ISSN 2301-6590

COORDINATION of ARCHITECTURAL CONCEPTS and CONSTRUCTION SYSTEMS

Case Study:
The basic principles of building applications on Garuda II and sustainable development at the Dr.Kariadi-hospital in Semarang.

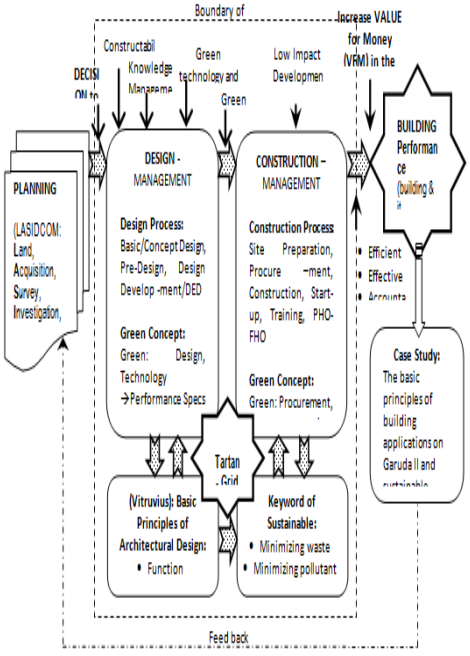
Eddy **H**ermanto.
(S3 Engineering Student of Architecture and Urban)

Abstract:*This paper reported the implementation of coordination between architectural concept and construction system in the area of dr.Kariadi hospital, in Semarang central Java. In principle, the coordination in the design-construction process can achieve the benefits of development by improving the quality of technical design. The use of Tartan Grid concept closely related to the coordination module that integrates seamlessly blend with the application of the concept of green architecture and design quality indicator (dqi) in architectural design can improve the quality of technical design. Furthermore, the construction phase was green construction methods will improve the performance of related construction projects of sustainable keyword: minimizing waste and pollutants, and achieved self sufficient. Matters are very useful for the future utilization of the building through post-occupancy evaluation.*

Keywords: *system, tartan-grid, technology, sustainable development.*

1. INTRODUCTION

Fig.1.BASIC FRAMEWORK MINDSET



The study was conducted at area hospitals Dr.Kariadi, in Semarang, which is being carried out and the construction of several tall buildings on the other side there is a protected historic building (conservation) which functioned for the general administration of the hospital.

Construction industry, in principle, is a project development activities are constrained execution time, different characteristics of each project, taking place once completed, which consists of its phase process: planning (master plan, feasibility study), design / drafting (basic / concept, preliminary, detail engineering), procurement (procurement), construction / physical implementation, acceptance, operation and maintenance . Development of the construction industry has now reached from Conventional, Rational until industry especially in the scope of the use of technologies that are industrializing, then the goal as described above to be

more of a challenge to be achieved so that the project which has one of the characteristics: large volume, high technology, high risk, using a multi-year contract sides need consideration: efficient, effective and accountable. In this context, one of the things that led to the success of construction projects is through the establishment of a construction project organization is partnering/alliance.Forms of partnering in principle follows the basic pattern and the shape of the relationship in Client-Designer-Contractor (CDC) (2,9).

The basic principle of the construction projects that have been put forward by: (1, 2), as the Iron Triangle consisting of the cost, time and quality, which is called the external triangle according to (9). The triangular relationship of the above to manage the three main components of project management: Time, Quality, Cost (TQC) as a success. Furthermore, the success of a construction project initially measured based TQC, but appropriate development is now an element of customer satisfaction including (6).The success of achieving quality of building construction projects are very closely related to the application of quality management worth and worth doing at all stages of the project (7). In a construction project there are stages where the design and construction phases of these two stages together have a major influence and contribute to determine the process to achieve the final product-quality especially on technical sides.

If the sequence is summarized in the development process, the things mentioned above will consist of: preparation includes green technology applications; site development and green or circumstances existing land / sites, green design and human-construction bionomic. All of these items starting from the use of The Tartan-grid closely related to the coordination-module.

Now the green concept, in line with the global warming issue and the Millennium Development Goals (MDGs, especially the seventh point: ensure environmental sustainability, and eighth point: develop a global partnership for development) where the target based on the achievement of certain time-existence strengthens the role of architecture as science and art.

The concept of Tartan-column grid which is a blend of the interface and the distance of each column are the size dimensions of the corner column (20x20 CM2) and middle columns (10x10 CM2) are Necessary to support the roof providing a full freedom in moving the infill components. The Tartan-grid applications generate a regularity in the construction of buildings related to the architectural, structural, mechanical and electrical, outdoor space design, preparation of working space for the physical development of contractor activities, coordinating all of the modules in a system.

In the design process of the building needed a tool to define and evaluate the substance of the design (Design Quality Indicator / DQI). Operational applications based on side-by-side: the impact, build quality, and functionality. These three elements each have overlapping areas (as added value) and the third focal point is the overlapping area of excellence (3). Vitruvius on architecture principles in his book 'ten books in architecture', asserted his opinion that the basic principle should show as utility structure (the purpose and use), Firmitas (materials and construction) and Venustas (proportion and scale).Matters of the building has undergone significant changes that building designers are faced with a variety of quality improvement requirements and constraints that must be met, for example: buildings are designed in harmony environment (green building) and innovative (7).

In principle, the system at this stage of the design process of a building characterized as buildings that are generated through: definition of scope, analyzed and formed into three-dimensional and has a specific nature. So in the process of construction of the building there is a design process that determines the success of the quality of the building. In the design process should be sufficient to control the performance of the main section. It continues to the end of the construction process so that the project goal is reached (5). Caused by the project team's performance does not meet the quality of the result in reworking (reworks) are many times that lead to exceeding the project schedule. This is a fundamental weakness of the building because the building the appearance aspect of the system was not achieved (10).

It is therefore very important and essential for any development of land in an area, especially in urban areas to prepare for the construction of the building and its environment in an efficient, effective and accountable as long as possible, by the use of environmentally friendly technologies.

2. METHODOLOGY

Identify the problem in this study: how the coordination of architectural concepts and construction system can run smoothly? Respondents consisted of project owners, project technical team, consultant designers, construction management consultant, Public Works Department of Human Settlements central Java, all of which carried an interview. The necessary data is primary data, taken directly from the sampling unit with equipment / tool with a list of questions / questionnaires.

The objectives of the study are to determine design of the developed area; and to develop a model of system to achieve building performance.

3. RESULTS AND DISCUSSION

Number	Stage of the Design Process	Stage of the Construction Process	Human Bionomic (OPERATION)
1	**Basic/Concept Design:** Grouping problem (Arditi and Gunaydin, 1997). • STAKEHOLDER MANAGERIAL • TECHNICAL • EQUIPMENT/ENVIRONMENTAL • CULTURAL/POLITICAL **Application/Implementation:** Conducted more detailed elaboration of LASIDCOM: Land, Acquisition, Survey, Investigation, Design, Construction, Operation, Maintenance. MANAGEMENT (PARTNERING): ➢ DESIGN COLLABORATION ➢ TRUST ➢ OPEN COMMUNICATION ➢ RISK SHARING SUBSTANCES: ✣ KNOWLEDGE MANAGEMENT ✣ CONSTRUCTABILITY/BUILDABILITY ✣ QUALITY TECHNICAL DESIGN ✣ REGULATION	**Site preparation:** Site preparation: ✓ Design Review ✓ Create a timeline of project activities ✓ Budget implementation plan ✓ Project quality plan: materials, method of implementation, the technical requirements that must be met. ✓ Explanation of materials available in the market ✓ Project procurement plan: materials, equipments and tools, skilled labor and unskilled, working methods. ✓ Regulation/ordinance survey ✓ Mobilization and demobilization of equipment ✓ Preparation of skilled labor and unskilled ✓ Site preparation ✓ Construction method MANAGEMENT (PARTNERING): - Construction Partnering - Planning: Supply Chain Management (SCM) - Coordination, Monitoring, Evaluation, Controlling.	Construction Industry in Indonesia requires: • Permission of the neighborhood population project (Dutch language: Meerderein; g Ordonantie;) • Building permit (IMB) • Environmental Impact Assessment (EIA (in Indonesia: AMDAL)

ISSN 2301-6590

2	**Design Development:** MANAGEMENT (PARTNERING): ➢ COORDINATION, MONITORING, EVALUATION, CONTROLLING ➢ DESIGN REVIEW ➢ APPLICATION of the PRINCIPLE of DESIGN OPTIMIZATION and GREEN DESIGN, COORDINATION of DESIGN DOCUMENTS SUBSTANCES: ✦ KNOWLEDGE MANAGEMENT ✦ CONSTRUCTABILITY ✦ BUILDABILITY ✦ QUALITY TECHNICAL DESIGN ✦ GREEN DESIGN ✦ REGULATION	**Site development → construction:** ✓ Design Review ✓ Total Quality Management (TQM=QC-QA) ✓ Shop Drawing → Action plan → Execution to construction process ✓ Site Meetings ✓ Options: change jobs, change orders, technology substitution ✓ Testing: building materials, work products, calibration equipments ✓ Application: Supply Chain Management (SCM) ✓ Application activities in fast track and considering the impact ✓ Application of health and safety ✓ Application of green construction ✓ Comply with the contract and does not violate the applicable development regulations ✓ Start up and training process	Construction Industry in Indonesia requires: o Handover of construction works from PHO to FHO o warrant of fitness function, o manual book: how to use, maintenance and upkeep of buildings; o As Built Drawings.
Negative Impact	Changes in design and engineering, Reworks.	Change order, Construction performance is not achieved, Construction failure.	Building performance is not achieved. Building failure by

			user contractor.
Scope of work	Apply to the construction of buildings with traditional methods / Design Bid Build (DBB) or the method of Design and Build (DB)		

Table 1 Process of Design, Construction and Human Ekonomic

ISSN 2301-6590

The Tartan Grid	8-10 floor high building design.	Construction Activities	Open Space Design
From the initial concept Tartan Grid: Size column corner 30/20 CM2, the columns between column corner 0/10 CM2 and spacing between columns 100 CM. BEING DEVELOPED: For MULTI-ROLE and FUNCTION	➢ Tartan Grid concept: Size corner columns and the columns between column corner 80/80CM2 and spacing between columns 800 cm. ➢ So the coordination module is 800 cm. ➢ Distance between buildings is 800cm. It is sufficient for the functioning of natural air movement, lighting the sky for the side and rear of the two buildings that face each other, infiltration wells (biopori, bioretention), sewer and landscaping. ➢ Parking at the building with the pattern of double loaded corridor where width of the road for two-way car traffic is sized 800cm, the size of a parking space is 400cm long and there are three cars for every distance between columns. ➢ Wide ramp connecting the floor is 400cm. The width of the ramp connecting the floor is 400Cm where the distance from the ground floor to the basement floor is 320cm. ➢ Distance of floor to	✧ Tartan Grid concept. So the coordination module is 800 cm. ✧ The distance between the edge of the column structure with tower crane column is 800cm. ✧ Short sleeve and long sleeve from the tower crane that has applied each size 800cm and 2400cm. ✧ Field office building and office building contractors is a two-storey temporary; 800x2400M2 size; second floor for contractor activities; first floor to perform activities of meetings, activities for construction management consultants and technical team owner, lavatory. ✧ Construction road width is 800cm. Size of a warehouse without roof 2x800x3200M2, and space for vehicle operating heavy equipment is 3200x3200M2. ✧ Road construction apart from the consumer (health care services) where there is only one point of	• Tartan Grid concept. So the coordination module is 800 cm. • Distance effective width of the road (right of way) is 800cm • In the event of force majeure, the outdoor space is used as an emergency hospital implemented a basic module building tents with 4x800x800M2 size. Distance between them 0.5 x800cm. • Distance between trees is 800M. • Street lighting columns to 800cm tall. • Design outdoor space can be used as a multi-function activity, for example: brisk walking activities, cycling, had a mean size of 1600x3200M2. • Each parking space has three in 800x400CM2 size where the width of the road for traffic flow is 800M. • Ramp width of outer space to

	floor is 400cm. The average distance from floor to ceiling is 270cm. ➢ Medium voltage electrical panel building of PLN is 800x800M2. ➢ Power house in the basement has a size of (800 +400) x2400M2 ➢ Ground water tank in open space has a size of 800x400x400CM3 ➢ Chiller plant on the top of Ground water tank and WWTP ➢ The sewage treatment plant (WWTP) has 3200x800x400M3 size tub with four units, each collector has 800x400x200M3 size. ➢ Medical gas central building has a size of 800x2400x3200M3. ➢ Location of the hydrant box / pillar hydrant application designed jointly position at any distance 2400cm or 3200cm. ➢ If the application needs to be done post-tension concrete is effectively applied starting on the distance between the columns is 800cm.	intersection traffic flow and traffic arrangements are made with management traffic. ✧ The width of the entrance / exit of construction land is 800cm. ✧ At each distance of 800cm for strengthening the framework of scaffolding are diagonally brace the frame in three dimensions. ✧ At each distance of 800cm to the utility grid horizontal (plumbing, ducting) applied to the main hanger. Similarly, for vertical use network utility main clamp. ✧ Cable networks such as horizontal cable tray has a width to the size of: 40, 80, 160cm ✧ At the time of termination of the project, the rest of the land for the collection of unused work has multiples 800x800M2 size.	the basement floor is 400cm. • Rainwater catchment design patterned fish spines based on the size of the space module 800x800M2. • In the design of rainwater network control basin at any distance 2400cm or 3200cm and small catchment wells on each spacing 800cm. • Design of outdoor space for parking twelve ambulances are 2x6x400CM2 shaped double loaded corridor. • Small river as flood control has an effective size of the riverbed as the water flow: 400cm, 400-800cm depth of the river, and the banks on either side of the river each horizontal width of 400cm. Landscape design done on the banks of the river serves as a river view.

Table.1 Developing of The Tartan Grid in: 8-10 floor high Building Design, Construction Activities and Open Space Design.

The main characteristics of the coordination of architectural concepts in building design with construction system is a key to reduce the uncertainty of the final result as the performance of a building construction project. In this case the most important is the application of the system must be able to ensure coordination in the design and construction process so there is no conflict or disputes, rework, and even the failure of the construction. To achieve success, the coordination must be optimized in terms of the substance of design in sustainable construction management.

Based on the planning stage, Based on the planning stage, then it should be considered important aspects, such as the scope of work, the proper equipment, competent personnel, working methods and organizational culture to support the success of the design and construction process as a whole project. Similarly, post-construction phase depends on strategic decisions that have been made in the planning stage. Finally, at the time held the post occupation evaluation will achieve optimal building performance.

Figure.1.shows the basic framework mindset. Framework shows the process and substance of the most influential and interact within the system boundary. If in it there is a small effect due to the impact of design quality is achieved, then there is sustainable development.

Table.1.shows that Stage of the Design Process in which there are elements within each classification grouping interact internally activities affect the next stage of construction process in which an interaction of internal activity, finally there is the human bionomic stage of the process.

Table.2. shows that The Tartan Grid concept developed multi role function has a significant influence on the following aspects: 8-10 floor high building design, construction activity, and open space design. Occurred relative

similarity in coordination modules: 80-800-80cm. In this case, the various substances design object has a correlation with the size of the basis in coordination module.

4. CONCLUSION

This study, however, indicate that the importance of the role that design should be able to achieve an increase in the optimal design of technical quality in the process of building projects. Design coordination will reduce the impact of construction failures, reworks and change order of items in the contract work. Contrary to the above, the technical quality of design coordination produces a better design from different point of view. The Author will continue study in monitoring the performance of post-occupancy evaluation related to the health care activities in this building and development of other buildings.

5. ACKNOWLEDGEMENTS

The Author would like to thank to the Department of Architecture, Engineering Faculty, Diponegoro University; and the General Hospital Dr.Kariadi, Semarang.

6. REFERENCES

1. Akintola Akintoye, Eamon Fitzgerald, 1995, **Design and build: a survey of architects' views**, *Engineering, Construction and Architectural Management J*, Vol. 2 Iss: 1, pp.27 - 44
2. Atkinson, 1999,**Project Management: Cost, Time and Quality, Two Best Guesses and A Phenomenon, It's Time to Accept Other Success Criteria**, *Int'l Journal Project Management, 17(6), 337-342.*
3. Anonym, **"Getting Value for Money from Construction Projects through Design",** NATIONAL AUDIT OFFICE/NAO (Commission of Architecture Building Environment/CABE, Organization of Government Commerce/OGC).
4. Habraken, N.J., 1972, An Alternative to Mass Housing, Praeger Publisher.
5. Haponava Tatsiana and Saad Al-Jibouri, 2010, **"Establishing influence of design process performance on end-project goals in construction using process-based model",** *Benchmarking: an International Journal*, Vol. 17 Iss: 5, pp.657 – 676.
6. Liu and Walker,1998, Evaluation of Project Outcomes, *J Constr Mngt Econm*, 16(2), 209-219.
7. Morris Hicky Morgan, 1960 (Memon, 2007), **The Ten Books On Architecture**. Dover Publication
8. Neale RH and Neale DE, 1989, Project Management: Construction Planning, Thomas Telford HQ London
9. Newcombe, 2000, The Anatomy of Two Projects: A Comparative Analysis Approach, *Int'l Journal of Project Management*, 18(3), 189-199.
10. Xiao.H and Proverbs, 2001, . Xiao and D. Proverbs, "The performance of contractors in Japan, the UK and the USA," International Journal of Quality & Reliability Management, vol. 19, pp. 672-687, 2002.