

PERFORMANCE BASED HOUSING POLICY IMPLEMENTATION: TOWARDS SUSTAINABLE CONSTRUCTION, INNOVATION AND COMPETITIVENESS

LUIS FELIPE BISMARCHI

Master Student at Programa de Ciência Ambiental da Universidade de São Paulo (PROCAM-USP)
Av. Prof. Luciano Gualberto, 1289 – IEE – Cidade Universitária, São Paulo – SP
Brasil
bismarchi@usp.br / fbismarchi@hotmail.com

PROF. DR. MARIA CECÍLIA LOSCHIAVO DOS SANTOS

Professor at Programa de Ciência Ambiental da Universidade de São Paulo (PROCAM-USP)
Av. Prof. Luciano Gualberto, 1289 – IEE – Cidade Universitária, São Paulo – SP
Brasil
<http://www.closchiavo.pro.br/>

Abstract

The building sector is one of the most strategic sectors everywhere in the sustainability context because of its socioeconomic role as one of the largest employers and also because of its environmental role as one of the world's biggest polluter. The adoption of a performance based procurement process to implement the Brazilian public housing policy is, as shown in this paper, a huge step the State might take towards the promotion of sustainable construction, using its significant purchase power to foster a fruitful environment for innovation, sustainability and competitiveness all along the Brazilian building sector value chain, having a leading role towards the path to a global low-carbon economy – with less greenhouse gas emission, contributing to slow down global warming – and also successfully fulfilling the targets of the national housing policy.

Keywords: Public purchasing power, innovation, performance-based procurement, sustainability, housing policy.

INTRODUCTION

The construction industry is known for its huge socioenvironmental impacts and, at the same time, as one of the largest employers. This impact is higher if seen during the whole life cycle of a building, once 80% of a building cost is concentrated in its use and operation time (PIMENTEL e LAURINDO, 2008). The national house deficit is over 6 million homes and 95% of it is concentrated in the poor families, that is one reason of the growing public investment in this sector. For the next four (2011-2014, Dilma Rouseff's term as president) the expected investments are over 168 billion dollars – just the second version of Programa Minha Casa Minha Vida (PMCMV) with a target of building two million houses until 2014, has a 43 billion dollars investment.

The purpose of this paper is to present the main achievement of an exploratory study whose main objective was to identify the impact on innovation and sustainability of using a performance-based procurement (PBP) approach in the implementation of the public housing policy. Another objective is to present PBP as a strategic tool for promoting competitiveness, innovation and sustainability in the construction chain through the use of the State purchasing power taking this chain towards a low-carbon, more environmental-friendly, economic model.

This paper is divided in four parts, the first aims to present how the construction chain is included in the sustainability context, in other words, this section presents the main challenges the building sector faces in the transition to a more sustainable context.

The second section presents the role of innovation in the sustainability context, how to promote it and use it to guide the construction value chain towards a low-carbon business model, that is, how to foster innovation in order to enable building professionals to project, plan, build, maintain, rebuild and demolish building that will cause the minimum environmental impacts possible as well as promote socioeconomic development of its dwellers.

The third section is an assessment of the impact of the use of Performance Information Procurement System – PIPS, a PBP methodology – by the governmental agency responsible for implementing the public housing policy on the two topics presented before: innovation and sustainability, based on the international experiences and the existing theory about innovation and sustainability summarized in this paper.

The fourth part presents the final considerations of the aforementioned study.

THE BRAZILIAN CONSTRUCTION VALUE CHAIN AND SUSTAINABILITY

The building sector, in Brazil and all around the world, has a strategic position in every country's development agenda because it is one of the largest employers and also one of the biggest polluter. In Brazil, this sector represents 5% of national GDP – if considered the expanded sector (called ConstruBusiness) this participation goes up to 15% (FDC, 2009) – and contributes with around 17% of all new job posts created in the country (MTE, 2010).

Since the first meetings about the environmental issue in the 1970's, the pressure for sustainable behavior is fastly getting stronger, be it due to more clarified citizens/consumers or be it due to the more frequent natural catastrophes that shock – and affect – all mankind (JACOBI, 1999; MANZINI; VEZZOLI, 2002). In this scenario, one of the planet's biggest polluting industry is not immune, therefore, it is fundamental that all actors in the construction chain search and/or develop competences that enables them to deliver solutions that satisfies consumer's needs and preserve the environment.

Several tools have been developed to guide States, companies and civil society towards sustainable development, whose most accepted definition is the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, presented by the Brundtland Report in 1987. One of this tools is Agenda 21 that can be defined as “a planning tool to build sustainable societies, in different geographic basis, that conciliates environmental protection, social justice and economic efficiency” (CIB, 2002) and can be split up from the global agenda into smaller agendas for regional, city levels or even for economic sectors agendas.

On this work of fostering sustainable construction, John et al. (2001) present the story of Agenda 21 for Sustainable Construction that defines sustainable construction as:

“Sustainable construction is a holistic process aiming to restore and maintain harmony between the natural and built environments, and create settlements that affirm human dignity and encourage economic equity” (CIB, 2002: 8).

Although this Agenda was created to developed nations, this definition can be extended to all countries. According to John et al (2001) what must be rethought are the actions determined in the Agenda when used to guide developing countries in the promotion of sustainable construction.

The discussions about this focus Agenda were presented in 2002 and, as discussed by John et al. (2001), it deals with the specificities of the developing world, such as how to make sustainable houses accessible to millions of people who don't have enough purchase power to buy houses on their own and the challenge to promote sustainable construction in areas where the basic infrastructure is bad – from the components/materials production according to some specification to bad roads and problems with energy and water supply (CIB, 2002).

The Agenda proposed by is organized in 6 groups of action and outlines the main challenges the building sector's agents in developing countries will face in the context of sustainability. Several actions proposed in the Agenda 21 are similar to the actions presented as challenges in the prospective study for the future of Brazilian building sector, corroborating the analysis made in that study and presented in this paper.

On the global context of sustainability, the Brazilian building sector must make the ongoing transition from a quantitative model of reproducing standardized houses to a qualitative performance-based model that delivers the needed amount of houses, while respecting the environment, the society and being economically feasible.

According to this Agenda, all participating actors must assume their responsibility on this transition. The research and education sector, the private sector, the clients and the government and it's regulatory agencies must unify their efforts and cooperate in order to raise an institutional environment that fosters innovation, the commitment to quality and performance. Partnerships must be sought to finance research of new technologies and techniques. Information and knowledge must be disseminated to promote a more conscient market that understands the impact of purchasing decisions. All roles must be reviewed, all agents must be aware of their importance in the search for a more balanced, sustainable building sector.

In order to understand the competitive situation of this Brazilian industry and to identify the challenges companies would face in the future, a prospective study coordinated by professors Dr. Alex Abiko and Dr. Orestes Marraccini Gonçalves to the Ministry of Developmente, Industry and Foreign Market.was conducted at the Engineering School of Universidade de São Paulo in 2003 for a ten-year period (PCC, 2003). This study presented the main challenges the building sector would have in order to keep growing and be competitive in the new century.

These are the main challenges: need to increase productivity, develop human resources skills, promote integration among all players in the value chain (universities, government, private companies, civil society), expand credit to build and buy houses, solve the 6 million houses deficit concentrated in the poor families, manage the growing land cost, promote a sectorial commitment to quality development, rethink regulations based on prescriptions and standards and institutional organization of the housing policy, foster innovation and sustainability and improve management skills across the whole chain – self-construction, building project, consumer orientation (knowing customer's needs) and research (PCC, 2003).

Focus on the end-user is essential to promote quality homes and its lack is notable in the popular building projects, reflecting the production model established after the Military Coup of 1964, that Bonduki (2000) defines as central-developing opposed to the new model he defines as environmental-participative and that is still incipient. According to the author, this central-developing model lasted until Collor government (1993), when “dozens of bad quality and bad location houses were financed and built by suspect companies and people who could afford them didn’t want to live there and those who would accept living there couldn’t afford. In the end, lots of these units were left unfinished or empty”.

Corroborating Bonduki’s definition, Leite et al. (2006) studying buildings of the Programa de Arrendamento Residencial (PAR – a leasing program of popular housing to low income population, created in 1998) operated by CAIXA stated that the client that most influences the requirements of the building project is CAIXA. These requirements, on the PAR’s buildings so far, don’t come from a systematic process starting in the end-user, but from guidelines of the program developed by the Ministry of Cities and by technical specifications made by CAIXA’s technicians. There is no community participation in the definition of these house’s characteristics.

Medvedovski et al. (2006) also studying PAR found results that show there are problems in maintenance of the buildings, on the building management – specially in the relation between the building managing company and the dwellers – and in the houses’ characteristics that are changed by its own users because they don’t their needs satisfied. This interventions not only might harm the building structure, safety and integrity but also shows a clear house deficiency to fulfill the user’s needs and expectations.

The improvement of management process, from project to production and delivery of buildings, must also take in consideration the needs of end-users, their participation must be sought in order to avoid delay in delivery due to changes in projects and higher costs due to this changes or even because the buildings, once they do not satisfy users’ needs, must be frequently modified (GUERRA et al., 2009).

An Ernst&Young (2008) study shows that from 2007 to 2030 the economic condition of families will sensibly change; it is expected that until 2017, 57% of all new families (that means new homes) will be on the base of the social pyramid while after 2017, 78% of all 19,9 million families will be part of the middle class, that means they will have different expectations on their homes and that must be part of the house project if we think about sustainability and flexible homes that could be rebuilt rather than totally replaced by another one.

Bonduki’s environmental-participative model is more compatible with the idea of sustainable development than the central-developing model but it is still not a reality all over the country and it’s not an only one organization responsibility to implement it. It is a city plan and not just a housing plan, being fundamental the participation and integration of several actors.

Workforce qualification, partnership among actors, search for continuous innovation and competitiveness, a performance-based legal and regulation framework and constant investments are the main tools to overcome the obstacles to achieve the sustainability goal. These challenges towards sustainability are very big and the work to be done is really hard but with the right planning and an effective coordination of policies and strategies of all chain’s actors

it will be possible the construction sector becomes a leading sector in the transition to a more sustainable business environment.

THE SUSTAINABILITY CONTEXT AND THE ROLE OF INNOVATION

As it happens with sustainability, innovation has several definitions, we will adopt in this paper the following concept based on Slaughter (1998 *apud* BLAYSE;MANLEY, 2004), Blayse & Manley (2004), Sakar (2007), Smeraldi (2009) and Drucker (2011) definitions: innovation is the capacity to identify, develop, adopt and explore new uses to existing knowledge in different contexts or new knowledge in existing contexts. The first application will be named *incremental innovation* and the second one *disruptive innovation*.

Innovation is nowadays the most important building block of competitive advantage in any company, in the long term this capacity to generate new ideas, new uses for old ideas or any mix of that will determine which companies will survive and which will not in this fastly changing world (HILL; JONES, 2009; LYNCH, s/d).

If we think sustainability – or sustainable development – as the balance of human actions' impacts among humans and between humans and nature, there is no other alternative but change the actual production and consumption model as well as all social relations – of exploitation, misery and exclusion – that come with it. In order to incorporate the planet's capacity to regenerate its resources and benefit the whole humanity for several generations we must be able to innovate.

The innovation focused on sustainability, is defined by Rennings (2000) as eco-innovation, "all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which develop new ideas, behavior, products and processes, apply or introduce them and which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets".

We will incorporate the concept of eco-innovation to the previous definition of innovation, so the use of the terms innovation and eco-innovation won't be distinguished in this paper. Therefore, innovation definition will be used as follow: the capacity to identify, develop, adopt and explore new uses to existing knowledge in different contexts or new knowledge in existing contexts aiming the promotion and implementation of sustainability.

Including the promotion of sustainability in the concept of innovation instead of treating this kind of innovation as another type shows there is no other alternative for companies but to incorporate the search for sustainable business in their strategies, objectives and processes (NIDUMOLU, PRAHALAD and RANGASWAMI, 2009). These authors show the implementation of sustainability doesn't mean higher costs, it's usually the opposite, several successful cases show the implementation of sustainability leads to cost reduction, higher productivity and market share even during period of crisis.

Loures (2009) summarizes the importance of innovation to achieve sustainability:

"We must call attention to the essential nature of innovation when we deal with sustainability. The challenges created by global issues, specially climate change, and the natural human desire for continuous life quality improvement, require creative answers and significative qualitative gains in productivity that don't compromise the future

generations possibilities. If we really want to use the best humanity has to offer, we must give a special attention to the human dimension, making that knowledge and creative abilities are released emerging the truly culture of innovation” (LOURES, 2009: 94).

Smeraldi (2009) states that rather than incremental innovations, radical or disruptive innovations will lead the path towards sustainability because of their own nature of breaking rules and paradigms.

The development of sustainable products, or at least more eco-friendly products, needs several changes in companies' structure, culture, market knowledge and also in the assessment of products impacts on the environment. The development process of sustainable products is still in a transition moment from a “green” improvement of the actual products to a real process of creation of new sustainable products that will substitute the existing ones. This transition is companies' greatest challenge once it transcends the departmental frontiers – and even organizational frontiers – and demands an integration of different professionals and players all along the production chain (PUJARI, 2004).

Focusing the building sector, these trends and needs to promote sustainability become an evident challenge to companies and professionals. The operation period of a house, as shown before, represents 80% of all building cost (PIMENTEL e LAURINDO, 2008). Brazilian data on the resources consumption of the building sector shows that “40% of all extracted natural resources are allocated to in the building sector, 50% of all urban solid waste come from buildings and demolition, 50% of all electric energy consumption is used in the housing operations” (CORCUERA, 2008), 12% of all carbonic gas emission come from Portland cement production in Brazil, sand consumption in the metropolitan region of Sao Paulo is approximately 12 million cubic meters per year, more than 68,5 million tons of waste is annually produced in building and demolition activities, higher than the urban solid waste produced and five times higher than the resources consumed to build (JOHN et al, 2004).

John (2009), citing Kilbert, presents six principles that must be observed when thinking of construction sustainability: 1) Minimize resources consumption (conservate); 2) Maximize reuse of resources (Reuse); 3) Use renewable or recycled resources (Renew/Recycle); 4) Protect the environment (Nature Protection); 5) Create a healthy, non-toxic environment (Non-toxic) and; 6) Search for quality in the building environment (Quality). Therefore, the following steps are important during the building process: 1) Building implementation, construction project and process; 2) Material selection; 3) Energetic planning; 4) Waste management; 5) Air quality and; 6) Project for flexibility. All this principles and steps demand increasing productivity of all resources – human, energetic and material.

As the house is inevitably a (material) product, only the search for dematerialization and service emphasis cannot promote sustainable constructions. It is fundamental that the incorporation of sustainable principles happens all along the process of project, production, delivery, use and rebuild/demolition of a house. That's where innovation must happen: the search for new housing solutions that will balance social demands, economic feasibility and environmental protection while promoting human development in all surrounding area.

Concluding, sustainable construction is not only the building project itself, it reaches out these frontiers and includes the surrounding area, the building integration in the urban tissue, the social relations generated and the economic opportunities created.

PIPS AND THE IMPACT ON INNOVATION AND SUSTAINABILITY IN THE BRAZILIAN BUILDING SECTOR

One important issue to be discussed is the development of performance norms instead of prescriptive norms and its impact on the building sector. This transition from a prescriptive model to a performance model is strategic to the promotion of sustainability and innovation and it is getting stronger (ALMEIDA, 1997) with the strengthening of global markets and real time communication across nations empowering consumers and putting stronger pressure on companies' reputation – the most valuable asset organizations have nowadays (BORGER, 2001; GUNNINGHAM, 2005).

The main support on the use of economic tools and performance norms is that once this regulations determines what is expected from companies' activities instead of how companies must operate (command and control model), these companies are free to find the best value alternatives that attend the regulation's expectation and the economic demands of companies (ALMEIDA, 1997; PEREIRA et al., 2007; VARELA, 2007). Although results are achieved faster in command and control methods, the use of economic tools and performance norms foster innovation and a proactive behavior of companies, however, it is essential the participation of all actors in the construction of these performance demands sharing knowledge and comprehension of what is expected (SEROA DA MOTTA, RUITENBEEK e HUBER, 1996; SEROA DA MOTTA, YOUNG, 1997; PeBBu, 2005).

In this transition context, the performance based procurement is a strategic tool to change the players behavior, once:

“The intent is to (...) shift the paradigm from traditional ‘acquisition think’ into one of collaborative, performance-oriented teamwork with a focus on program performance, improvement, and innovation, not simply contract compliance. Performance-based acquisition offers the potential to dramatically transform the nature of service delivery, and permit the federal government to tap the enormous creative energy and innovative nature of private industry” (GSA, 2001: 3).

PeBBu Final Report (2005) stresses two main characteristics of performance concept application:

- Use of two languages, one to the demand and another to the supplier of the solution for the expected performance. It reflects the change in roles played by consumers and suppliers. In a performance based context, consumers use their voice (VoC) to express WHY and WHAT the building solution must attend/perform while suppliers will offer HOW this performance/goal will be achieved, in other words, the development of the solution goes from the consumer to the supplier. This is the greatest breakthrough in the building sector, although it is not new (there are register of performance based demands in Hamurabi's time), performance based approach in the building sector is not frequently used (PeBBu, 2005, CHONG et al., 2007, KASHIWAGI et al., 2010).

- Need to validate and verify the results achieved compared to the expected performance. It is necessary from the selection of the building solution to the assessment of the performance during the effective building operation. Several methodologies were developed to help this assessment such as Serviceability Tools & Methods® (ST&M®) by Internation Centre for Facilities, a KPI list by the US Federal Facilities Council and the Construction Product Directive by the European Union (PeBBu, 2005).

There is not enough experience in performance based procurement that enables a building to be entirely planned, procured, delivered, maintained and used based on performance documents, so a blend of the two models (performance and prescription) is still needed, however it is important to keep in mind the shift in the role of consumers and suppliers/contractors, where the first says WHAT they want and the second present HOW they will fulfill it. Despite the challenges in implementing this structural change, countries like Australia, Canada, Finland, the European Community as a whole, Hong Kong, the Nordic Countries, Singapore, South Africa, Spain, The Netherlands and the United Kingdom have been testing PBP where clients understand this approach serves their purposes better (PeBBu, 2005).

In this paper research it was adopted a 17-year tested methodology called Performance Information Procurement System (PIPS), created by professor Dean Kashiwagi at Arizona State University in 1991. This system is based in the Information Measurement Theory (IMT), Kashiwagi Solution Model (KSM) and the Construction Industry Structure (CIS). All these components are continually followed, assessed and updated in order to strengthen the proposed model and simplify it (KASHIWAGI, 2010).

IMT concepts basically show that: decision making brings risk and demands ones subjective bias and experience to make it; the use of dominant information – clearly identifiable and understood data – is the main resource to minimize decision making; the past performance and future capability enables one to predict future performance and; experts can identify risks before they happen and they can simplify complex information into simple explanations to non-experts (CHONG, 2007).

PIPS have been tested over 700 times, for over 17 years, projects worth more than 2 billion dollars. The results show an average of 98% customer satisfaction (projects delivered on time, within budget and according to expectations), reductions of 90% in project management transactions and less than 1% “surprise factor” of nonperformance (KASHIWAGI, 2009, 2010).

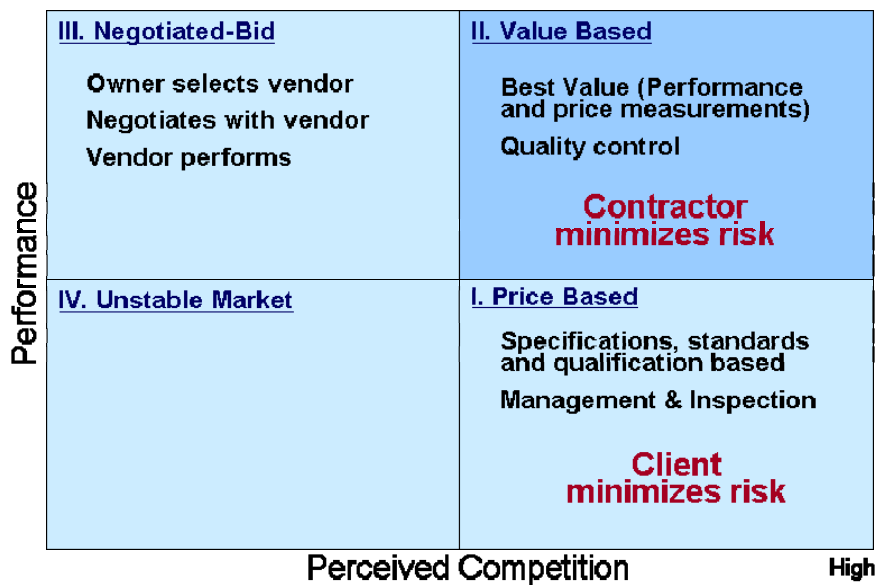
Duren and Dorée (2008) make a critical assessment of Kashiwagi’s declared results and identified that even some numbers are overestimated, the average results found are higher than the ones from traditional low-bid contracts. The authors also use the New Institutional Economics (NIE) to explain these results instead of Kashiwagi’s IMT, KSM and CIS and found PIPS has a great potential in reducing uncertainty, opportunism and transaction costs.

The KSM aims to identify if a person has more of visionary characteristics (called Type A) or management/control characteristics (called Type C) in an extreme characteristics model. The most indicated type to support and implement PIPS is Type A, because of it’s characteristics these kind of people use more logic than personal bias and experiences to choose experts, delegate responsibility and release control, minimizing risks as show in the IMT concepts (SULLIVAN et al., 2007).

The CIS classifies an industry into four quadrants according to the perceived competition and the performance factors (Figure 1). Nowadays construction industry all around the world is in the first quadrant – price based – where the clients minimizes risks they identify by managing and controlling all contractors actions (ADEYEMYI et al., 2009, KASHIWAGI et al., 2009).

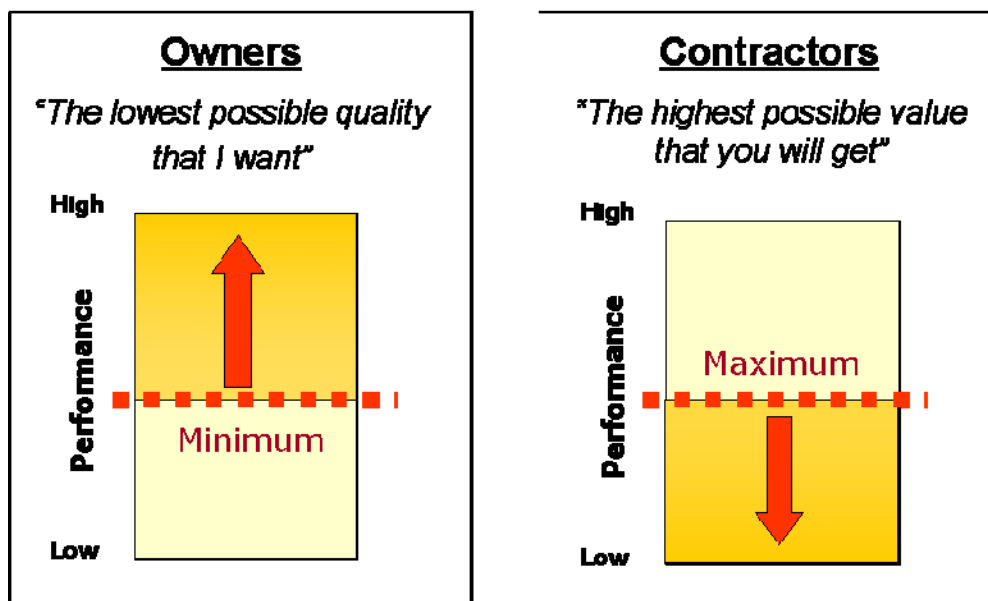
This price-based model not only reduces contractor's performance but also stimulates a reactive behavior where contractor will do exactly what the client specifies, instead of analyzing all the risks the client may not have identified that would impact on performance (Figures 2 and 3), that's why this delivery system (based on client's control over contractors and price based selection) is considered the main source of the problems identified in the delivery of construction (not in time, out of budget and not satisfying consumer's expectations) and not the lack of technical expertise of players as it was thought (ADEYEMYI et al., 2009; DUREN & DORÉE, 2008; KASHIWAGI et al., 2009, 2010).

Figure 1: Construction Industry Structure (CIS)



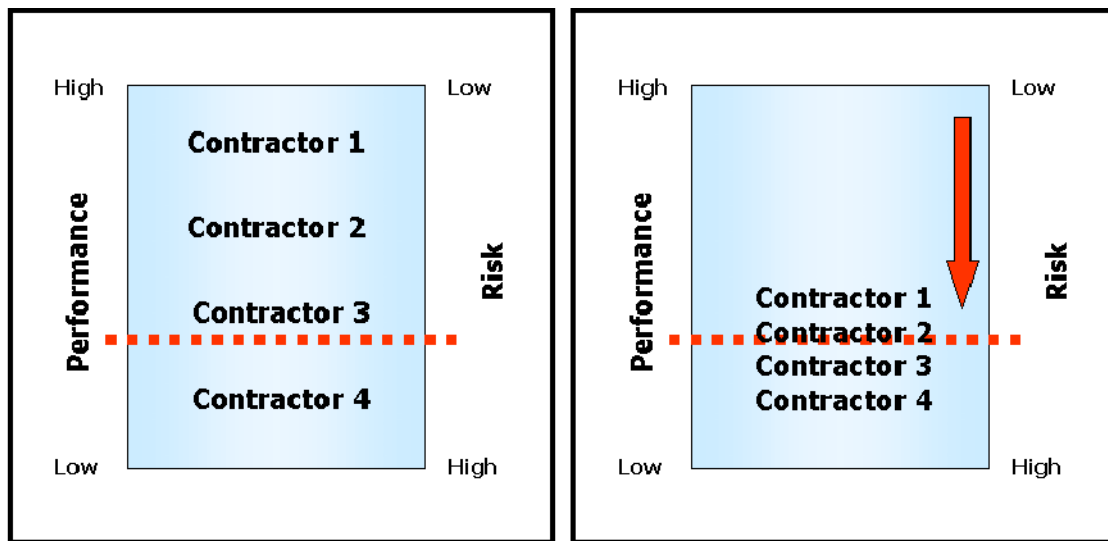
Source: KASHIWAGI et al., 2009.

Figure 2: Problem with Price Based Procurement



Source: KASHIWAGI et al., 2009.

Figure 3: Price Based Award



Source: KASHIWAGI et al., 2009.

PIPS proposition is to reduce as much as possible all decision making based on subjectivity and increase the use of dominant information (clearly identified and understood by anyone) to identify the best performer, the best contractor that will be selected to present the best solution (HOW) to the customer's needs and expectations (WHY and WHAT) based on its past performance and its proved capacity of risk management and customer orientation.

PIPS – as well as other performance based procurement methods – will foster a transition from quadrant I to quadrant II: best value quadrant in the CIS represent a context where contractors have high performance in a competitive context, clients are satisfied once they choose the best value contractor, in other words, best performance (project on time and within budget) for the lowest cost (ADEYEMYI et al., 2009).

PIPS structure is briefly presented by Kashiwagi (2011):

“The BVP/PIPS has three phases: selection, pre-award, and management of the project risk.

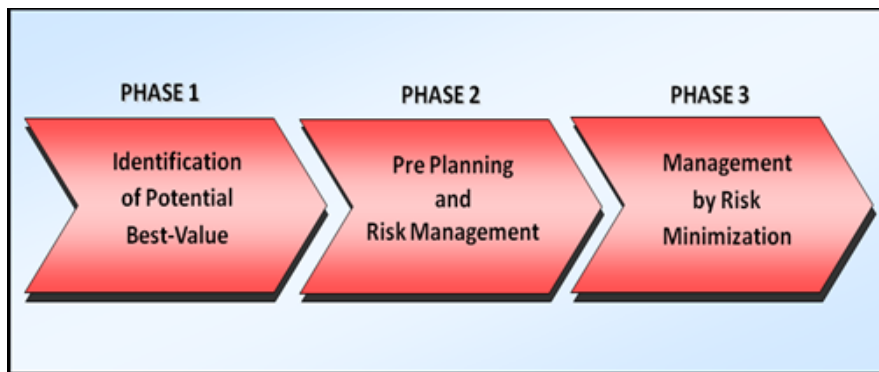
The selection phase has five filters: past performance information, competitive ability to manage and minimize project risk, interview of key personnel, prioritizing the vendors and doing a dominance check to ensure that the best value vendor is the best value.

The client's representatives assume the vendors are experts through the selection process then assume the best value vendor is not an expert in the pre-award phase to minimize the risk of the vendor. The paradigm is to minimize the need for technical decision making in the selection process, and maximizing the need for the best value vendor to prove they are an expert in the pre-award phase.

The previous paradigm also forces vendors to show dominant differential in performance that minimizes the need for any technical decision making by the client.

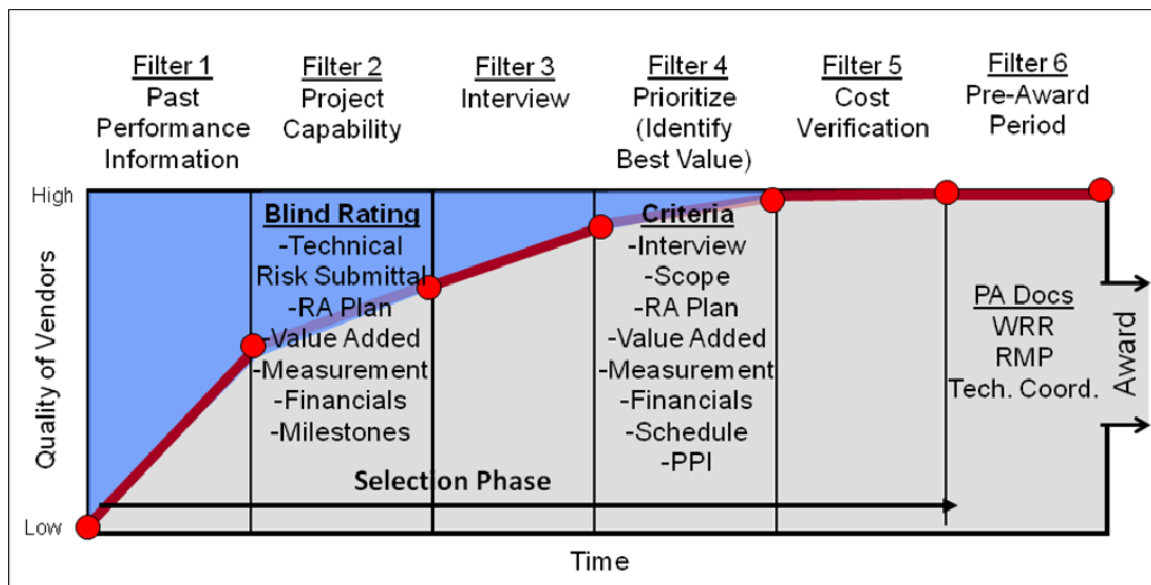
The risk is shifted to the vendors to show value through dominant expertise, knowing that experts minimize both risk and cost, thus providing the best value for the lowest cost” (KASHIWAGI, 2011: 36).

Figure 4: PIPS Phases



Source: Adeyemi et al., 2009.

Figure 5: Five Filters of PIPS Selection Phase



Source: Adeyemi et al., 2009.

The proposition of PIPS adoption in the implementation of the Brazilian public housing policy incorporates ten points that we consider essential to promote sustainable construction using the public investment in the sector:

- 1) Stimulate cooperation among participants of the sector;
- 2) Stimulate construction companies to understand and attend dwellers needs and expectations;
- 3) Promote the building integration in the urban tissue, fostering socioeconomic integration of it's dwellers;
- 4) Promote the search for sustainable solutions in all building phases, specially during it's operation period;
- 5) Stimulate creativity during the building project, fostering innovation;
- 6) Focus on the building expected performance not on specifications and standards;
- 7) Stimulate continuous search for quality and development;
- 8) Promote building solutions compatible to regional specificities;
- 9) Stimulate social participation in the building selection phase and;

10) Foster human resources' development throughout construction value chain.

The flexibility found in the PIPS guidelines allows all points to be incorporated in the public housing policy implementation. One important change proposed is to use the statement of objectives instead of specified models for popular houses – the current practice adopted in the public housing policy.

A request for proposals (RFP) must be done in a way that lets the market (building companies) free to create new solutions that attend the expectations and objectives declared in the RFP. That is the first condition to promote innovation according to the theory presented.

Demanding solutions that take into consideration local specificities and the needs of dwellers, plan the integration of the building – and its people – in the urban tissue and fostering economic opportunities for these people are the main drivers to find real sustainable construction proposals.

The maintenance of the requirement for companies to be certified by the Brazilian national program of quality and productivity in habitat fosters the continuous search for development and quality and strengthen the relationship among players across the building sector and use the State power to facilitate the market development and proactiveness not just reactivity and compliance.

A selection committee can be made with representatives of several professionals of CAIXA (the responsible operator of the public housing policy). This multidisciplinary group has a very important role in the blind assessment and interview phases and during the pre-award meetings where the project risks can be discussed as well as the assessed capacity of the contractor to perform according to what was asked.

The focus on the capacity of the contractor to perform according to what was asked and manage the project risks not the focus on the compliance of this contractor to the standardized house presented by CAIXA is a great step towards the transition to a participative, sustainable model of promoting the public housing policy.

Once the contractor is selected according to its evident capacity to perform successfully, the project is presented to the committee and can be discussed based on its attendance to the objectives requested by CAIXA as well as the effectiveness of the innovative solutions presented. All explanations must be based on dominant information and technical certification of the solutions capacity to perform according to what was asked.

Despite the need of technical certifications, according to IMT findings, any expert – in this case, the contractor – can explain the complex details of its expertise knowledge in a simple way anyone can understand, so, we believe technical explanations and discussions won't be a problem to keep the participative structure of the process, in other words, committee members don't have to be experts in engineering or architecture to know whether a contractor is capable or not to perform and solve any risk identified in a project.

After all discussion on project risks (mainly of non-performance) are over, the contract is signed based on the risk management documents, the project developed along with the informations provided during the selection and pre-award process. CAIXA must follow the

building phase according to the risk management plan (assessing if the contractor is managing the risks identified and what it is doing to mitigate any risk that might happen) and contractor must do what they know how to do best: build and deliver according to the customer's expectations on time and within budget.

To conclude, we can say the main achievements of the exploratory study summarized in this paper are: • the use of PBP to implement the Brazilian public housing policy, which means basically select contractors that will have their projects financed, enables a wider range of project options that incorporate both regional and sustainable aspects as well as develop regional economic agents in the building value chain like material suppliers and local maintenance companies; • a faster approval process; • a cheaper and faster conflict resolution actions in very common problems identified in the existing buildings such as painting and lighting maintenance and security; • a more participative and transparent process; • innovation, the most important building block of competitive advantage, is also stimulated by this performance-based model of implementing the national housing policy that promotes also sustainability and competitiveness in the whole construction value chain. In other words, the use of a performance-based approach in the public housing policy has great potential to promote sustainable construction in its holistic concept previously presented.

FINAL CONSIDERATIONS

This paper summarizes the main achievements of an exploratory study on the impact the use of performance-based procurement in the implementation of the Brazilian public housing policy has on innovation and sustainability in the building sector.

Although the study was focused on popular housing that is financed by governmental policies and is, nowadays, the most attractive niche in the building sector, the discussion about sustainability transcends this niche. Sustainability has been a market strategy to differentiation and that is, by definition, not sustainable. The responsible use of resources and universal access to houses are fundamental to build a truly sustainable society where everyone has a decent place to live and has support to develop their capabilities to contribute to the whole society improvement.

The achievements shown in the exploratory study, although based on Brazilian experience on public housing policy, are based on international theory of innovation, sustainability, performance based procurement and sustainable construction, therefore, it can be extended to other countries. We must be aware, however, that the implementation, or even a proposition of implementation as the one made to Brazil, must be adapted to the countries' reality: social and environmental demands, public policy characteristics and current position of Construction Industry Structure and industry level of development.

We believe the intent of the paper was achieved and some opportunities for future research in this area are: the acceptance of this new procurement system by the main actors responsible for this policy implementation; the level of development of each agent identified in the Agenda 21 – how committed to these strategies are they? –; the development of an educational program to train all actors participating in this procurement process and; the development of mathematical methods to assess reputation and a selection score to determine whether companies will or will not have their projects financed.

REFERENCES

ADEYEMIY, A., SSEGAWA, J., KASHIWAGI, D., SULLIVAN, K. (2009). *Botswana Construction Procurement Process: A New Approach*. 5th International Conference on Construction in the 21st Century, p. 573-480, Istanbul, Turkey.

ALMEIDA, Luciana Togeiro de (1997). *O debate internacional sobre instrumentos de política ambiental e questões para o Brasil*. In: Anais do II Encontro Nacional da Sociedade Brasileira de Economia Ecológica, p. 03-21, São Paulo, available at: http://www.ecoeco.org.br/conteudo/publicacoes/encontros/ii_en/mesa1/3.pdf <access on June 9th 2009>.

BLAYSE, A. M., MANLEY, K. (2004). *Key Influences on Construction Innovation*. Construction Innovation, v. 4, p. 143-154.

BONDUKI, Nabil Georges (2000). *Habitar São Paulo: reflexões sobre a gestão urbana*. São Paulo: Estação Liberdade.

BORGER, Fernanda Gabriela (2001). *Responsabilidade Social: efeitos da atuação social na dinâmica empresarial*. Tese de Doutorado (Administração de Empresas) – Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, São Paulo.

CIB, International Council for Research and Innovation in Building and Construction (2002). *Agenda 21 for Sustainable Construction in Developing Countries: a discussion document*. Pretoria: CIB & UNEP-IETC, available at: <http://cibworld.xs4all.nl/dl/publications/Agenda21Book.pdf> <access on July 9th and 10th 2009>.

CHONG, Nathan, SULLIVAN, Kenneth, SULLIVAN, Marie, KASHIWAGI, Dean (2007). *The Cultural Revolution*. 4th Annual Acquisition Research Symposium, Monterey: California.

CORCUERA, Daniela (2008). *Produção de Empreendimentos Sustentáveis*. São Paulo: ANAB, available at http://www.anabbrasil.org/artigos.asp?id_art=24&action=v_art <access on July 6th 2009>.

DRUCKER, Peter Ferdinand (2011). *Inovação e Espírito Empreendedor*. São Paulo: Cengage Learning.

DUREN, Joop van, DORÉE, André (2008). *An Evaluation of Performance Information Procurement System (PIPS)*. 3rd International IPPC Conference, Amsterdam: Holland.

ERNST & YOUNG (2008). *Brasil Sustentável: potencialidades do mercado habitacional*. São Paulo: E&Y, available at: [http://www.ey.com/Publication/vwLUAssets/Brasil_Sustentavel_-_Mercado_Habitacional/\\$FILE/Brasil_Sustentavel_-_Mercado_Habitacional.pdf](http://www.ey.com/Publication/vwLUAssets/Brasil_Sustentavel_-_Mercado_Habitacional/$FILE/Brasil_Sustentavel_-_Mercado_Habitacional.pdf) <access on July 9th, 2009>.

FDC, Fundação Dom Cabral (2009). *Criando Empresas Inovadoras*. Belo Horizonte: FDC, available at

http://www.fdc.org.br/pt/pesquisa/inovacao/Documents/200906_arruda_barcelos_criando_e_mpresas_inovadoras.pdf <access on July 10th 2010>.

GSA, General Services Administration (2001). *Seven Steps to Performance-based Services Acquisition*. S/l, available at:

https://www.acquisition.gov/comp/seven_steps/library/SevenSteps_execversion.pdf <access on July 9th 2010>.

GUERRA, Georgio Mathias, KERN, Andrea Parisi, GONZÁLEZ, Marco Aurélio Stumpf (2009). *Empreendimentos de Habitação de Interesse Social: o desafio na relação área/custo*. Rio Grande: Dunas/Teoria e Prática na Engenharia Civil, n° 14, p.51-58, available at http://www.editoradunas.com.br/revistatpec/Art6_N14.pdf <access on July 10th 2010>.

GUNNINGHAM, Neil (2005). *Reconfiguring Environmental Regulation: the future public policy agenda*. Documento preparado para a conferência Environmental Law in a Connected World, Wisconsin: Estados Unidos, available at:

<http://www.lafollette.wisc.edu/research/environmentalpolicy/gunninghamreconfigure.pdf> <access on June 9th 2009>.

HILL, Charles W. L., JONES, Gareth R. (2009). *Essentials of Strategic Management*. Mason: Cengage Learning.

JACOBI, Pedro (1999). *Poder Local, Políticas Sociais e Sustentabilidade*. Available at: <http://www.scielo.br/pdf/sausoc/v8n1/04.pdf> <access on July 10th 2009>.

JOHN, Vanderley M (2009). *Desenvolvimento sustentável, construção civil, reciclagem e trabalho multidisciplinar*. Available at:

http://www.reciclagem.pcc.usp.br/des_sustentavel.htm <access on July 11th 2009>.

JOHN, Vanderley M., SILVA, Vanessa Gomes da, AGOPYAN, Vahan (2001). *Agenda 21: Uma proposta de discussão para o construbusiness brasileiro*. Canela: ANTAC, available at:

http://pcc5100.pcc.usp.br/01_Construcao&Desenvolvimento_sustentavel/Agenda%2021%20CCivil%20-%20evento%20ANTAC.pdf <access on July 9th 2009>.

JOHN, Vanderley M., ÂNGULO, Sérgio C., MIRANDA, Leonardo F.R., AGOPYAN, Vahan, VACONCELLOS, Francisco (2004). *Strategies for Innovation in Construction Demolition Waste Management in Brazil*. CIB World Building Congress/Toronto: Canadá, available at http://www.reciclagem.pcc.usp.br/ftp/strategies_john%20et%20al.PDF <access on July 7th 2009>.

KASHIWAGI, Dean, KASHIWAGI, Jacob, SAVICKY, John (2009). *Industry Structure: Misunderstood by Industry and Researchers*. PBSRG, Performance Based Studies Research Group, available at <http://www.pbsrg.com/downloads/>.

KASHIWAGI, Dean, KASHIWAGI, Jacob, SULLIVAN, Kenneth (2010). *The Replacement of Client Decision Making with a Deductive Logic Structure*. Proceedings of the 2010 Industrial Engineering Research Conference, Cebu, Filipinas.

KASHIWAGI, Dean (2011). *Case Study: Best Value Procurement/Performance Information Procurement System Development*. Journal for the Advancement of Performance Information and Value Vol. 3, unpublished article, informations sent by the author.

KIPERSTOK, Asher, COSTA, Dora Parente, ANDRADE, José Célio, AGRA FILHO, Severino, FIGUEROA, Edmundo (2002). *Inovação como Requisito do Desenvolvimento Sustentável*. READ, v. 8, p. 2-20.

LEITE, Fernanda Lustosa, SCHRAMM, Fábio Kellermann, FORMOSO, Carlos Torres (2006). “Gestão de empreendimentos habitacionais de interesse social: foco na gestão de requisitos do cliente e no projeto do sistema de produção”. In: SATTLER, Miguel Aloysio, PEREIRA, Fernando Oscar Ruttkey (editores). *Construção e Meio Ambiente*. Porto Alegre: ANTAC, Coleção Habitare, v. 7, p. 208-239, available at http://www.habitare.org.br/ArquivosConteudo/ct_7_cap7.pdf <access on 1st May 2009>.

LOURES, Rodrigo C. da Rocha (2009). *Sustentabilidade XXI: educar e inovar sob uma nova consciência*. São Paulo: Editora Gente.

LYNCH, Robert Porter (s/d). *Creating Competitive Advantage with your Supply Chain to Thrive the Economic Earthquake*. S/l, available at <http://www.warrenco.com/Creating Competitive Advantage with your Supply Chain.pdf> <access on May 22nd, 23rd 2010>.

MANZINI, Ezio, VEZZOLI, Carlo (2002). *O Desenvolvimento de Produtos Sustentáveis: os requisitos ambientais dos produtos industriais*. São Paulo: Edusp (Trad. Astrid de Carvalho).

MEDVEDOVSKI, Nirce Saffer, CHIARELLI, Ligia Maria de Ávila, TILLMANN, Patrícia, QUANDT, Michelle Muller (2005). *Gestão habitacional para uma arquitetura sustentável*. Porto Alegre: ANTAC, n° 3, v. 5, p. 49-61.

MTE, Ministério do Trabalho e Emprego (2010). *Estatísticas do Cadastro Geral de Empregados e Desempregados – Caged*. Brasília, available at <http://estatistica.caged.gov.br/consulta.aspx?mesCPT=11&anoCPT=2010> <access on December 20th, 22nd, 26th 2010>.

NIDUMOLU, Ram, PRAHALAD, C. K., RANGASWAMI, M. R. (2009). *Why Sustainability is now the key driver of Innovation*. Harvard Business Review, p. 3-10.

PCC, Departamento de Engenharia da Construção Civil da Escola Politécnica da Universidade de São Paulo (2003). *O Futuro da Construção Civil no Brasil: resultados de um estudo de prospecção tecnológica da cadeia produtiva da construção habitacional*. São Paulo: Poli/USP, available at <http://prospectiva.pcc.usp.br/arquivos/O%20futuro%20da%20constru%C3%A7%C3%A3o%20civil%20no%20brasil.pdf> <access on May 20th, 21st 2009>.

PeBBu, Performance Based Building (2005). *PBB: Conceptual Framework*. Rotterdam: CIBdf, available at:

http://www.pebbu.nl/resources/allreports/downloads/04_framework_final.pdf <primeiro access on July 10th 2010>.

PIMENTEL, Lenita, LAURINDO, Rafael (2008). *Eficiência energética X certificações ambientais: uma abordagem prática*. Apresentação realizada no Fórum Permanente de Energia e Meio Ambiente em 4 de novembro de 2008 na UNICAMP, available at http://www.ceset.unicamp.br/arquivos/noticias/Lenita_e_Rafael.pdf <access on July 6th 2009>.

PUJARI, Devashish (2004). *Eco-innovation and new product development: understanding the influences on market performance*. ScienceDirect: Elsevier, available at: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V8B-4D16V4K-1&_user=10&_coverDate=01%2F31%2F2006&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&_view=c&_searchStrId=1624671958&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=3c468759b27c1d768df7a83bd7f9b98a&searchtype=a <access on July 10th 2009>.

RENNINGS, Klaus (2000). *Redefining innovation – eco-innovation research and the contribution from ecological economics*. Ecological Economics, v. 32, p. 319-332.

SAKAR, Soumodip (2007). “Inovação: metamorfoses, empreendedorismo e resultados”. In: TERRA, José Cláudio Cyrineu (org.). *Inovação: quebrando paradigmas para vencer*. São Paulo: Saraiva, p. 27-31.

SEROA DA MOTTA, R.; RUITENBEEK, J. & HUBER, R. (1996). *Uso de instrumentos econômicos na gestão ambiental na América Latina e Caribe: lições e recomendações*. Texto para Discussão nº 440. Rio de Janeiro: IPEA, available at: <http://www.ipea.gov.br/pub/td/td0440.pdf> <access on June 10th 2009>.

SEROA DA MOTTA, R.; YOUNG, Carlos (1997). *Instrumentos Econômicos para Gestão Ambiental no Brasil*. Rio de Janeiro, available at: http://www.coletivobraganca.com.br/download/instrumentos_econ%C3%B4micos_de_gest%C3%A3o_ambiental_no_brasil.pdf <access on June 9th 2009>.

SLAUGHTER, E.S. (1998). *Models of construction innovation*. Journal of Construction Engineering and Management, v. 3, p. 226–232 *apud* BLAYSE, A. M., MANLEY, K. (2004). *Key Influences on Construction Innovation*. Construction Innovation, v. 4, p. 143-154.

SMERALDI, Roberto (2009). *O Novo Manual de Negócios Sustentáveis*. São Paulo: Publifolha.

SULLIVAN, Kenneth, KASHIWAGI, Jacob, SULLIVAN, Marie, KASHIWAGI, Dean (2007). *Leadership Logic Replaces Technical Knowledge in Best Value Structure/Process*.

VARELA, Carmen Augusta (2007). *Instrumentos de Políticas Ambientais, Casos de Aplicação e Seus Impactos para as Empresas e a Sociedade*. In: Anais do IX ENCONTRO NACIONAL SOBRE GESTÃO EMPRESARIAL E MEIO AMBIENTE, Curitiba, available at: <http://engema.up.edu.br/arquivos/engema/pdf/PAP0430.pdf> <access on June 10th 2009>.