

# **AN INNOVATIVE SELF-ASSESSMENT APPROACH FOR MINIMIZATION OF CONSTRUCTION PECULARITIES ON LEAN-ORIENTED D&B PROJECTS**

**Christy P. Gomez<sup>1</sup>**

## **ABSTRACT**

It has been established that the three peculiarities (3 P's) of construction production, namely: site production; one-of-a-kind product; and temporary production organization, leads to variability and thus to waste, as well as low performance levels affecting delivery of value to the client. This phenomena is often taken for granted as a permanent characteristic and a given feature of the construction industry. However, there are a growing number of findings regarding established benefits (especially based on whole-life costing approach) to be gained from long-term relationships, systems formwork, industrialized building systems, automation in construction though using light-weight construction materials, and planning and scheduling techniques such as Line-of-Balance etc. It is argued in this paper that it is necessary to challenge these basic assumptions and secure innovative approaches to drive concerted fundamental efforts towards minimizing waste and maximizing value in construction. In line with this argument, a Lean Excellence Assessment Framework Driver (LEAF-D) for construction project organizations that is focused on minimizing site production; implementation of generic production and installation tools and techniques; and incorporation of elements towards development of more permanent organization structures, is proposed. Additionally, taking into account that the construction industry is confronted with immense communication difficulties, and an evidently ineffective use of information and communication technology, the LEAF-D is being designed as a simple-to-use web-based tool, entitled Web-Lean Assessment Framework Phase 1 (Web-LEAF1). The assessment will be consistently undertaken by representatives of the various disciplines of the novated design-and-construct (ND&C) organizations on a continuous basis (to stimulate continuous improvement) within certain set time-frames to fit with the project durations, that will only require input of new and updating of existing data based on specific elements as identified under the 3P's. With respect to the often regarded traditional nature of the construction industry, this innovative approach is viewed as one of the necessary drivers to initiate action for transforming construction so as to be within the relevant eco-system to support lean concepts and principles. The framework is designed to be implemented on ND&C project organizations that are committed to developing their potential for minimizing waste and maximizing value.

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<sup>1</sup> Senior Lecturer, Department of Construction and Property Management, University Tun Hussein Onn Malaysia (UTHM), Batu Pahat, Johor, Malaysia. PH: (+6)07-453 7193; FAX: (+6)07-453 6021; email: [cpgomez@uthm.edu.my](mailto:cpgomez@uthm.edu.my)

## **Keywords**

Lean Excellence Assessment, novated design-and-construct, innovative.

## **BACKGROUND**

This paper takes on the proposal put forward by Vrijhoef and Kosela (2005), regarding the advantageous resolution of peculiarities of construction in a selective mode by altering the current processes, and as a pilot attempt to focus on a niche market. Koskela (2000) forwarded the hypothesis that construction peculiarities contribute to waste and value loss; and the necessity to eliminate or reduce them or mitigate their impacts on the level of control and improvement. It is important to remind ourselves that the focus is on the wider impact to society by focusing on value rather than reduction of waste and costs.

It is pointed out by Matilda and Stehn (2008), that the tools and approaches developed based on the production theory of lean construction (LC) mainly cope with variability in an attempt to stabilize the construction workflow within the project environment. They point out that the three peculiarities (3 P's) of construction production, namely: site production; one-of-a-kind product; and temporary production organization, that has been discussed thoroughly by Vrijhoef and Koskela (2005); as being part of the deep-rooted construction culture, and is viewed as a constraint in the application of lean construction principles. It is noted by Matilda and Stehn (2008), that “the characteristics of construction imply a [traditional] project culture that complicates the adoption of new approaches such as lean principles”. There is a strong case for the argument that lean is implemented in the logic of [traditional] project setting, and that most implementations within LC have been fragmented, and mainly focus on project performance improvement through the application of new tools and techniques in terms of [traditional] project settings. However, of late there have been considerable efforts by leading lean construction practitioners and researchers, namely Lichtig, W. (2005), who proposes the Integrated Project Delivery (IPD) approach.

Matthews and Howell (2005) have identified at least four major systemic problems with the traditional contractual approach: (1) good ideas are held back; (2) contracting limits cooperation and innovation; (3) an inability to coordinate; and (4) pressure for local optimization at the expense of the project as a whole. It is argued by Koskela and Vrijhoef (2000) that “construction innovation is significantly hindered by the prevalent theory of construction, which is implicit and deficient”. They highlight three mechanisms through which this hindrance is being caused. This paper focuses on the first, wherein: production theories in general, as well as construction theories specifically, have been implicit; hence it has not been possible to transfer such radical managerial innovation as mass production or lean production from manufacturing to construction. It is noted by them that direct application of these production templates in construction has been limited to different context in construction in correspondence to manufacturing, and hence theory and practice of construction has not progressed as in manufacturing.

According to Luecke and Katz (2003), a definition of innovation from an organizational perspective is as follows.

*"Innovation . . . is generally understood as the successful introduction of a new thing or method . . . Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services.*

The innovative approach, here is motivated by the need expressed by industry practitioners for a way forward in their attempts to realize the potential of relational contracts without having to deal with gross uncertainty faced with the current 'radical' approach towards adopting relational contracting. Hence, the attempt here is to adapt the existing frameworks provided by Bennet and Jayes (1998) based on their work on Partnering and form a cohesive link with the current lean initiatives (industry practices) that fundamentally aim to achieve a reduction of the 3P's of construction.

Taking into account the above issues, this paper is an innovative attempt based on an instrumental *evolutionary* approach aimed at achieving the practice of Integrated Project Delivery (IPD). Taking into account the prevalent state of the construction industry that is averse to change, it is crucial to consider the *industry* implications as pointed out by Vrijhoef and Koskela (2005). The point being that, currently construction contracting parties are in a constant 'open' work culture of the various projects running at the same time based on different management and procurement strategies. This issue has seldom been addressed, and is framed in this paper as the *multi-modal construction managerial environment*. It is hypothesised in this paper that this immediate managerial environment for a contracting company's senior management personnel can be problematic if such a 'diverse' project management initiative is not considered as a strategic form of project leadership.

Thus, the strategic form of project leadership approach recommended in this paper is to formulate an evolutionary movement based on current embedded practices within the industry and provide industry the clear direction towards achievement of the future state perceived radical change of implementing IPD. In having identified the major barriers to the implementation of LC, it is important to address the two key ones: (i) the inability to coordinate and (ii) the limiting factor for cooperation and innovation. It is proposed in this paper that the first can be addressed by utilizing the ND&C approach, whilst the second is adopting a *progressive* partnering framework agreement. Thus, providing a 'sensible', *pull* adoption and adaptation of key principles embedded within IDP for enabling effective implementation of LC.

This attempt is not to be confused with the transitional IPD family route. The American Institute of Architects (AIA) have published two separate IPD families: the so-called transitional IPD family, built on a construction management at risk model, and the Single Purpose Entity (SPE) family, developed as the contract embodiment of the principles espoused in *Integrated Project Delivery: A Guide* (the *IPD Guide*). The above is seen as a radical adoption, whilst what is proposed in this paper is an evolutionary adaptation aimed at providing sensible eco-system to initiate the journey (cultural change) towards total implementation of the IPD. The attempt here is to situate the construction project within a collaborative environment, and develop a strategy for avoiding the 'problem-solving' mentality in construction projects that does not allow problems to be evaluated with a focus on changing the traditional allocation of responsibilities and the often resorted to 'common sense' approach that is employed by sub-contractors; viewed here as the key constituent logic of traditional project settings.

## **RATIONALE FOR ND&C-PARTNERED FRAMEWORK ORGANIZATION**

The focus of this paper is of building into the fundamental construction processes the concept of waste minimization and value maximization right from the start. The focus here is to work with the ND&C Action Team (ND-CAT) as having been instituted right from the tendering stage, thus formalization of the ND-CAT is best to be a requirement to be written into the contract. Obviously the implications based on current modes of working that often result in high percentage of project delays. Additionally, the difficulties of clear availability of key construction resources to be assigned to new projects is viewed as problematic under current construction project delivery mechanisms; and possibly thought of as an impossible or utopian state.

Vrijhoef and Koskela (2005) contend that the peculiarities of production are interlinked by causal relations, and that the peculiarities on the production level are related to the peculiarities on the product and industry level. Additionally, Davidson, C. H. (2008), emphasises that the techniques of manufactured construction can only succeed if they are accompanied by appropriate organizational design. Organizational design is seen as more than just supply chain management involving planning and making stable arrangements for sharing advantages and risks, and for fitting with prevailing procurement ethics. Organizational design is conceived as involving the creation of a structure for the roles, processes, formal and informal reporting relationships within an organization.

This paper is *an initial attempt* to situate the implementation of LC concepts within the most appropriate adaptation of current procurement strategies that can provide the fundamental *operational framework* for the organizational design which can enable systemic collaborative planning to take place. The proposed innovative strategy can reliably serve this end, provided there is a steering mechanism to avoid being “sucked” into the practices of traditional construction, as in the case of D&B procurement practice, and hence the guiding principle of partnering is seen as providing the *strategic and policy framework* to guide such an organization.

It is noted by Dolo, H. (2008), that the novated design and construct (ND&C) contract is one of the increasingly preferred options among developers of large commercial and residential projects across Australia. Client’s are more favourable towards ND&C contracts because of perceived controls over innovation and design quality aspects in projects (Akintoye and Fitzgerald, 1995). However, for the benefits to be fully recognized, it is pointed out that a clear understanding of the novation process and appropriate definition of roles, responsibilities and obligations of the client, the design team and the contractor are fundamentally important for successful execution of the project. These are pertinent issues that need to be addressed in terms of the case of ND&C, which is proposed here as the selective project procurement approach that can provide the fundamental avenues for addressing the constraints emplaced by the features of the 3P’s of construction, so as to provide a contextual organizational framework and environment to implement lean principles.

An important point of departure of ND&C from D&C, is that in ND&C, the design team engaged by the client for developing preliminary design documentation is inherited by

the contractors for detailed design over the planning and implementation phases of the project. This has an inherent contribution to how all parties in the process interact leading to higher success in achieving project outcomes. The notion of radical change is not seen as a viable option for the construction industry as the levels of uncertainty in terms of production are relatively high. Hence, it is proposed that concerted attempts at innovating towards achieving incremental improvements, embedded within the concept of continuous improvement are crucial for achieving the benefits of lean construction principles. It is acknowledged here, that as the communication networks and reporting channels at operational levels are mainly loose relationships, especially between interfaces.

Amongst the various findings, it is noted by Doloi, H. (2008) supporting Akintoye (1994), the selection of ND&C procurement is based on the three overriding factors:

- The impact of novation is found to be an effective vehicle motivating contractors on value engineering exercises
- Clarity of design brief
- More effective communication amongst key stakeholders

Based on a comprehensive study of related literature on various procurement strategies, it is concluded that the ND&C procurement approach focused on the key three factors as identified above are key to providing the operational framework necessary based on *current practice* to be conducive for delivering the possibilities for minimization of construction peculiarities.

## **RELATIONAL CONTRACTING AS A POLICY DRIVER**

A relational contract is one agreement by the owner architect and contractor that is later "joined" by sub consultants and sub contractors. There are no "general conditions". It provides for the formation of a core group, and integrated project delivery (IPD) team, and a senior manager team. The core groups is responsible for the overall management and success of the project. In proposing this evolutionary innovative framework for achieving IPD, the original ND-CAT is seen as the *predecessor* to the IPD. The notion of the ND-CAT is fundamentally based on the concept of the 'Strategic Team' as proposed under the Seven Pillars of Partnering and phased into the 2<sup>nd</sup> Generation Partnering phase. The Strategic Team is based on a strategic decision to cooperate by a client and a group of consultants, contractors and specialists engaged in a series of ongoing projects.

It is noted by Ballard et.al., (2001), that it is inappropriate to conceive contracts exclusively in terms of transactions, and that they can also be relational. Koskela et al. (2006) argue that it is the adversarial business context created by transactional contracting methods that discourages collaboration between contracting parties in order to define the solution that will best fit the business purpose. Ballard et.al., (2001), suggest that relational contracting creates a more appropriate context for value generation. They provide a ends-means hierarchies in order to move from desired ends to actionable goals of the production systems, in terms of 'doing the job', 'maximizing the value', and 'minimizing the waste'; the focus being on production system design with the emphasis on flow and value generation. It is argued by Bengt Toolanen (2007), based on his

comprehensive study of relational contracting, that it is a useful route towards reduced transaction costs and also for fostering cooperative relationships. Barbara Colledge (2004), notes that relational contracting not only fosters mutual trust, but also facilitates the sharing of knowledge and information to generate innovation and value for the partners in the relationship (see Table 1).

Table 1: Economic Models and Governance Structures Source: **Barbara Colledge (1992)**

<b>ECONOMIC MODEL</b>	<b>GOVERNANCE STRUCTURE</b>	<b>FEATURES</b>
Markets	Classical Contracting	<ul style="list-style-type: none"> <li>• Reliance on the market; discrete transaction</li> <li>• Adherence to legal frameworks</li> <li>• Use of legal remedies</li> <li>• Standardised contract planning</li> </ul>
Networks	Neo-Classical Contracting	<ul style="list-style-type: none"> <li>• Longer-term relationship begins to assume more importance</li> <li>• Development of relational tendencies</li> <li>• Contract provisions cater for flexibility</li> </ul>
Hierarchies	Relational Contracting	<ul style="list-style-type: none"> <li>• The commercial relationship assumes equal or greater importance compared to the legal agreement</li> <li>• Significant sharing of benefits and burdens</li> <li>• Greater interdependence</li> <li>• Bilateral governance (e.g. Strategic Alliance, Partnering)</li> <li>• Unified governance (e.g. Joint Ventures, Mergers)</li> </ul>

It is proposed that a self-assessment framework for reducing the 3P's be integrated within the concept of *achieving* Third Generation Partnering- 'The Seven Pillars of Partnering'. It is noted by Bennet and Jayes (1998) that, "partnering provides the essential elements of what is needed for the building industry to focus on continuous improvement", additionally it is seen as guiding the *relationship* element. However, it is seen that with a commitment towards reducing the 3P's of construction based on the self-assessment framework, there is a clear route-map towards achieving increasing levels of reduction of the 3P's of construction with a focus on eliminating the 3P's in a systematic and systemic manner. In fact, this approach can allow for bringing more relevance to the concept of Partnering that has not had an impact on the construction industry in terms of developing less adversarial relationships. Table 2, provides a brief overview of the Evolutionary Policy Developmental Framework Towards IPD, whilst Table 3 and 4 provide a brief overview of the Project Operational Checklists, which constitute the two main Sections of the Lean Excellence Assessment Framework Driver (LEAF-D). Hence, simply put the LEAF-D is for construction project organizations that are focused on minimizing site production; implementation of generic production and installation tools and techniques; and incorporation of elements towards development of more permanent organization structures. It is a structured evolutionary approach to provide construction contracting organizations an integrated framework for achieving Third Generation Partnering, which is seen here as an enterprise-readiness phase for adopting Integrated Project Delivery, with a clear route for strategic leadership enabled by the ND-CAT of 'permanent' organization members.

Table 2: The Evolutionary Policy Developmental Framework Towards IPD (adapted from: Bennet, J. and Jayes, S., 1998)

<b>First Generation</b>	<b>Second Generation</b>	<b>Third Generation</b>
<b>Organizational Design</b> Designed based on activities and sub-contracts	Designed based on work-structuring	Designed based on work-structuring and integrated teams
<b>Technology</b> Designers working with contractors to improve designs with a clear understanding of Whole Lifecycle Cost	Specialists brought into multi-discipline task forces to tackle specific design problems and search for new ideas including set-based design techniques	Highly industrialized components and modules are manufactured in factories and assembled on site
<b>Processes</b> Design and construction integrated and streamlined with a clear emphasis on the identification of flows and value generation including achieving reduced cycle time	Creative, open decision making guided by well developed management systems focused on delivering value through SCM, JIT; Process Mapping and Constraints analysis with reduced inventories	Highly standardized processes are integral to the technology aimed at reducing negative iteration in design using Design Structure Matrix; reducing processing time, and improved constructability
<b>Clients</b> Involved in project core teams to signal their commitment to relational contracting (partnering)	Take strategic decision to partner with industry firms to get better value for money	Marketing of highly developed products and services to broad categories of customers
<b>Teams</b> Adversarial attitudes remain, however a clear focus for developing collaborative planning	Training in cooperative behaviour enabling multi-discipline teams to work in open project offices aimed at achieving Lookahead Planning	Integrated teams use supply chain management to reduce cost of acquiring and using of resources, materials and information
<b>Professionals</b> Empowered to use best practice defined by their own professional bodies and education and a clear understanding of the concepts of work flow and value generation	Empowered to be creative by open decision making in which they are challenged to explain their professional judgements	Multi-discipline professionals competent in design, management and marketing especially with regards to concepts for minimizing waste and maximizing value
<b>Basic Workforce</b> Little change except allowed to work more consistently with fewer interruptions and possess basic understanding of workflow and value generation	Given the opportunity to put forward ideas for better ways of working including a high focus on the Last Planner System	Multi-skilled manufacturers in factories and assemblers on site using Last Planner System for reliable planning and effective production control
<b>Cost Benefit Targets</b> Reduction of up to 30% can be achieved	Reductions of up to 40% can be achieved	Reduction of more than 50% can be achieved
<b>Time Benefit Targets</b> Reductions of up to 40% can be achieved	Reductions of more than 50% can be achieved	Reduction of 80% or more can be achieved
<b>Quality Benefit Targets</b> Quality little changed	Zero defects become a realistic aim by identifying and acting on causes of defective work and reduction of rework	Fully defined and appropriate quality is consistently achieved focused on improved design constructability, using in-process inspection e.g. poka yoke

The Seven Pillars of Partnering as identified by Bennet and Jayes (1998) are:

- *Strategy* – developing the client’s objectives; and how consultants, contractors and specialists can meet them on the basis of feedback
- *Membership*-identifying the firms that need to be involved to ensure all necessary skills are developed and available
- *Equity*-ensuring everyone is rewarded for their work on the basis of fair prices and fair profits
- *Integration*-improving the way the firms involved work together by using cooperation and building trust
- *Benchmarks*-setting measured targets that lead to continuous improvements in performance from project to project
- *Project Processes*-establishing standards and procedures that embody best practice based on process engineering
- *Feedback*-capturing lessons from projects and task forces to guide the development of strategy

The approach towards structuring the Lean Excellence Assessment Framework Driver (LEAF-D) based on the Seven Pillars of Partnering is meant to be flexible, such that the organization proceeds to customize the Seven Pillars of Partnering elements to incorporate the fundamentals as initially outlined in this paper towards reducing the 3P’s of construction as indicated briefly in Table 3 and Table 4. However, here there is an additional adaptation to signify three different levels of achievement based on level of integration of the elements throughout the project organization. The weightages accorded to each element is currently being evaluated based on practice feedback and analysis. Each organization is required to prepare a document, with clear examples of having undertaken the aspects as pointed out in each element, which will be scored and verified by a team of three assessors and feedback provided, as well. The validation process is based on having the assessment team verifying the assessment outcome and key issues with the core team. The levels are determined by the achievement indicated by the degrees separated by the symbol //. An overall rating will be worked out to place the organization within the broad category of practice, as averaged out. This is meant to provide a progressive evaluation that constitutes the concept of continuous improvement. Hence, this LEAF-D is currently work-in-progress, and is presented here, both as a contribution to knowledge in terms of being an innovative approach to relational contracting, vis-à-vis reduction of the 3P’s of construction, and an example of making construction knowledge more explicit (a hindrance to implementation of Lean as argued by Koskela).

Table 3: Operational Project Checklists (adapted from: Bennet, J. and Jayes, S., 1998)

<b>STRATEGY</b>	<b>1<sup>st</sup> Level</b>	<b>2<sup>nd</sup> Level</b>	<b>3<sup>rd</sup> Level</b>
The core team (with the client) has produced//disseminated at all levels//practiced at all levels an agreed mission statement describing the challenge or opportunity underlying the project with a high focus on reducing the 3p’s of production in construction .			
The core team has identified//individually verified//incorporated additional benefits of all the internal and external stakeholders that influence the client’s			



objectives and considered what each could get from the project that is exciting, surprising and goes beyond their expectations.			
The core team discuss the client's business case openly at a partnering workshop//help the client prepare the business case//emplace mechanisms to ensure critical elements of business case will be achieved, and carry this out early enough for building issues to be taken into account with special attention to maximizing value and minimizing waste.			
The core team members can describe//can forward alternatives//can identify value maximization and waste minimization strategies//regarding the client's business case in terms that the client understands and agrees with.			
The core team spend time early in the project identifying risks//identifying opportunities//and agreeing how to deal with them.			
The core team has produced a written Brief which is as detailed as the client's objectives will allow//the Brief will develop as key decisions are made//the Brief is verified constantly with the client's representative.			
The final Brief sets out clear and agreed objectives for the core team//the final Brief has taken into consideration carefully thought-out requirements for the building//It identifies potential problems and risks and defines the measurements used to evaluate the project's success.			
The core team members understand the current Brief//including the client's criteria for success//the standards and targets that must be met and how flexibly they can be interpreted.			
The core team members understand the client's priorities and values//have discussed the kind of trade-offs than can be allowed//the core team has assessed the risk of changes to the client's objectives and taken this into account in its working methods.			

Table 4: Operational Project Checklists (adapted from: Bennet, J. and Jayes, S., 1998)

<b>MEMBERSHP</b>	<b>1<sup>st</sup> Level</b>	<b>2<sup>nd</sup> Level</b>	<b>3<sup>rd</sup> Level</b>
The necessary skills are available early so all members of the team have every opportunity to cooperate in making their best possible contribution to the success of the project//including suppliers //including specialist contractors.			
For key aspects of the project, clusters of firms are appointed that have worked together on earlier projects//as far as possible for most aspects of the project, clusters of firms are appointed that have worked together on earlier projects//as far as possible the people involved have worked with the client on similar projects.			
Team members are competent in their own discipline//and skilled in communicating their decisions and judgements//as well as skilled in communicating their decisions and judgements in terms other disciplines understand.			
Team members are selected very carefully to match the needs of the project//especially whether it is intended to deliver routine efficiency//or to encourage creativity in a search for new answers.			
Firms select people with flexible attitudes and authorize them to adopt new ways of working at three distinct levels: <ul style="list-style-type: none"> <li>• <b>Strategic</b>-leaders of the core team who determine the overall vision//</li> <li>• <b>Tactical</b>-designers and managers who define the building and run the control systems needed to produce it efficiently//</li> <li>• <b>Operational</b>-managers responsible for the work of each specialist.</li> </ul>			
The core team is carefully selected to form a balanced team//that includes			

people who between them provide all the characteristics needed for effective team working//the core team maintains effective communication assisted by integrated web-based communication facilities .			
Training is provided for all who need it in communication skills such as emphatic listening so people become better at understanding and discussing their real feelings about decisions//training is also available for core skills such as process analysis, work planning//training is also available for problem solving and performance measurement.			
Individuals who develop partnering skills are rewarded by their firms// Individuals unable to act cooperatively are replaced//special provision is made for an unusually talented person..			

The LEAF-D is currently being designed as a simple-to-use web-based tool, entitled Web-Lean Assessment Framework Phase 1 (Web-LEAF1). The assessment will be consistently undertaken by representatives of the various disciplines of the novated design-and-construct (ND&C) organizations on a continuous basis (to stimulate continuous improvement) within certain set time-frames to fit with the project durations, that will only require input of new and updating of existing data based on specific elements as identified under the 3P’s.



Figure 1.1 : Screenshot of LEAF-D Main Menu

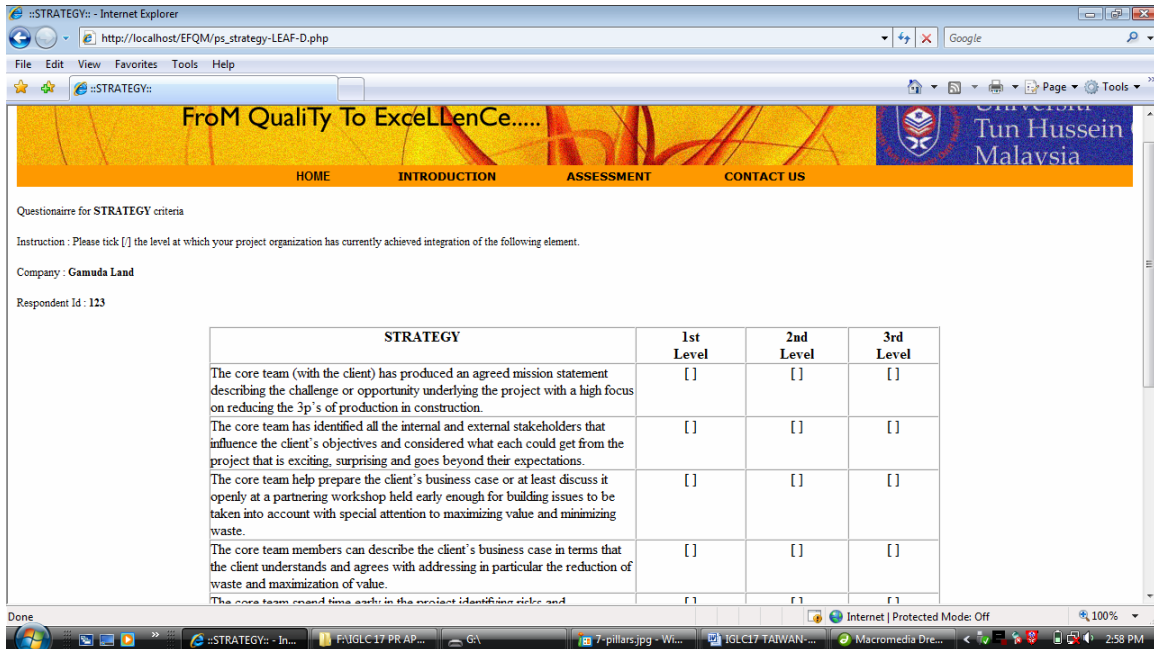


Figure 1.2 : Screenshot of Strategy Element

## CONCLUSION AND DISCUSSION

It is acknowledged that there is a strong argument against pursuing standardization of construction products, as expressed by Howell and Ballard, 1998. Their understanding is that that even in the manufacturing industry there is the necessity of producing a prototype with the associated and acknowledged expectations of what is a prototype in the sense that it is not meant to be market ready. Additionally, as rightly pointed out by Howell and Ballard (ibid), at this phase there are no serious attempts for standardization. However, it should be noted that at the actual production phase, where value is the primary focus, the manufacturing industry has moved towards standardization. The comparisons to the prototyping phase of manufacturing and construction can be misleading, and distract the focus of the current needs within construction of increasing high expectations on quality of the market-ready finished product, which is a prototype none the less.

Hence, the focus of this paper is that in acknowledging the difficulties associated with delivering a market-ready prototype with the high ideal of perfection, there needs to be a serious attempt not only towards structuring the process (see Tsao et. al., 2004) and focusing on reliable, collaborative planning but to also provide key drivers towards ensuring that such a high expectation that can be practicably achieved. Within this context, it is relevant to reflect on Howell and Ballard's (1998) statement, "the nature of change that is required for implementing Lean Production as a new way to coordinate action in construction, rests on a new mental model moving away from an activity based view to a system view, and aspects of this model being that of 'specifying value' and to 'stop the line' as the philosophy is to embrace 'uncertainty' and 'complexity'"; and also to keep a tight focus on the *delivery system* for ensuring high quality of the finished product underscored by the notion of waste reduction. Hence, it is argued here, that the

focus on the wider issues of the delivery system are often lacking in terms the necessity to incorporate innovative approaches that can enhance the concept of maximizing value and minimizing waste as “unique” delivery systems for delivering prototypes of high quality.

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