

## 科学研究費助成事業（科学研究費補助金）研究成果報告書

平成24年6月11日現在

機関番号：21401

研究種目：基盤研究（C）

研究期間：2009～2011

課題番号：21510148

研究課題名（和文）品目間の関連性をマイニングする在庫ポリシーに関する研究

研究課題名（英文）A Study on Inventory Policy of Mining Relationships among Inventory Items

研究代表者 郭 偉宏 (KAKU IKOU)

(秋田県立大学 システム科学技術学部 教授)

研究者番号：30315618

研究成果の概要（和文）：

本研究は在庫品目間に関連性があるとき、その実態、扱い方および在庫ポリシーなどの項目について調査研究をし、以下の成果を上げていた。

## (1) データベースの整備

在庫データは特殊なもので、一般に使われているデータマイニングのベンチマークにない特性が入っている。そのために、独自のデータベース（コンビニとスーパー）をランダムサンプリング法で作成した。

## (2) 在庫品目間の関連性

利益最大や損失最小という評価指標を用いて関連規則で品目間の関連性を評価した。

## (3) 在庫ポリシーに対する影響

欠品による損失費用を定量的に見積もり、それをういた在庫モデルを提案した。

## (4) 在庫政策の検討

関連して様々な条件のもと在庫政策を検討した。

数多くの成果を上げていた。

研究成果の概要（英文）：

This study investigates real states and treatments of inventory items among them there may are relationships. Then inventory policies involving these relationships are considered. Following contributions are achieved in our researches:

## (1) Set up original data bases for our further researches

(2) By using the framework of support-confidence, new concept of classification of inventory items is developed. New algorithm and comparison experiment had been made to show the utility and performance of our algorithm.

(3) We also estimated the cost when lost sales are occurred. Several models including partial and complete backorder based on the new cost function are presented.

(4) Other inventory control and production planning problem, especially on multilevel lot sizing problem are investigated.

A lot of journal papers are presented on the research.

交付決定額

(金額単位：円)

	直接経費	間接経費	合計
21年度	1,000,000	300,000	1,300,000
22年度	1,300,000	390,000	1,690,000
23年度	1,300,000	390,000	1,690,000
年度			
年度			
総計	3,600,000	1,080,000	4,680,000

研究分野：複合新領域

科研費の分科・細目：社会・安全システム科学・社会システム工学・安全システム

キーワード：経営工学（在庫管理）

#### 1. 研究開始当初の背景

牛乳とパンと一緒に売れるというような実例はスーパーマーケットによく見かける販売行為である。しかし、このような在庫品目間に関連性がある商品の在庫管理や生産計画の理論がまだない。

#### 2. 研究の目的

在庫品目間の関連性を評価した上、新しい在庫理論（在庫管理のあり方よ方法論）を考案する。

#### 3. 研究の方法

在庫理論の分野において、理論と現場に大きいギャップが存在することを念頭に置いて、理論研究を中心に、現場のデータを用いたシミュレーションや実験による検証を用いて補佐する。

#### 4. 研究成果

一々述べないが、3年間で21本のジャーナル論文を発表している。この分野での研究としては輝かしい成果である。

#### 5. 主な発表論文等

（研究代表者、研究分担者及び連携研究者には下線）

〔雑誌論文〕（計21件）

1. Yong Yin, Chenguang Liu and 郭偉宏: Cooperation and leadership policies in a serial supply chain, *Journal of Manufacturing Systems*, Vol. 30, pp.1-7, 2011.
2. Yong Yin, Chenguang Liu and 郭偉宏: Some underlying mathematical definitions and principles for cellular manufacturing, *Asia-Pacific Journal of Operational Research*, (accepted), 2011.
3. Yiyong Xiao, Xinghong Zhao, 郭偉宏 and Renqian Zhang: A reduced variable neighborhood search algorithm for uncapacitated multilevel lot-sizing problems, *European Journal of Operational Research*, Vol.214, pp.223-231, 2011.
4. 郭偉宏 and Yiyong Xiao: A simulation based study on meta-heuristic algorithms for

solving multilevel lot sizing problems, *Asia Pacific Journal of Industrial Management*, (accepted), 2011.

5. Renqian Zhang, Yiyong Xiao and 郭偉宏: Model and heuristic algorithm of the joint replenishment problem with complete backordering and correlated demand, *International Journal of Production Economics*, doi:10.1016/j.ijpe.2011.01.019, 2011.
6. Yiyong Xiao, Renqian Zhang and 郭偉宏: A new approach of inventory classification based on loss profit, *Expert Systems with Applications*, Vol. 38, pp.9382-9391, 2011.
7. Yiyong Xiao, 郭偉宏, Xinghong Zhao and Renqian Zhang: A variable neighborhood search based approach for uncapacitated multilevel lot-sizing problems, *Computers & Industrial Engineering*, Vol. 60, pp.218-227, 2011.
8. Yi Han, 郭偉宏, Jiafu Tang, Nico Dellaert, Jianhu Cai, Yanlai Li and Gengui Zhou: A scatter search approach for uncapacitated multilevel lot-sizing problems, *International Journal of Innovative Computing, Information and Control*, Vol.7, No.7, pp.4833-4848, 2011.
9. 郭偉宏, Renqian Zhang and Yiyong Xiao: A quantitative approach for estimating the opportunity cost with cross-selling, *International Journal of Services Sciences*, Vol.4, No. 1, pp. 14-37, 2011.
10. Renqian Zhang, 郭偉宏 and Yiyong Xiao: Deterministic EOQ with partial backordering and correlated demand caused by cross-selling, *European Journal of Operational Research*, Vol.210, No.3, pp.537-551, 2011.
11. Yiyong Xiao, Renqian Zhang and 郭偉宏: A new framework of mining association rules with

- time-windows on real-time transaction database, *International Journal of Innovative Computing, Information and Control* Vol.7, No.6, pp.3239-3253, 2011.
12. Yong Yin, Meng Li, 郭偉宏 and Chenguang Liu: Design a just-in-time organization system using a stochastic gradient algorithm, *ICIC Express letters*, Vol.5, No.5, pp.1739-1745, 2010.
  13. 郭偉宏, Dongxiao Jiang and Tahashi Shinzato: A new product design approach through integral architecture, *ICIC Express letters*, Vol.5, No.5, pp.1709-1716, 2010.
  14. Yi Han, Jiafu Tang, 郭偉宏, Nico Dellaert, Jianhu Cai and Gengui Zhou: A comparison of particle swarm optimizations for uncapacitated multilevel lot-sizing problems, *日本経営工学会論文誌*, Vol.61, No.3E, pp.203-213, 2010.
  15. 郭偉宏, Zhaoshi Li and Chunhui Xu: Solving large multilevel lot-sizing problems with a simple heuristic algorithm based on segmentation, *International Journal of Innovative Computing, Information and Control*, Vol.6, No.3, pp.817-827, 2010.
  16. 郭偉宏, Zhaoshi Li and Chunhui Xu: An effective heuristic algorithm based on segmentation for solving a multilevel lot-sizing problem, *International Journal of Biomedical Soft Computing and Human Sciences*, Vol. 15, No. 1, pp.51-57, 2010.
  17. Jiafu Tang, Xiaoqing Wang, 郭偉宏 and Kai-leung Yung: Optimization of parts scheduling in multiple cells considering inter-cell move using scatter search approach, *Journal of Intelligent Manufacturing*, Vol.21, No.4, pp.525-537, 2010.
  18. De-bi Cao, Yong Yin and 郭偉宏: A criterion of production model selection for building material with delivery delay, *International Journal of Production Research*, Vol.48, No.10-12, pp.3429-3443, 2009.
  19. Yi Han, Jiafu Tang, 郭偉宏 and Lifeng Mu: Solving incapacitated multilevel lot-sizing problem using a particle swarm optimization with flexible inertial weight, *Computers and Mathematics with Applications*, Vol. 57, pp.1748-1755, 2009.
  20. 郭偉宏, Gong Jun, Jiafu Tang and Yong Yin: Modeling and numerical analysis of line-cell conversion problems, *International Journal of Production Research*, Vol. 47, Issue 8, pp. 2055-2078, 2009.
  21. 新里隆, 郭偉宏: トレンド効果を考慮した安全在庫管理の大偏差統計的解析, *日本経営工学会論文誌*, Vol. 62, No. 4, pp. 164-173, 2011.
- [学会発表] (国際学会 15件)
1. 郭偉宏, Yang Yu, Jiafu Tang, Jun Gong, Chenguang Liu and Yong Yin: Several cognitive and theoretical insights on line-cell conversion problem, *Proceedings of the 2011 Asian Conference of Management Science & Applications (ACMSA2011)*, Sanya, 2011.
  2. Dongxiao Jiang, Tahashi Shinzato, 郭偉宏 and Yong Yin: A mathematical model of product through integral architecture, *Proceedings of the 21th International Conference on Production Research (ICPR-21)*, Stuttgart, 2011.
  3. 郭偉宏, Dongxiao Jiang and Tahashi Shinzato: A new product design approach through integral architecture, *Proceedings of the 4<sup>th</sup> International Conference on Innovative Computing, Information and Control (ICICIC2010)*, Xian, 2010.
  4. 郭偉宏 and Yiyong Xiao: A simulation based study on meta-heuristic algorithms for solving multilevel lot sizing problems, *Proceedings of the 10<sup>th</sup> International Conference on Industrial Management (ICIM2010)*, pp.71-76, Beijing, 2010.
  5. 郭偉宏 and Yiyong Xiao: Implemental techniques and their effectiveness for evolutionary algorithms used to solve multilevel lot sizing problems,

- Proceedings of the IEEE 5<sup>th</sup> International Conference on Bio-Inspired Computing: Theories and Applications (BIC-TA2010)*, pp.303-309, Changsha, 2010.
6. Yiyong Xiao and 郭偉宏: Variable neighborhood search based approach for solving multilevel lot-sizing problems, *Proceedings of the 9<sup>th</sup> WSEAS International Conference on Applications of Computer Engineering( ACE'10)*, pp.119-124, Penang, 2010.
  7. 郭偉宏: Complexity on the solution of multilevel lot-sizing problems, *Proceedings of the 3<sup>rd</sup> International Conference on Innovative Computing, Information and Control(ICICIC2009)*, Kaosheung, 2009.
  8. 郭偉宏, Xuezhi Chen, Renqian Zhang and Yiyong Xiao: A new approach of inventory classification with loss rule, *Proceedings of the 20th International Conference on Production Research (ICPR-20)*, Shanghai, 2009.
  9. Renqian Zhang, 郭偉宏 and Yiyong Xiao: A deterministic model of the joint replenishment problem with complete backorders and correlated demands, *Proceedings of the 2<sup>nd</sup> International Workshop on Institutional Supply Chain Management*, Xian, 2009.
  10. Yiyong Xiao, Renqian Zhang, 郭偉宏: A framework of mining association rules with time-window on real-time transaction database, *Proceedings of the 2<sup>nd</sup> International Workshop on Institutional Supply Chain Management*, Xian, 2009.
  11. Takashi Shinzato, 郭偉宏: Improved and developed upper bound of price of anarchy in two echelon case, *Proceedings of the 2<sup>nd</sup> International Workshop on Institutional Supply Chain Management*, Xian, 2009.
  12. Yi Han, Jiafu Tang, 郭偉宏 and Nico Dellaert: A comparison of particle swarm optimizations for uncapacitated multilevel lot-sizing problems, *Proceedings of the 2<sup>nd</sup> International Workshop on Institutional Supply Chain Management*, Xian, 2009.
  13. Yi Han, Gengui Zhou, 郭偉宏, Jianhu Cai and Huazhen Lin: An application of particle swarm optimization to uncapacitated multilevel lot-sizing problems with series structure, *Proceedings of 2009 International Conference on Computational Intelligence and Security*, Vol.2, pp.541-544, 2009.
  14. 郭偉宏, Zhaoshi Li and Chunhui Xu: A simple heuristic algorithm based on segmentation to solve multilevel lot-sizing problems, *Proceedings of the 13<sup>th</sup> IFAC Symposium on Information Control Problems in Manufacturing*, Moscow, 2009.
  15. 郭偉宏, Yang Liu, Jun Gong, Jiafu Tang and Yong Yin: Using L27 array to investigate the performance improvements in line-cell conversion, *Proceedings of the Symposium on Group Technology and Cellular Manufacturing*, Kitakyusyu, 2009.
- 国内学会 口頭発表多数 (詳細略)
- [図書] (計 3 件)
1. Data Mining: Concepts, Methods and Applications in Management and Engineering, 共著, Springer-Verlag, 2010, (Chapter 2,5,12,13).
  2. Assembly Line: Theory and Practice, 共著, Intech, 2011, (Chapter 7,pp.107-130).
  3. 経営システム工学とその周辺, 共著, 横浜図書, 2011 (まえがき、1 3 章 pp. 143-157) .
- [産業財産権]
- 出願状況 (計 0 件)
- 取得状況 (計 0 件)
- [その他]

6. 研究組織

(1) 研究代表者

郭 偉宏 (KAKU IKOU)

(秋田県立大学 システム科学技術学部)

研究者番号：30315618

(2) 研究分担者 なし

(3) 連携研究者

YIYONG XIAO

(北航大学 システム工学科)

RENQIAN ZHANG

(北航大学 管理学院)