

Mitigating the Cost of Empty Container Repositioning through the Virtual Container Yard: An Appraisal of Carriers' Perceptions

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Abstract—Empty container repositioning is a fundamental problem faced by the shipping industry. The virtual container yard is a novel strategy underpinning the container interchange between carriers that could substantially reduce this ever-increasing shipping cost. This paper evaluates the shipping industry perception of the virtual container yard using chi-square tests. It examines if the carriers perceive that the selected independent variables, namely culture, organization, decision, marketing, attitudes, legal, independent, complexity, and stakeholders of carriers, impact the efficiency and benefits of the virtual container yard. There are two major findings of the research. Firstly, carriers view that complexity, attitudes, and stakeholders may impact the effectiveness of container interchange and may influence the perceived benefits of the virtual container yard. Secondly, the three factors of legal, organization, and decision influence only the perceived benefits of the virtual container yard. Accordingly, the implementation of the virtual container yard will be influenced by six key factors, namely complexity, attitudes, stakeholders, legal, organization and decision. Since the virtual container yard could reduce overall shipping costs, it is vital to examine the carriers' perception of this concept.

Keywords—Virtual container yard, imbalance, management, inventory.

I. INTRODUCTION

THE nature of the liner shipping industry means that the supply and demand is very difficult to match [1]. Freight transportation is highly sensitive with respect to the timely delivery of cargo; thus, the availability of containers is as vital as that of ships. However, commercial cargo traffic never seems to be in balance [2]. It is rare that shipping lines have a well-balanced container inventory. The many practical reasons creating this imbalance include international trade patterns and the consequence of imbalances in the worldwide trade distribution [3], the uncertainties of customer demands, widespread allocation of container ports and customers, and the dynamic nature and increased complexity of the container shipping industry [4] and the types of commodities to be moved etc.

Container inventory management (CIM) is a highly complicated issue due to the volatility of container demand

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and supply. Reference [5] identifies container availability as one of the criteria that determines the service quality of ocean container carriers. The container inventory imbalance generates various costs and has a direct impact to shipping lines and their agents [6]. Shipping companies spend on average \$110 billion per year in the management of their container fleets (purchase, maintenance and repairs), of which, \$16 billion is for the repositioning of empties [7]. These costs include port handling costs (PHC), slot fee for the sea passage, land transport costs, ground rent and handling costs at container freight stations (CFS) etc. In addition to the direct costs, expenses related to wear and tear, and cleaning etc. are also to be considered.

According to [8], empty container movements would not exist in a perfect world, because there would always be cargo to fill every container when and where it was emptied [2]. However, shipping is not a direct demand, but a derived demand of international trade. Therefore, carriers are faced with a dilemma to strike a balance between the demand and supply [9]. Every domestic container contributes to the traffic movement on road network [10]. This is a global problem. For example, low production costs and the need for empty boxes to transport Chinese exports, made China the natural location for setting up factories for the construction of containers [11]. On the other hand, there is huge oversupply of containers in the United States due to high level of imports to the country. The empty container stocks would also occupy ground space for storage for prolonged stay, and thus creates environmental hazards. There is tremendous pressure on reducing logistics costs and the carbon footprint [12].

The concept of the virtual container yard (VCY) is based on the container interchange between carriers on a global platform. Each carrier has the virtual control of their containers globally and may release them to others only when they are not in use. The fundamental prerequisite in a VCY is that there should be a carrier who has a deficit inventory and another with excess containers. Carriers have rationalized that that a carrier's surplus containers at a particular area could be needed by another carrier which is experiencing an inventory demand in the same place [13]. This argument provides a positive incentive to the container interchange approach. However, the industry has not made a notable attempt to evaluate the benefits of container exchange because the carriers believe that there is no opportunity for container exchange, as the intrinsic trade imbalance is commonly applicable to all carriers [12]. Use of foldable containers is