

Green and Sustainable Port Project Planning: Paradigm Shift For An Integrated Container Handling System Expansion

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ABSTRACT

The revolution from economical cost-effectiveness to being financially self-sufficiency has met with a paradoxical concept of sustainability that seemingly violates the very basic functionality of port planning, be it private or state-owned ports. Can ports veer through achieving sustainability at the risk of losing customers that translate into profit lost? Nevertheless, the call to sustainability cannot be deterred and sustainable strategies have to be drawn to maintain as a competent port in global arena of shipping. This paper proposes a sustainable port project planning model giving specific add-on components to the basics of sustainability. This model assimilates concepts of sustainability from individual components under one roof for port project planning (PPP) into a new sustainable proposition for port productivity, traffic forecast and environmental impact forecast for. The results from this research is a thorough generic proposition model with quantifiable achieving benchmark for each component.

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INTRODUCTION

As technology strives in the 21th century, planning for the management of port development has to draw that ever-essential balance, if not a new approach, to accommodate the paradigm shift of the various maritime ship classes traffic that increase in load-size and the capacity enhancement of ports container handling system. As MIMA probes malaysian ports to adopt greener initiatives, in an multilateral effort from Marine Department of Malaysia, Department of Environmental Malaysia, Envergy Commission Malaysia and national port authorities. The national planning tables the proposal of shore based connection – cold-ironning (MIMA, 2014). On top of that, malaysia's transport ministry and relevant agencies have been urged to map out more comprehensive sustainable national development policies for reducing CO₂ emission such as fiscal and financial incentives or mechanism encouraging technology adoption such as higher crane efficiency, deploying auto-vehicle monitoring system and gate control as-well-as electric rubber tyred gantry and other solar-powered panels (Star News, 2014). Addressing the need for sustainable port projects model, this paper has reexamined the port development methodology by UNCTAD to keep track of the basic function of planning. After thorough studies, a model is proposed by consolidating all

packages of sustainable endeavours into one long-term planning proposal that can achieve the targeted sustainable benchmark efficiently.

Proposed Green and Sustainable Project Planning Model:

Management of port development involves a few tiers of planning which includes: (1) national port planning (npp) - the overarching planning phase on the national level probes crucial policy decisions that define the governing vision and end-achievement of the port in terms of management, operations and economical targets (UNCTAD, 1985); (2) port master planning (pmp) – it crafts the long-term implementation adhering to the vision provided at the national planning. This phase of planning sets no specific timeframe in achieving the end-outcome but merely plans step-by-step, moving one notch forward with each port project; (3) port project planning – a physical and constructive plan to materialize fractions of the master plan at the precise time given and in specific designed criteria.

A paradigm shift does not dictate a total revamp in the whole conventional planning framework for container handling equipment. However, the motivation of sustainable planning implores that the new element of sustainability should not take absolute precedence in the decision making of CHE planning but instead should hang in the balance, by trade-off

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manner, with other planning variables. Neglecting any of those parameters, namely traffic demand, productivity demand and designation of planning overarching objective, merely for the environment sake would prove ill-advised as it can never carry far when running on financial deficit. Not being

sustainable see actions that eliminate huge amount of work-force to operate the port by automation, this destroys job opportunities and push the livelihood of jobless port personels to a state of desperation (Dekker Sander., 2010).

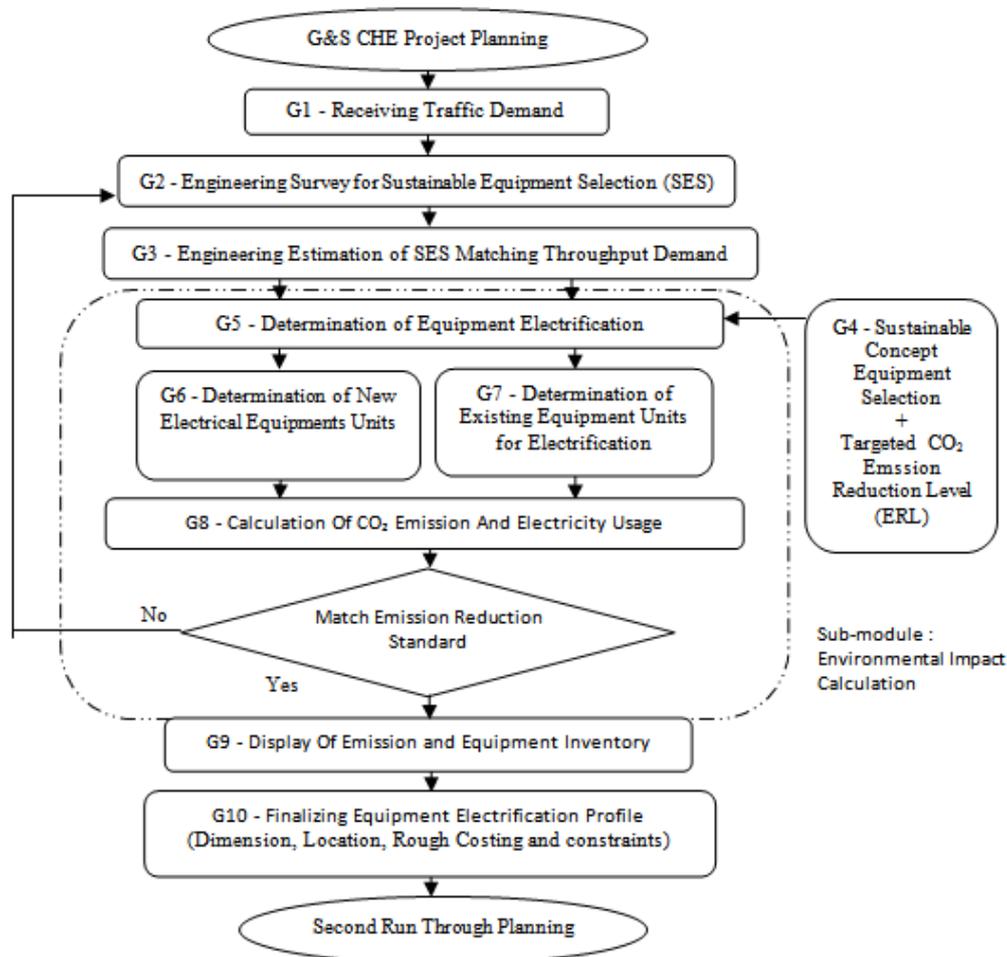


Fig. 1: Green and Sustainable CHE Planning Procedural Flow (source: Authors)

The model of this paper stipulates the merged concept for sustainable container handling equipment planning project, as shown in **Fig. 1**. The major add-on to the UNCTAD model of port project planning is the sustainable concept to reduce CO₂ emission from the container handling equipment (CHE) in order to achieve the targeted benchmark. Therefore, an iteration process is in the loop to cross check the emission reduction level by electrification. Should the reduction fall short of the specified standard, the planning process will be iterated to propose an alternative equipment selection profile that corresponds to all variables requirements. For a robust model, all phases will require data and information for their planning iteration to propose an alternative of

equipment selection. **Fig. 2** shows the supporting data and information necessary for the conceptual model.

The sustainable equipment project planning comprises data and informations from components of (1) sustainable-defined planning package, (2) sustainable port productivity forecast package, (3) hybrid traffic forecast package and (4) environmental impact forecast package.

Each packages are the results of the integrating of various data and information as shown in **Fig. 2**. Fundamentally, there will be a concept or theoretical-driven component that constructs the basic functionality of the package. It is also further enhanced by injecting current conforming trends and monitoring system by latest technological advancement.

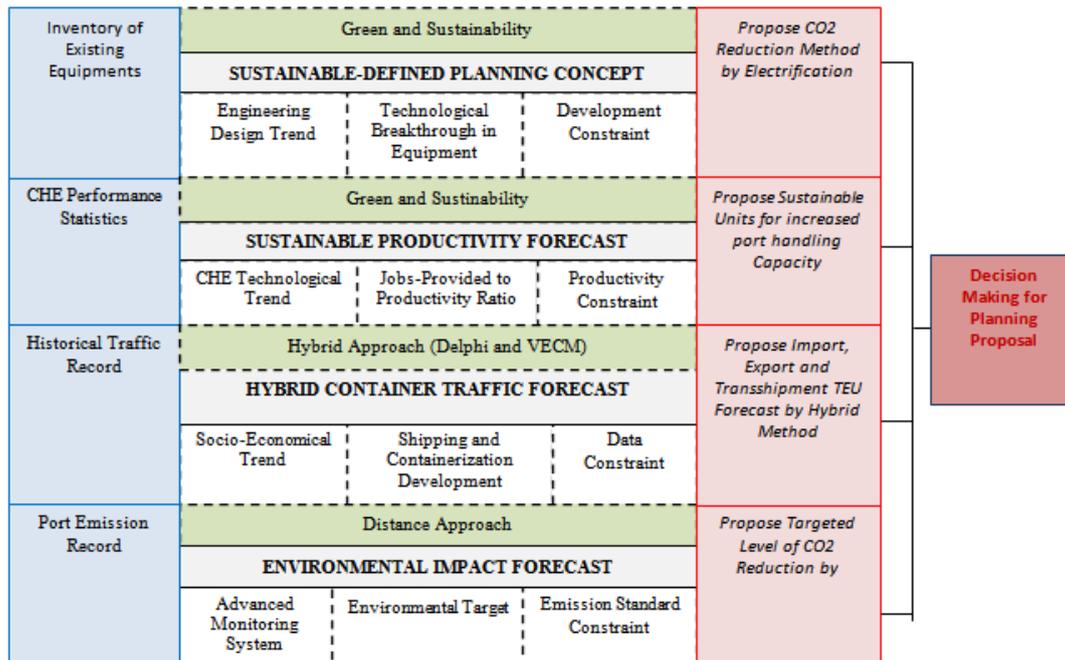


Fig. 2: Data and Information Required for Sustainable Planning Decision (source: Authors)

Sustainable-Defined Planning Concept:

Electrification has been a mainstream sustainable concept to mitigate emission to an ideal zero level direct emission. The indirect emission – waste gases from electricity generation by coal, fuel and other materials, omitted from power stations will not be addressed in this model. Besides, adopting green engineering design trends that has a life-cycle outlook on their equipments maybe assimilated into this sustainable package. Others could include: (1) economic order quantity (EOQ), (2) green purchasing policy (low maintenance, longer life-span, ISO 14001 compliance product), (3) green development of extra infrastructure to facilitate electrification. (4) advanced inventory. Nonetheless, observing developmental constraints would prove farsighted as when enough research is done that a solution may bring forth breakthrough for port application. E.g. fast-charging batteries (Max Wei *et al.*, 2013).

Sustainable Productivity Forecast:

Determining port productivity has presented on-going challenge to planners, as of the wide array of influencing factors, that they could only do so much to enhance productivity. Common productivity measurement associated to equipment planning are crane utilization, crane productivity, non-port truck time in terminal and labour-equipment productivity. Singapore port and Kwai Tsing port (Hong Kong) ranked one of the few highest productive ports that despite constraints of limited land supply, by mere information technology advancement and ground-breaking container handling system, it suffices to meet vigorous demands (Cullinane, K., *et al.*, 2006).

Hybrid Container Traffic Forecast:

Generally, techniques employed to predict with greater accuracy the TEU throughput are time series forecasting, which are based on acquired historical data for simple extrapolation to complex regression models (Ee, J. Y. C., *et al.*, 2014). In this model, the multivariate forecasting will be done by vector error correction model (VECM) that includes variables from closely correlated socio-economical data, tested by Pearson correlation. After checking the impulse response function (IRF) for forecast stability, the TEU forecast will be presented for experts survey by Delphi method that corresponds experts' opinion on TEU fluctuation by percentage and the confidence level toward ones own proposal (Duru, O. and S. Yoshida, 2009).

Environmental Impact Forecast:

European ports have regulating guidelines under the Port Environmental Review System (PERS), Eco-management and Audit Scheme – EMAS and commonly the International Organization for Standardization – ISO 14001. These organizations grants recognition or accreditation for achieving its requirements. APM who has led the pioneering work to electrify all rubber-tired gantry (RTG) claimed that retrofitted RTG fleet has reduced CO₂ emission by 70,000 tons annually, bringing down the overall reduction to 20% per TEU handled at just a payback period of 2.2 years (Yang, Y.C., and W.M. Chang, 2013). This package of environmental forecast proposes a 5% CO₂ reduction per TEU every year. Here, a superior specific monitoring method has been developed to better understand the CO₂ emission and to provide effective solution to reduce emission

percentage according to port characteristics (Geerlings, H. and R. van Duin, 2011). The distance-based emission modeling will tabulate emissions and give perspective on how emission is happening.

Summary:

In short, the port project planning has to be designed in conformity to green and sustainable trend. Hence, an integrated green and sustainable port project planning framework with consolidated conceptual approaches and theoretical methods has been created. This framework will be utilized before submitting project plan for financial analysis. Port planners can benefit from this framework by referencing to the sustainable practices and technical planning strategies reviewed in this paper

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