The Flagship Effect
– Sustainable School Projects as the Education Tool for Sustainability

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Abstract: In the past ten years, many exemplar projects are completed in China to encourage the sharing of knowledge and experience of Sustainability. Many of these projects are landmark buildings, because they can attract more public attentions; then, raise more awareness of sustainable development. However, school projects are rarely mentioned in the news and annual inspirational project lists.

The fundamental point of this paper is to challenge the common concept in China that school buildings are only used exclusively by children in formal education. According to the paper's review of the school schemes in England and Wales, not only the inspirational sustainable schools created the opportunities and responsibilities to accelerate positive changes, but also they developed a vision of an asset that supports lifelong learning and sustainable lifestyles for the whole community.

In this paper, the definition of a 'sustainable school' is summarised by comparing the statements and concepts in England and Wales. Moreover, the wide range of benefits gained by project stakeholders and communities are also demonstrated through case studies. In the end, the paper concludes the lessons and innovations which can be learnt by Chinese school projects.

The illustrations provided by this paper do not aim to solve all the issues of promoting a sustainable school in China, but to open people's minds to the impacts of their actions, and to help build the knowledge and cooperative framework to promote public sustainable projects.

Key words: sustainable schools, inspirational framework, multi-stakeholders, community, change for sustainability

1 Introduction

In the World Summit on Sustainable Development (2002), the United Nations launched the decade of Education for Sustainable Development (2005-2014) which emphasises that education is a critical element for achieving global sustainable development. Since then, many counties established their own policies and schemes to stimulate the education of sustainability.

In China, the efforts of the sustainability education mainly focus on the reform of curriculums and the training of teachers. Although energy savings, carbon reduction and sustainable school buildings are mentioned frequently in local authorities' strategies or some schools' development plans, the built environment and the concept of a school in people's mind did not change observably. The first claimed sustainable school project, Xin Jin Dai Primary School in Chongqin, is finished on 26th March 2011. This inspirational project sets an example of a holistic approach of school design and a wide range of stakeholder involvement. But to bloom such projects around China, a national strategy as well as new school design standards have to be established. In addition, the local authorities, policy makers and funders should avoid the misunderstanding that sustainable school projects are only to build new school buildings. It is essential that schools are at the forefront of sustainability both in the way that they are used and in their performance. This represents a break with the old way of teaching and should change the whole concept of 'school', from a physical place where children are simply given information to one where a whole community of individuals can share sustainability values, learning experiences and environmentally friendly activities. These benefits can certainly be gained beyond new schools. Also, it is through the education system that sustainability can become part of mainstream culture, and China has put many efforts on this aspect, but down to the methods of integrating sustainability education to schools' built environment, there are still many gaps to be filled.

One difficulty in promoting sustainable project is to explain sustainability as a whole concept and a holistic approach to all stakeholders. For school projects it is even more complicated, due to the wide range of stakeholders, especially the children who use totally different 'language' to communicate their thoughts and comprehension. Therefore, in this paper the definition of a 'sustainable school' is summarised by comparing the statements and concepts in England and Wales.

Furthermore, sustainable school projects have been carrying on in England and Wales for more than six years, and many exemplar projects are finished and handed over for operation. Although Chinese schools have their own characters, there are still many sharable knowledge and experience which can be drawn from the British projects. So the case studies in this paper try to illustrate the wide range of benefits gained by project stakeholders and communities, together with any lessons that have been learnt.

2 The definition of a sustainable school

There is a need for a clear, simple way of explaining sustainability to all stakeholders within education including pupils, staff, local authorities and parents so that an informed and consistent approach can be taken. This needs to be simple and clear using terms and descriptions that can be understood by all. A number of approaches to introduce the concept of sustainability for schools have been developed in England and Wales.

The Welsh Assembly Government Education for Sustainable Development and Global Citizenship (ESDGC) toolkit's aim is to provide 'education that will prepare young people for life in the 21st century' with sustainability and sustainable development at its core. The ESDGC set out five common areas [1]:

- Commitment and Leadership;
- Learning and Teaching;
- School Management;
- Partnership and Community;
- Research and Monitoring.

This list illustrates a holistic approach to the incorporation of sustainability into education in Wales. However, the terms provided are complex and are unlikely to be understood by all involved. Therefore, seven themes are also included in order to introduce a common understanding of ESDGC:

- Consumption and Waste;
- Choice and Decisions;
- Health;
- Identify and Culture;
- Natural Environment;
- Climate Change;
- Wealth and Poverty.

These themes are more likely to be used by teachers as they are more specific and likely to be understood by more people. They are not to be looked at a list of topics but a set of pieces that can be put together in a variety of ways depending on the requirement of school.

The 'Eight doorways'[2] is another popular approach developed by the Department for Children, Schools and Families as part of the Sustainable Schools Strategy uses more clearly defined, comprehensive and understandable headings. It can be used to help schools to initiate or develop sustainable activities through to design and management. The 'Eight doorways' cover the areas of:

- Food and drink
- Energy and water
- Travel and traffic
- Purchasing and waste
- Buildings and grounds
- Inclusion and participation
- Local well-being
- Global dimension

Although the 'Eight Doorways' provide a good starting point, with very nicely designed interface to disseminate details of each doorway (e.g. Figure 1), subject areas are still very broad with topics such as waste and energy grouped together which should be considered separately.
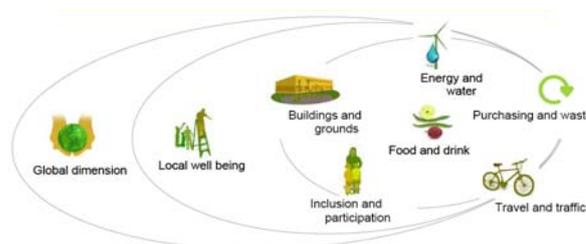

Fig.1 Sustainable Schools National Framework – 8 doorways

The British Council for School Environments (BCSE) published a report in 2006 which focused on the process of delivering sustainability in schools, including existing school projects. The report [3] presents the successes and difficulties involved in achieving good performance, and it uses the following sustainability headings to present its work, pointing out areas where sustainability can be considered.

- Sustainability through briefing;
- Obtaining a sustainable school;
- Sustainability through construction;
- Sustainability in the curriculum;
- Sustainability through technology;
- Sustainability and local authorities;
- Sustainability: energy efficiency;
- Sustainability through good controls;
- Sustainability and ICT.

The above methods for including sustainability into

the school system illustrates the complexities behind the subject whilst demonstrating the need to present information in a simple format to allow for clear understanding. They also show that there is no a best format of defining a sustainable school, simplicity is vital but a broad range of subjects need to be included.

3 Reasons for promoting sustainable school projects

3.1 Enable good behaviours

In Honolulu, Hawaii, October 1999, the delegates of the Millennium Young People's Congress (MYPC) made education its No. 1 priority and explained, 'We believe that, if every young person is educated about environmental protection, human rights, tolerance, democracy, health and sustainable development, all our other problems (referring to violence, poverty etc) will vanish over time.' They also observed however what was required was not 'the stifling schools that imprison us within four walls' but 'an education which stimulates our creative energies through active experiential learning.' [4]

Pupil and staff thrive within a healthy, comfortable, productive place to learn and work. The active experiential learning can never be isolated from the school buildings, the playgrounds and the schools' surrounding environment. A holistic sustainable design of schools can deliver these environments. As a result, improved behaviour of children can have a far reaching impact on the school and the wider community.

For example, since Newport High School in South Wales was rebuilt in 2009, Year 11 students have enjoyed the schools best ever GCSE results with over 75% of Newport High Year 11 students gained 5 A*-C grades or the vocational equivalent, which is almost 25% improvement in just one year. This is not a casual event. Studies on the relationship between pupil performance, achievement and behaviour and the built environment have found that test scores in well designed buildings were up to 11 per cent higher than in poorly designed buildings [5]. The studies also show that good design can help recruit and retain staff, cutting the costs of staff turnover.

However, the above findings are not to suggest that design alone can raise educational achievement or people's awareness of sustainability. As stated by Jim McManners that 'Children need first to enjoy their environment and to be inspired and amazed by its complexity. From a very early age we must provide the experiences which give reasons to care. We must help open their eyes to what they have to lose. Understanding and knowledge will follow and be developed through the activities across the curriculum. We must also provoke critical thinking in all of this work

and to encourage discussion and engender positive attitudes of concern, unselfishness, consideration and empathy.'

3.2 Contribute to energy savings and carbon reduction

Department for Children, Schools and Families (DCSF) divide greenhouse gas emissions from the schools sector into four main sources [6]:
• The use of energy in school buildings;
• Pupil and staff travel to and from school, and other journeys undertaken on school business;
• Emissions produced by companies that supply goods and services to schools, for example, for a school food provider, this could include emissions related to their use of energy to run their buildings and produce their food products, as well as the emissions associated with transporting their products to school sites;
• Emissions from waste produced by schools.

In DCSF's report, it is also estimated that in 1990 schools' greenhouse gas emissions for the UK stood at 6.5 million tonnes of carbon dioxide equivalent ($MtCO_{2e}$). By 2006, emissions had risen to 7.3 $MtCO_{2e}$, an increase of 12%.

In another study delivered by Sustainable Development Commission (SDC) in 2006, it is estimated that 'the schools estate is responsible for 10.4 $MtCO_{2e}$ from direct and indirect sources per year' [7]. And these emissions are analysed and presented by two figures in their report (Fig 2 and 3).
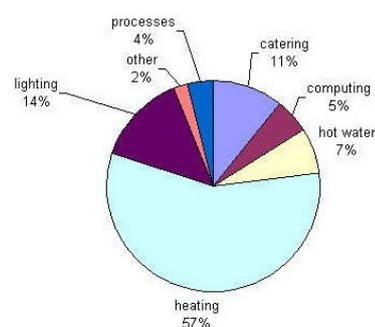

Fig.2 Schools Carbon Footprint broken down according to major consumption categories
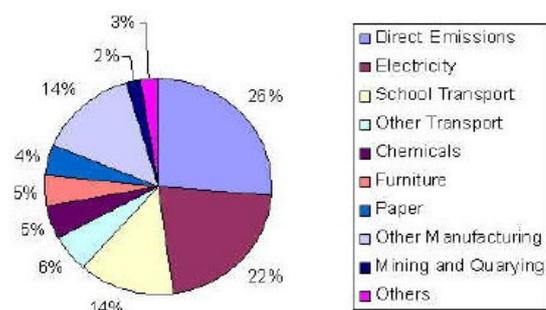

Fig.3 Carbon emissions from direct energy consumption in education buildings

Although having different estimations of schools' emissions status, similar conclusions are given by these two studies on the reasons of why schools' carbon emissions increased in the UK in the past two decades. Firstly, the extension of school hours has undoubtedly resulted in higher energy consumption through the increased demand for heating and lighting running late into the evenings and at weekends. However, up to a third of the additional energy consumption has been attributed to an increase in the provision and use of Information and Communication Technology (ICT) equipment. This increase in ICT can conflict with an energy reduction strategy in two ways; the equipment itself uses electricity and, dedicated ICT rooms often have to be mechanically cooled as a result of the incidental heat generated. Secondly, besides the direct emissions, the indirect ones from school travel and transport has also increased by a massive 59% between 1990 and 2006, and the National Travel Survey suggests that journey distance to school has increased by 25% since 1990 (National Travel Survey, 2010).

The above studies point out that schools are becoming energy intensive and carbon heavy places, due to the new teaching method and facilities. Also, the indirect emissions almost doubled between 1990 and 2006, which indicates that the change of infrastructure in the UK brought negative impact on schools, and travelling to schools increasingly relies on vehicles. Although schools only consist of small proportion in the public buildings sector, their impact can not be underestimated. As stated by the SDC, the schools' emissions 'represent less than 2% of UK carbon emissions, but almost 15% of carbon emissions attributable to the public sector. If the government is to demonstrate leadership through deep cuts in public sector carbon emissions, schools will be a key component'.

3.3 Stimulate innovations of sustainable design

The characteristics of the built environment within a school have changed significantly over time as the learning environment has become more complex, providing more facilities and opportunities for both pupils and the community as a whole. Sustainable design needs to allow for future changes to be incorporated into the built environment simply, with minimum expense and disruption. These requirements definitely bring challenges to designers. However, challenges also bring innovations and creativities, and this has been demonstrated repeatedly by many inspirational school projects in England and Wales.

A retrofit SUDS scheme has been installed at the sites of Holywell Primary School and Walsley Hills High School in Worcestershire. This system has involved intercepting overland flow from adjacent land in collector swales, storage of unpredictable water volumes in landscaped features, replacement of conventional drainage infrastructure that is undersized for severe storms and reduction of silt blocking using silt interceptors and re-routing of drainage to natural features (Fig 4).

The SUDS system saves on sewerage disposal charges, which amount to an annual cost of £3,879 combined.

Fig.4 Sustainable Drainage System at Walsley Hills High School and Holywell Primary School

Rainwater is collected at Netherfield Primary school for toilet flushing from the roof which has an area of $994m^2$. There are 330 pupils and staff at the school. Water is stored underground in a non-pressurised tank which contains 20,000 litres of water (Fig 5).

The estimated water savings per year are $618m^3$ which saves approximately £1,113. The system includes an Education Monitoring Unit and Activity Pack to help with informing the pupils of why the conservation of water is important.

Fig.5 Netherfield Primary School

In 2008 a 6kW wind turbine was commissioned at the St Columb Minor School, Cornwall County Council. The solar PV and wind turbine combined generates about 23,000 kWh/year electricity, saving about 11 tonnes of CO_2 per year in total. Electricity consumption has fallen by around 37% as a result of the turbine, solar PV and behavioural measures.

Parents and the community were consulted regularly during planning for the turbine and no objections were raised. There is a display meter in the school foyer showing the energy generated and CO_2 saved together with a monitor showing the schools electricity consumption (Fig 6).

Fig.6 Pupils take wind speed readings during lessons, with the wind turbine in the background

The Burnham Copse Primary School in Hampshire was built in the 1950s as a secondary school. The original layout was three separate buildings that were joined only at ground level by a continuous corridor (Fig7.).

The refurbishment remodeled the internal space, built a specialist teaching extension and provided an external walkway at first floor level to link all three existing blocks.

Fig.7 The walkway provides essential shading for classrooms on the ground floor

The walkway acts as a balcony for all upper level classrooms, enabling full access with the addition of a fire evacuation lift located in the heart of the school. The canopy of the walkway provides shade that prevents overheating and glare in the classrooms and provides sheltered outside teaching spaces. The positioning of the walkway structure was designed to offer uninterrupted views from the classroom. These detailed decisions have all made for a more pleasant learning environment.

3.4 Benefit the local community significantly

Schools have patterns of use that are different from most other public building types. Even under normal use, spaces may be intermittently occupied throughout the day during term-time, then empty and quiet immediately in out of school hours, and there are long periods during the holidays when the spaces are empty. This special occupancy means that schools have large potentials to be used in relation to community activities. For example, where a school has facilities suitable for use by the wider community (e.g. playing fields, sports facilities, IT facilities, halls), it can open these up to meet wider community needs. According to Active Places data, in England 76% of sports halls are on education sites, and 73% of artificial grass pitches are located on education sites [8]. These figures illustrate that schools have large potentials to offer a valuable supply of facilities for local communities' developing and delivering of sports.

Moreover, investment in primary schools can often fit into wider regeneration plans of providing better community services. In 2003 a national programme, Full Service Extended Schools, was roll out of by the previous Department for Education and Skills (DfES). This initiative is carried on for eight years in England, and the three wins benefits are summarised as [9]:

Benefits for pupils and schools
- Higher levels of pupil achievement
- Increased pupil motivation and self-esteem
- Specialist support to meet pupils' wider needs
- Additional facilities and equipment
- Greater opportunities for staff for flexible working and career development
- Enhanced partnership working with the community and better school security
- Easier access to essential services for staff, helping staff recruitment and retention

Benefits for families
- Improvements in child behaviour and social skills
- Greater parental involvement in children's learning
- More opportunities for local adult in children's learning
- Greater availability of specialist support for families

Benefits for communities
- Better access top essential services
- Improved local availability of sports, arts and other facilities
- Local career development opportunities
- Better supervision of children outside school hours
- Closer relationships with the school

4 Difficulties of promoting sustainable schools

4.1 Communication and involving stakeholders

Good quality information that is easily understood is required to enable all stakeholders to understand the sustainability aims of a new build or refurbishment. However, it is already explained at the beginning of this

paper that sustainability itself is a complex concept, so it is never easy to deliver the project aims and disseminate appropriate information in a way that is understood by all. Also, stakeholders need to meet physically on a regular basis, and in the meantime in between meetings information needs to be kept up to date throughout the whole process. This will enable stakeholders to have responsibility and feel part of the decision making process. The previous experience in England and Wales shows that this can be very challenging because it is often difficult for one person to take on the role of co-ordination while getting on with their normal day-to-day duties. Therefore, a strong leadership of the client's project management team is essential to establish a communicating structure so that people know when and how they can have their say. Moreover, the amount of time and effort required by the school to ensure that they get the building they want should not be underestimated.

4.2 Capital cost

A UK study of pupil performance found that capital investment in school buildings had a strong influence on staff morale, pupil motivation and effective learning time [10]. However, funding to rebuild or retrofit schools is always limited. The School Building Survey of 1962 conservatively estimated that £1,368 million would be required at that time to bring all schools in the UK up to standard. This would be equivalent to approximately £2.2 billion in 2009. For such scale of investment, it is very difficult for any government in the world to fund the whole cost by itself in a short period.

A new study carried on by British Council for School Environments (BCSE) in 2010 also analyses the school capital investment [11]. The cost model is based on the updating of a group of Victorian and 1960s school buildings giving costs for different options relating to the extent of intervention: refresh, refurbish and remodel and reuse and renew. The results indicate that whole school refurbishment and remodelling does not deliver significant cost reductions over new build. The cost and disruption to learning caused by complex phasing and decanting does not always deliver value for money. What this model does demonstrate is that tactical interventions on specific areas can significantly improve learning environments for less money and with less disruption. The key to achieving more from less lies with partnerships of skillful architects and educationalists, who intuitively understand where the value lies in existing buildings and can make inspired judgements on where the resources should be deployed.

4.3 Procurement

The method of procuring a building depends on the size of the project, the type (new build or refurbishment), time scale, method of funding and the level of cost certainty required by the client. Procurement traditionally includes purchasing, inventory control, traffic and transportation, receiving, inspection, management, store keeping, salvage and disposal. But sustainable procurement involves more in incorporating social and environmental costs into the purchasing process, which often makes sustainable options more expensive to purchase at the outset. Thus, it is very important to collaborate with the supply chain, including suppliers and installers, to ensure joined up thinking and make new build or refurbishment projects cost effective.

The National Audit Office presented the main barriers of sustainable procurement [12] which include:

- Cost: perception of increased cost is associated with sustainable procurement. Value for money is perceived to be inconsistent with paying a premium to achieve sustainability objectives;
- Knowledge: lack of awareness of the need for and processes required to conduct procurement more sustainably;
- Awareness and information: lack of information about the most sustainable option; lack of awareness of products; lack of monitoring of suppliers; perceptions of inferior quality;
- Risk: risk-averse buyers prefer to purchase from suppliers with a good track record. Organisations fear criticism from the media and are therefore less keen to take innovative approaches;
- Legal issues: uncertainty as to what can, and cannot be done, under existing rules (both UK and EC) on public procurement;
- Leadership: a lack of leadership – both organisational and political – leading to a lack of ownership and accountability at all levels;
- Inertia: lack of appetite for change. Lack of personal or organisational incentives to drive change.

The sustainable procurement can be even harder to be implemented in China, because the whole supply chain in China extremely lack of knowledge, information and appetite for change.

4.4 Ensure the design quality and standalise assessment criteria

Before 1995, school properties were seen as general public buildings in the UK, therefore there were no specific design guidance and assessment tools for school buildings. However, since the end of the 20th century, the bloom of new technologies made huge influences on the teaching methods as well as school building

performances, both in terms of energy consumption and environmental impacts. The general public building design criteria cannot guide school designs anymore. That is why from 1996 a series of Building Bulletins were developed to regulate the school designs in the UK. Till the moment, there have been 22 Building Bulletins released for guiding the school designs, and they are updated regularly to ensure the nationwide design and performance standards. In theory, this is a well organised developing process to deliver high standard schools; but in practice, it is extremely difficult to ensure the designs' quality through the involvement of both 'supply side' (Architect, Structural Engineers, Building Services Engineers, Specialist Designers, Quantity Surveyors, Engineers, Project Manager, Contractors, Sub contractors etc.) and 'demand side' (Project Leader, Client, Facilities Manager, Building community, Other building users, Local Community etc.).

Diversity is the nature of sustainable school projects, which makes the assessment of such projects difficult. In the UK, BREEAM is a commonly used environmental assessment method to evaluate a sustainable school project's performance. It is originally developed by the Building Research Establishment to assess the environmental performance and sustainability of buildings, and it was adapted for school buildings in 2004/05. The method considers a wide range of sustainability issues within a single assessment. Its criteria are based on environmental performance levels rather than specific design solutions, giving the design team flexibility to select appropriate systems and innovative solutions to meet these standards. Even such level of assessment method is still widely critisised for its use in sustainable school projects, because the wider range sustainability issues of school projects, such as education quality improvement, community engagement impacts, and longer term positive behaviour change, are not included in the assessment criteria.

5 What can be learnt by China

5.1 Leadership

The fifteen years' school project experience in England and Wales demonstrates that it is government, at all levels, that is best placed to co-ordinate a collective approach to change, through an enabling policy framework. Sustainable school projects are not just investment programmes and that transforming education towards sustainable pathway is not just high-quality school buildings. A strategy for change must be set up at a national level to define the stakeholders, clarify each stakeholder's role, and regulate the participants' responsibilities. China has put a lot of efforts in curriculum reform and teachers' trainings for

sustainability education, however, sustainable schools are not just about developing an educational place to teach the knowledge of sustainability, but about enabling school communities learn about and develop sustainable lifestyles, both in school, at home and within the wider community. Therefore, an inspirational national framework must be established. On these aspects, two national policies in the UK- Every Child Matters [13] and Extended Schools [14] – are good examples to be learnt from.

5.2 Initiative

Besides the top-down policy driven actions, the bottom-up initiatives of NGOs, schools and local communities are equally important to stimulate fundamental changes. In the UK, a diverse range of programmes have been initiated by both public and private organisations to promote different aspects of sustainability, some of the programmes are described as follows:

Programme	Content
	Every Child Matters is a shared programme of change to improve outcomes for all children and young people. It takes forward the Government's vision of radical reform for children, young people and families.
	Eco-Schools is a programme for environmental management and certification, designed to implement sustainable development education in schools by encouraging children and youth to take an active role in how their school can be run for the benefit of the environment.
	Growing Schools aims to give all children the opportunity to connect with the living environment, whether it is an inner city window box, a school veg plot or a natural woodland. Interacting with living plants and animals provides a very rich, hands-on learning experience in which both formal and informal education can flourish.
	The Healthy Schools Programme (NHSP) is a joint initiative between DCSF and Department of Health (DH) - which promotes a whole school/whole child approach to health.The Programme has existed since 1999. It is recognised as a key delivery mechanism in the Children's Plan and in Healthy Weight, Healthy Lives – 21st Century White Paper reference.
	A **school travel advisers** toolkit has been jointly produce by DfT and DfES to help develop a strategic approach to school travel issues. It promotes the use of walking, cycling and public transport to reduce car dependency for journeys to school.

LEARNING OUTSIDE THE CLASSROOM	The **Learning Outside the Classroom** Manifesto sets out a vision to enable every young person to experience the world beyond the classroom as an essential part of their learning and personal development. The manifesto brings together a coalition of organisations to support schools and others in providing these valuable opportunities.
globalgateway bringing an international dimension to edu	The **Global Gateway** is a website to help teachers around the world become confident in all aspects of international work in schools. The International School Award (ISA) is an accreditation scheme for curriculum-based international work in schools and is now an integral part of the new Global Gateway.

Moreover, before rolling out any compulsory scheme, it is essential to give authorities and schools the time to think about what they want to do and the way that they want to do, because it is the best way to ensure that what emerges at the end is an excellent learning environment, rather than a striking interference which does not meet the needs of its users as well as it should.

5.3 Research

In the UK, since 1996 there have been 22 Building Bulletins produced by the Department for Education to offer guidance on a range of subjects, from whole school design schedules to detailed engineering specifics. These documents are based on solid research and tremendous multi-disciplinary cooperation. In the past 15 years these guidance effectively helped designers, policy makers, and head teachers in the UK to understand the crucial elements and the up to date standard of schools. But in China, there neither has been such a systematic guidance especially provided for schools, nor a long term institution which constantly tracks the changes of education and their impacts on school built environment.

Changes in technology, demographics and culture of the past decade have already drawn obvious impacts on the teaching methods and the requirements of education. As stated in the JISC Conference [15], 'Organisations all face pressure to deliver higher standards of education, to greater numbers of students, with tight financial restrictions, but still need to provide facilities that will attract students in a competitive educational market'. Therefore, much more efforts should be put into the multi-disciplinary research, which brings the expertise together and supervises the practices in a holistic way.

6 Conclusions

Sustainable design is not isolated to a building. The built environment and wider issues must be considered thoroughly to formulate a holistic and feasible approach for sustainability to be delivered. These issues include education, infrastructure and mechanisms for delivering sustainable projects, general policy/legislation and targets, tools for sustainability assessment, stakeholder involvement methods and affordability. Public buildings can make a significant contribution to sustainability demonstrating good and best practice to private markets and the public as a whole. Although school buildings account for a relatively small part of the public sector, their influence cannot be underestimated as schools can establish the core values of sustainability into minds of future generations. Therefore, sustainable school project can be and should be the flagship of the demonstrating projects to deliver sustainability in China.

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