBS as a method of construction in Malaysia is evolving. Many private companies in Malaysia have teamed up with foreign expert to offer solutions to their IBS projects (Eastern Pretech, BPB Malaysian Gypsum, Lafarge and Duralite). Many had acquired enough knowledge through technology transfer to build up own capacity in IBS technologies (PKNS Engineering, Setia Precast and Global Globe). Setia Precast and Global Globe using technologies first adopted by Taisei Corporation of Japan. In fact, Malaysian was also developed their own IBS technologies (Zenbes, CSR, IJM Formwork, Pryda, Baktian and HC Precast). The local IBS manufacturers are mushrooming, although the facilities yet to operate in full capacity. The IBS system is largely used for private residential projects in Shah Alam, Wangsa Maju and Pandan, Dua Residency, Taman Mount Austin and Tongkang Pecah, Johor. It used in public residential projects in Putrajaya Prescient 17 and Prescient 9, PPR Sungai Besi, Sungai Bedaun, and Telipok, Sabah. The new generation of building that utilised IBS is better in term of quality, and architectural appearance compared to the earlier generation. IBS is also widely used to construct government's schools and teachers housing complexes (Kuala Kangsar, Yan and Sungai Petani), hospitals (Serdang Hospital and UKM Hospital), collages and universities (Penang Matriculation Collage, UiTM, Kuching and University PETRONAS and University of Malaysia Sabah), custom and immigration complexes (Kelana Jaya and Johor Bahru), private buildings (Weld Tower, Maju Perdana, Traders Hotel, City Square and Olympia Tower, Jaya Jusco, IKEA) and police quarters (Senawang). The IBS agenda was further boosted with the 2004, 2005 and 2006 Malaysia Budget announcements. In 2004, new government building projects had been strongly encouraged to have at least 50% of IBS content in their construction elements which had been calculated using IBS Score Manual developed by CIDB. Furthermore, in 2005, the government had pledged to construct 100,000 units of affordable houses using IBS (Hamid *et al.* 2008). Finally, in 2006, a tax incentive was offered through Acceleration Capital Allowance (ACA). IBS manufacturers would be given ACA for expenses incurred in the purchase of steel moulds used for production of precast concrete components to be claimed within three years (CIDB, 2005 and Shaari, 2006).

7. 2008 – Present

One of the most important milestones of IBS policy is regulation on the use of IBS in the construction of public buildings. In November 2008, the Treasury Malaysia issued a Treasury Circular Letter, now referred to as SPP 7/2008, to all Malaysian government agencies directing them to increase the IBS contents of their building development projects to a level not less than 70 points of the IBS score and in that sense IBS must be incorporated as part of the contract document for tender (Hamid *et al.* 2008). The circular letter took effect immediately and the Implementation and Coordination Unit (ICU) of the Prime Minister's Department has been given the task of monitoring the level of compliance to this directive by the respective agencies. The decision was to create sufficient momentum for the demand for IBS components and to create a spill-out effect throughout the nation. To monitor the implementation, the government established the National IBS Secretariat. It involves coordination between inter-ministry levels to make sure the policy is successfully implemented. During a period from October 2008 and May 2010, about 331 projects under 17 ministries were awarded and constructed using IBS (CIDB, 2010). The majority of the projects were construction of public schools, hospitals, higher learning institutions and government offices throughout Malaysia. The total cost of the projects was about RM 9.6 billion (CIDB, 2010).

EXPERIENCES AND LESSONS LEARNED ON IBS CONSTRUCTION IN MALAYSIA

1. There is a change in paradigm regarding IBS in Malaysia in the past few years. In the past, the majority of contractors and industry stakeholders still divided either to use IBS or conventional method although the benefits of IBS are clear and eminent. But this is not the case now, the industry, nowadays has to think of a system to be implemented in their project (weather it conventional or IBS) due to the increase need of quality end-product and speed of construction, and coping with the issue of foreign workers. In the case of public building projects, the industry is instructed to use IBS system. So, the industry both in the private and public construction projects has no other choice but to be involved in IBS and adopt industrialisation in construction. *(In November 2008, the Treasury Malaysia issued a*

Treasury Circular Letter, now referred to as SPP 7/2008, to all Malaysian government agencies directing them to increase the IBS contents of their building development projects to a level not less than 70 points of the IBS score and IBS must be incorporated as part of the contract document for tender. The decision was to create sufficient momentum for the demand for IBS components and to create a spill-out effect throughout the nation). Due to this policy, the cost of constructing in IBS has reduced significantly. The adoption in the past was normally based on wanting rather than by viability. IBS system in Malaysia is now, mostly competitive if not cheaper if one compare it to the conventional practices depending on type of projects, type of systems and volume.

2. The IBS in Malaysia promotes open system or hybrid system and encourages full industry participation compared to the prefab closed system where only limited industry companies can participate. IBS supply chain should comprises of modular component-based products that can be produce and interchangeable between any project thus promote mass customisation at the customers end. Therefore, a company that can utilize the IBS supply chain will enable it to sell systems rather than selling single products. Standardising the construction industry is a critical factor in establishing an Open System in Malaysia. The concept of the OBS is similar to what has happened in the ICT industry whereby through standardization of jointing parts such as USB ports, consumers can buy computer equipment such as mouse or scanner anywhere in the world. The equipment can then be easily installed by the users as the connection from the equipment to the computer has been internationally standardized.

3. One of the important milestones in IBS Roadmap 2003-2010 was the introduction of Modular Coordination (MC). MC is a concept of coordination of dimensions and space where buildings and components are dimensioned and positioned in a basic unit or module known as 1M which is equivalent to 100 mm, as stipulated in MS 1064, and developed in 2000. The concept allows standardisation in design and building components. It encourages participation from manufactures and assemblers to enter the market, thus reducing the price of IBS components. Modular need to be adopted to cut down the waste in IBS. However the implementation of modular coordination requires better design planning.

4. Malaysian construction industry is very good in modifying and adopting IBS technologies captured from oversea practices. Many private companies in Malaysia in present day have teamed up with foreign expert to offer solutions to their IBS projects. Many had acquired enough knowledge through technology transfer to build up own capacity in IBS technologies. Many world-class Malaysian developers have chosen IBS over the conventional methods for important projects such as the Petronas Twin Towers, Putrajaya, KL Sentral and KLIA. There is ample evidence that the failures of past construction systems are due to blind acceptance of foreign products that were not open (flexible) and were unsuitable to our climate and culture.

5. Successful IBS contractors as observed are not a user of technology or limit its role as project manager and assembler. Most successful IBS contractors have an in-house manufacturing and design capacity. They also invest in and sometimes invent systems, and so do not just depend on existing manufacturers. The also partner with oversea partners to acquire the technologies.

6. One of the major issues of IBS is on changing users' perception. Users tend to think that IBS buildings is easy to leak and can not be renovated. However, through the advancement of technologies and better planning and design, IBS buildings/housings in the present days have improved in term of performance and can be renovated by users.

7. Some of the foreign systems that were introduced during the late 60s and 70s were also found not to be suitable with Malaysia climate and social practices. Newer and better technologies were constantly being introduced than in the market since wet joint systems were identified to be more suitable to be used in our tropical climate and it was also better to utilised the bathroom types which were relatively wetter than those in the Europe.

8. IBS in Malaysia is seen as a threat to traditional methods but in reality many IBS technologies like block works is exist together with conventional practices. The failure of IBS to penetrate the market is due to a misconception that it will eventually replace the traditional sector, while it actually should work closely in tandem to promote best practice in construction. The sharing of best practice between the two approaches is essential for the continued successful development of both construction sectors. IBS should be looked by the industry as easy, simple and cost effective solutions to the players.

9. Each IBS system has its own advantages and limitations. The selection and implementation of correct technology in IBS projects is perhaps the key to IBS success. There is a need to realise that precast concrete IBS is not suitable for every project. If more people were aware of its capabilities and available technology, they could identify particular system that suited the project. The advantages of IBS systems in Malaysia are as follows:

BARRIERS TO IBS ADOPTION IN MALAYSIA

1. Currently, the incentives for IBS are not sufficient. IBS adoption requires more pull and push factors from the government. Due to the small profit margin, the change from conventional to IBS was not feasible, unless, more attractive incentive systems and benefits which can lure the conventionalist to IBS are in place.
2. The availability of cheap foreign labour which offsets the cost benefit of using IBS is a root cause of the slow adoption in the past. As long as it is easy for the industry to find foreign workers, labour rates will remain low and builders will find it unattractive to change into simplified solutions such as IBS.
3. The limited take up also relates to sheer cost of investment and the inadequacy of market size. Since the Asian financial crisis in 1997 and global recession in 2008, it becomes apparent that large investments in central production plants are uneconomical.
4. To use a higher level of IBS, the adopters require a huge volume of works to break even on the investment. Although it creates more value to construction, it is literally a more expensive option due to the paid up capitals and maintenance of machineries. Inconsistency of volume over time and lack of business continuity resulted in the investment in latest innovation not being commercially sustainable.
5. Low standardisation of components also hinders successful use of IBS. The tailor-made components which do not fit into another project will increase initial costs due to the cost of the mould and design. Lack of standardisation was due to a lack of a certification and accreditation scheme on IBS and the lukewarm response to Modular Coordination (MC) promotion under MS 1064.
6. There is a general consensus among practitioners that IBS needs mass production to achieve economic viability, but currently, in Malaysia, there is no assurance of continuity of production, thus limiting interest in IBS.
7. Supply Chain Management (SCM) and partnering concept has not been fully understood by the industry. Currently, the cooperation between contractors, manufacturers and suppliers is weak in many cases. Improving the procurement system and supply chain is the key to achieving IBS success for contracting companies.

THE WAY FORWARD

The lesson learnt on IBS construction in Malaysia has led to the following recommendations towards the future improvement of IBS adoption in Malaysia:

1. The rising sustainability awareness around the globe has put the construction industry under immense pressure to improve project efficiency and deliverables. Industrialised Building System (IBS) has the potential to promote sustainability development and green construction. This may be achieved from a controlled production environment, minimization of construction waste, extensive usage of energy efficient building material, a safer and more stable work environment, and possibly better investment for long term project economy. The industry need to seize this opportunity and use IBS as their competitive advantages in promoting sustainable construction.
2. The mass construction workforce, especially the locals, needs to upgrade their skills to be involved in IBS. The policy on labour focuses on encouraging personnel to acquire skills in more than single trade. This would add more value by providing a more skilled workforce which would ultimately enhance the competitive advantage of the industry in facing the issue of adoption from conventional to the IBS. They must be equipped in design, installation and project management skills which are critical to IBS. A comprehensive preliminary study should be conducted by the government to identify the skill gaps in the IBS sector in order to create a comprehensive and systematic training programme. The preliminary study will ensure that the training fits the needs of IBS organisations and accommodates current skill shortages in the market, particularly specialist skills such as design and installation, based on information from real practice.
3. A vendor development programme modeled along the lines of the development of the national car industry should be established to target delivery of building components for the construction. The vendor program is to be accredited by existing government agencies which can provide a vetting process not only to guarantee consistent quality but also the achievement of structural capacity, fire rating and other requirements. The selected vendor are to be provided training, seed capital, components design, and selected private sector consultant to start up production factories. The location of this vendor's manufacturing plant has to be located in the areas with available labour. Based on educated assumption, the expected investment requirement of RM 1.25 million is considered within the reach of SMEs and small contractors displaced by the new technology. A system is to be developed such that building component accredited will be given green lane approval such that technical and non-technical legislation that hinders implementation of the new technology will be removed. The government can help by conducting market research to ascertain market opportunities to the vendors. The vendors also need inventory management consultancy and advice and development of better tools and infrastructures required for location of manufacturing plant.
4. Manufacturers and all players of IBS sectors need to create highest value for IBS to serve the

clients best interest, as we know clients in a private sector are more demanding in term of design esthetic value. With this regards, we need to move from mass production of components to mass customisation of buildings where the building design can be tailor-made to specific customer needs. The industry shall need to encourage automation and robotic to be really reduce the use of workers in construction and prefabrication. The government also perhaps needs to encourage manufacturers to produce 'modular housing' which move all the work trade at site to the manufacturing floor. We need to move up the level of industrialisation and encourage innovation, whilst low innovative systems which do contained enough value like mould systems will be discouraged. Proper incentive and tax holiday need to introduce to cater the production of innovative IBS.

5. Malaysian IBS contractors need to benchmark IBS technologies, lesson learnt and best practices from other countries. Construction industrialisation is a worldwide agenda. IBS is already successful adopted in Finland, Sweden, Japan, Germany and Singapore where offsite technologies had eventually modernised and improved the industry. This research recommended the industry players to find ways to capture and disseminate technologies, lesson learned, and best practices from successful countries and companies to expedite our learning curve on IBS and to guide the way forward. The government should launch a forum on a regular basis of academics and associated practitioners active in IBS for exchange of information and experience, development of new techniques and advice on promotion and implementation of IBS. An online portal was also suggested to disseminate international trends, products and processes associated with the IBS.

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