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A Performance Comparison between the Base Stock (BS), Traditional Kanban Control System (TKCS) and Extended Kanban Control System (EKCS)

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Alvin Ang

Department of Mechanical and Aerospace Engineering

Nanyang Technological University (NTU), Singapore

ANGW0038@ntu.edu.sg

Abstract –

This paper presents a simulation experiment done comparing the Single Stage, Single Product Base Stock (BS), Traditional Kanban Control System (TKCS) and Extended Kanban Control System (EKCS). The results showed that BS incurs the highest cost in all scenarios; while EKCS is found to be effective only in a very niche scenario. TKCS is still a very powerful factory management system to date and it was a letdown that EKCS did not perform exceptionally well. The only time EKCS did outperform TKCS was during low demand arrival rates and low Backorder (C_b) and Shortage costs (C_s). That's because during then, it virtually holds no stock. The most important discovery made here is that EKCS *becomes* TKCS once it has base stock (or dispatched kanbans). But this is difficult to spot especially when their schematics look so different. The results have also evinced the strength of the pure kanban system, the TKCS over BS. Hence managers using BS should consider upgrading to TKCS to save cost in all scenarios.

Keywords – Kanban, BS, TKCS, EKCS, Arena, Simulation

(I) Introduction

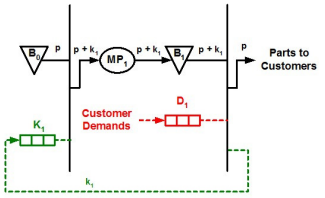

Figure 1: A Single Stage, Single Product Traditional Kanban Control System (SS – SP – TKCS)

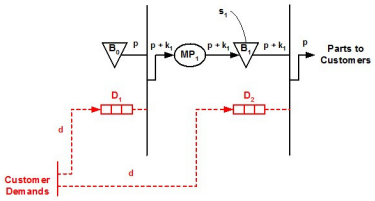

Figure 2 : A Single Stage, Single Product Base Stock System (SS – SP – BS)

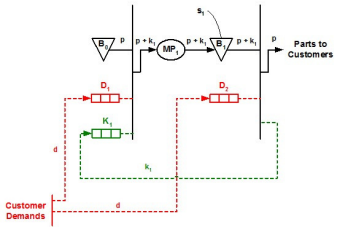

Figure 3: A Single Stage, Single Product Extended Kanban Control System (SS – SP – EKCS)

(II) Key Simulation Assumptions

- Both systems make only a Single Product Type.
- They do not produce defective parts.
- All systems adopt a Single Stage i.e. only one Manufacturing Process (MP).
- Each MP contains only one machine or server.
- Demand signals and kanbans flow instantaneously.
- All systems assume customer demand arrival rates following a Poisson Process.
- All MPs assume processing times to be exponentially distributed.

(III) Results, Conclusions and Future Work

1. EKCS outperforms TKCS significantly only in low demand rates (<50% utilization rate) and low Backorder (C_b) and Shortage Costs (C_s).
2. If EKCS has base stock, then optimal EKCS *becomes* optimal TKCS. Their performance become the same because their optimal number of dispatched kanban is the same. If EKCS has base stock, its undispatched kanbans become ineffective.
3. Since it has been shown that the Multi Stage EKCS behaves similar to Multi Stage TKCS (with the assumption of negligible kanban transfer time), it would not be wise to investigate Multi Stage, Single Product KCS further. Instead, more plausible results could stem from Multi Product KCS since their working mechanisms are entirely different. Hence, future work will be to explore Single Stage, Multiple Product KCS to see if Multiple Product EKCS then prove its worth.

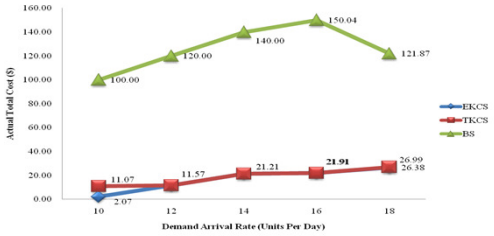

Figure 4: Comparing EKCS, TKCS and BS in a Low Backorder and Shortage Cost Scenario

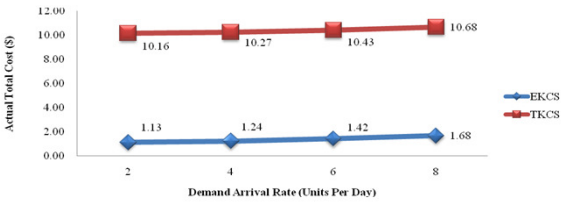

Figure 5: Comparing EKCS and TKCS in a Low Backorder and Shortage Cost; and Low Demand Arrival Rate Scenario