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Assessing Inventory Management Indicators in Chain Pharmacy Stores: An Importance – Performance Analysis

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Abstract: Effective inventory management is essential for the successful operation of chain pharmacy stores. As an integral component of chain management, its purpose is to oversee the movement of products from manufacturers to warehouses, and ultimately to patients. This study aims to investigate 13 key performance indicators sourced from a comprehensive literature review on inventory management. The primary objectives include analyzing the relationships among these indicators and evaluating their relative importance. The research adopts a qualitative approach, employing survey as the chosen method. The study participants are comprised of 18 managers or branch heads affiliated with chain drug stores in Thailand. The research employs the Importance Performance Analysis (IPA) tool to interpret the findings, with the objective of enhancing work quality. From the results obtained, the summary indicates a need to assess the indicators presently utilized in managing chain stores and to identify additional areas for performance enhancement. The results highlight specific areas requiring attention due to their high importance coupled with suboptimal performance. These areas include monthly stock adjustment and product shortages. Conversely, the study reveals aspects where managers excel and are considered significant, such as safety stock, inventory turnover, product availability, replenishment frequency, and Items on shelf. Additionally, our study involves acknowledging the significance of existing indicators in guiding store management practices while also recognizing the necessity of addressing logistics supplementary issues to develop overall performance.

Keywords: Logistics engineering, Chain pharmacy store, Importance – performance analysis

Introduction

The pharmacy store, or drug store, serves as a vital primary care facility within the healthcare ecosystem. It functions as a crucial channel for delivering essential healthcare services and dispensing pharmaceutical products to individuals with primary illnesses residing in nearby communities. The distinguishing characteristics of a pharmacy store encompass its dual role: generating sustainable profitability for long-term business expansion (Sanchez-Ruiz et al., 2018) while fulfilling its integral role within the broader healthcare system, adhering to the ethical principles inherent in the pharmacy profession.

The market for these medications is experiencing significant growth, propelled by increasing public awareness of general health issues and advancements in pharmaceutical and healthcare technologies. The global revenue within the OTC pharmaceuticals market was also anticipated to exhibit a continuous increase from 2024 to 2029, amounting to a total of $54.4 billion (representing a 27.01 percent growth). Following the eleventh consecutive year of growth, it is estimated that the indicator will attain $255.83 billion, thus marking a new peak in 2029. It is noteworthy that the revenue within the OTC pharmaceuticals market has demonstrated consistent growth over recent years (Statista, 2024). According to data from the Statistics of Thailand, the OTC

pharmaceuticals market in the country was also valued at $137.5 million in 2022, with an anticipated CAGR of 5.36% over the same period, reaching $208.8 million by 2030, allows the sale of non-prescription drugs, which are medications that can be obtained without a prescription (Insight10, 2023). This trend underscores the increasing importance of accurate inventory management for organizations.

Effective inventory management holds paramount importance for enterprises, particularly chain store pharmacies. Consequently, chain store pharmacies typically designate a branch administrator, whether a manager or branch head, to oversee inventory management aligned with the organization's key performance indicators (KPIs). The role of the branch manager or branch head encompasses vigilant supervision of product inventory to prevent shortages or surpluses. This involves managing warehouse operations and ensuring alignment between actual stock levels and the inventory management system (Pentrakan et al., 2023), while proactively seeking solutions to mitigate discrepancies or minimize their occurrence. Such measures enhance competitiveness within the business sector (Khan et al., 2019).

Numerous studies have highlighted the challenge of high inventory management and storage costs faced by pharmacy stores (Farmaciawaty et al., 2020). Inefficient inventory management can result in either excess stock or shortages of essential medicines. The operational nature of pharmacy stores is typically categorized into standalone establishments and chain stores, with the latter showing a propensity for further expansion due to corporate branch expansion policies. OTC drug sales through pharmacies constitute approximately 20% of the total drug market value, indicating the necessity for drug stores to maintain a diverse range of products to adequately serve their clientele while exercising cost control (Krungsri Organization, 2022). Hence, effective inventory management and KPIs demand careful consideration. This is essential for preserving the satisfaction of service recipients and bolstering competitiveness within the business sector.

In our investigation, we directed our attention towards examining the KPIs outlined in the literature review research conducted by MacAs et al. (2021). These encompass a range of facets, such as the actual inventory and its integration with the company's information system and stock adjustment (Cui et al.,2017), inventory levels (Zhang & Rajaram, 2017) occurrences of shortages of scarcities (Zhou & Piramuthu, 2015), procedures for product reordering and replenishment (Solti et al., 2018), service levels (Hahn & Leucht, 2015), product availability (Ishfaq et al., 2016), excessive inventory (Sabir & Farooquie, 2018), items stocked on shelves (Choi, 2016), returns (Qin & Zhong, 2017), Inventory cost (Kwan et al., 2019) and Inventory turnover (Kasiri, 2016). These indicators are pertinent to the operations of drug chain stores, and our inquiry sought to identify the key indicators and their corresponding performance directions within this context (Martilla & James, 1977).

Method

This study utilized a qualitative design, employing survey as the primary method of data collection. The participants in our study comprise branch leaders or branch managers across various chain drug stores in Thailand, individuals vested with the authority to oversee product replenishment for each branch and responsible for managing the branch's financial status, encompassing inventory costs. Guided by Macmillan's principles (Macmillan, 1971), which advocate for the collection of data and the distillation of knowledge from a panel of experts in relevant domains, a sample size of 17 individuals or more is deemed adequate to ensure reliable qualitative findings. This sample size facilitates a focused exploration of research issues pertinent to both the current study and those anticipated in the future.

We employed a simple method to select our sample and conducted survey via online from February to March, 2024 using a structured questionnaire format, ensuring consistency by posing the same set of questions to each participant. Invitations were extended to experts, providing them with comprehensive information to aid in their decision-making process regarding participation. Detailed instructions, including procedures for data recording and storage, were provided to ensure informed consent. Furthermore, the reliability of our research instruments was assessed by three experts, who scrutinized the draft survey questions. Subsequent adjustments were made based on their feedback, resulting in the finalization of the survey questions to be utilized in our study. The survey is estimated to last approximately 30 minutes, excluding any recording (audio or video). This will adopt a structured format, fostering a friendly atmosphere and offering flexibility in responding to questions.

In this study, descriptive statistics were employed to analyze the data obtained from the responses to each question, whereby percentages and standard variation were calculated. Subsequently, content analysis was conducted. Furthermore, the scores provided by respondents for each answer were utilized to compute the

average and standard deviation values. These statistical measures were then used to construct an Importance-Performance Analysis (IPA) chart, facilitating a concise summary of the findings, as shown in Figure 1.

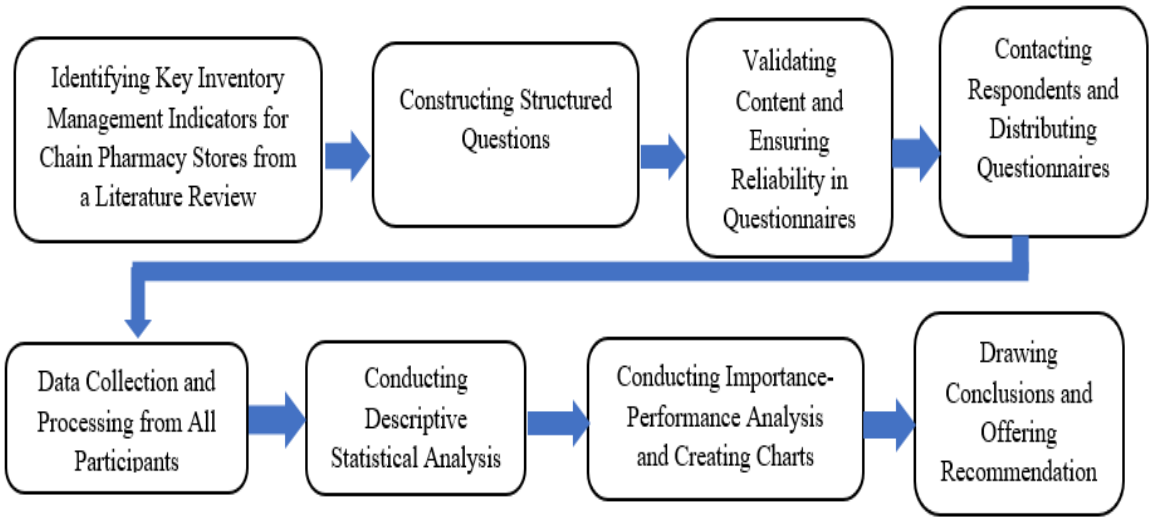

Figure 1. Methodology process

Results and Discussion

A total of 18 branch managers or store heads (average experience: 8 years) were asked to assess the significance of performance indicators and their respective performance levels. They were tasked with rating each indicator on a scale as follows:

A score of 5 signifies the highest importance/performance with respect to the indicators,
A score of 4 indicates a very significant/a high level of performance
A score of 3 suggests moderate importance/moderate performance
A score of 2 denotes lower importance/lower performance
A score of 1 represents the least importance/least performance concerning the indicators.

The descriptive statistics findings encompassed the mean ($\bar{X}$), standard deviation (S.D.) and mode, with the results tabulated in Table 1.

Table 1. Descriptive statistics of study

Indicators	**Importance**			**Performance**		
	$\bar{X}$	**S.D.**	**Mode**	$\bar{X}$	**S.D.**	**Mode**
Inventory accuracy (IA)	3.94	0.80	4.00	3.89	1.02	4.00
Day on hand (DOH)	4.44	0.78	5.00	4.06	0.73	4.00
Inventory turnover (IT)	4.28	0.75	5.00	4.17	0.51	4.00
Shortage of scarcity (ST)	4.33	0.84	5.00	3.78	1.11	4.00
Product availability (PA)	4.44	0.92	5.00	4.00	0.69	4.00
Over stock (OS)	4.06	0.87	4.00	3.50	1.10	4.00
Inventory cost (IC)	4.00	0.84	4.00	3.94	0.87	4.00
Replenishment frequency (RF)	4.17	0.79	5.00	3.83	0.71	4.00
Adjust stock (AS)	4.17	0.99	5.00	3.50	1.29	4.00
Items on shelf (IOS)	4.22	0.81	5.00	3.83	0.71	4.00
Return product from customer (RC)	3.89	1.02	5.00	3.61	1.04	4.00
Return product from pharmacy store (RP)	3.89	1.02	5.00	3.61	1.04	4.00
Safety Stock (SS)	4.22	0.88	5.00	4.11	0.90	4.00

Based on these results, we subsequently utilized Importance-Performance Analysis (IPA) to pinpoint the indicators requiring the most substantial improvements or those that could potentially undergo adjustments without significantly compromising overall quality, as shown in Figure 2.

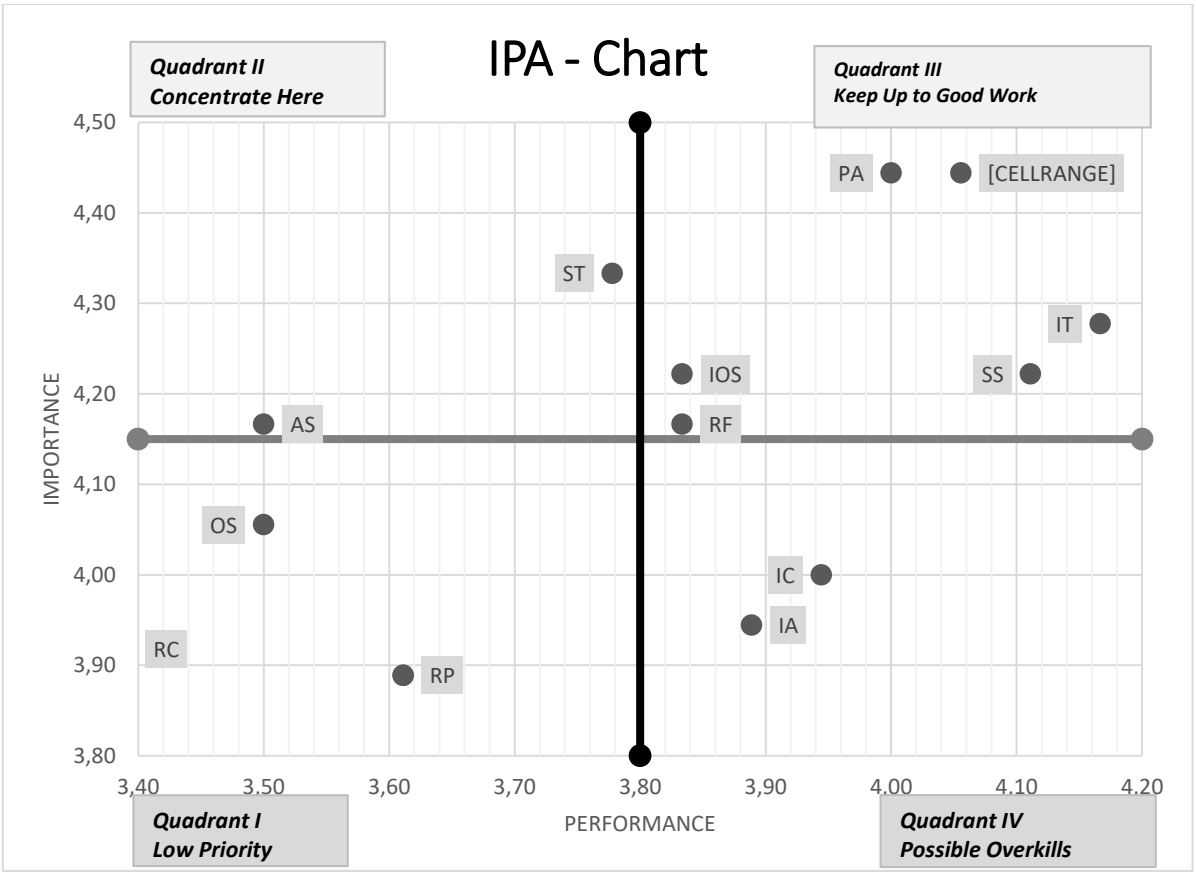

Figure 2. Importance- Performance Analysis (IPA) chart

The analysis of the IPA chart indicates that quadrant II recommends managers or store heads to focus more on two crucial indicators, namely shortages or scarcity and adjustments to stock. The quadrant I suggests maintaining the current efforts for indicators such as stock availability, days on hand, inventory turnover, safety stock, items on shelf , and replenishment frequency. Quadrant III categorizes indicators as low priority, including overstock, return products from pharmacy stores, and return products from customers. Quadrant IV is identified as having potential overkills in managing inventory cost and inventory accuracy. To provide a more detailed overview of these findings, it is advisable to present the results in a table format for each quadrant, as summarized in Table 2.

Table 2. Indicator summary across IPA chart quadrants

Concentrate here		**Keep up the good work**	
ST	Shortage of scarcity	DOH	Day on hand
AS	Adjust stock	PA	Product availability
		IT	Inventory turnover
		SS	Safety stock
		IOS	Items on shelf
		RF	Replenishment frequency
Low priority		**Possible overkills**	
OS	Over stock	IC	Inventory cost
RP	Return product from pharmacy store	IA	Inventory accuracy
RC	Return product from customer		

The respondents evaluated the significance of key performance indicators, which are highly important, with the top three indicators being product availability (PA), day on hand (DOH), and shortage (ST). For ST is in the low performance group. In general, earning losses due to ST status can far outweigh the stock losses themselves (Kang & Gershwin ,2005). The majority of respondents rated the performance outcomes positively based on these indicators for PA and DOH. However, it is noteworthy that the shortage indicator does not align with this pattern. Generally, if PA and DOH demonstrate good performance, it is expected that the shortage indicator

would also reflect positively (Aastrup & Kotzab, 2009). However, upon examining the mode value, which predominantly falls at level 4, the results are comparable to those of PA and DOH. Consequently, it is conceivable that some respondents assigned very low scores.

The respondents assessed the significance of less prominent key performance indicators, ranking return product from pharmacy (RP), return product from customer (RC), and inventory accuracy (IA) as the top three. Concerning RP and RC, equal scores were observed, indicative of suboptimal performance outcomes. Previous research suggests that RC's impact extends to customer confidence in the organization, while RP affects employee work performance. In contrast, respondents noted positive progress in IA, which contrasts with AS stock alignment. This discrepancy could arise from IA's potential to reduce AS occurrences through good performance. Respondents commonly associate AS with issues such as missing, stolen, or damaged items, necessitating inventory adjustments. Conversely, IA tends to encounter fewer issues and is perceived as highly effective, thanks to daily stock counts by staff and weekly checks by managers, bolstered by monthly stock audits. This proactive approach likely mitigates IA-related issues, employing a comparison-based measurement method for improvement assessment. Current research proposes an effective tool is Auto-ID (Kang & Gershwin, 2005) for example: applied to RFID (Bertolini et al., 2015).

The respondents' prioritized performance indicators for operational efficiency encompass inventory turnover (IT), safety stock (SS), and day on hand (DOH), all of which are high scored in their importance ratings. It is intriguing to note their approach in evaluating performance, leveraging the organization's calculated outcomes for IT and DOH across branches, while SS estimations consider seasonal fluctuations and contextual factors like impending price adjustments or recurrent shortages from manufacturers necessitating augmented stocking. Currently, ongoing studies are focused on formulating policies for product replenishment and assessing the imperative for specific branches to implement SS (Kwan et al., 2019).

The respondents assessed that the two least efficient operational performance indicators were adjust stock (AS) and over stock (OS). AS was a metric related to direct product shortages, such as incorrect sales, expired products due to delayed return notifications, failure to pick products according to First Expired First Out (FEFO) or First In, First Out (FIFO) principles, often resulting in expired or damaged products during transportation, degraded product quality, and lost products. When stock adjustments occurred, responsibility was shared among branch employees (Cui, Zhang & Bassamboo, 2017). OS was of less interest to most pharmacies and therefore yields limited operational results. This was because the pharmacy policy emphasized having sufficient stock ("better to have than to lack") (Sabir & Farooquie, 2018). However, there may be a need to review or consider importing policies to find the most suitable approach for maximizing service while minimizing costs.

The aspects of replenishment frequency (RF) and Items on shelf (IOS) were intriguing as they both pertain to the same category, with most respondents providing high ratings for these indicators and yielding positive performance results. However, the occurrence of ST underscores the imperative for implementing suitable policies to assess operational efficiency, including the determination of order quantities and timing (Solti et al., 2018).

In contrast, respondents accorded lesser importance to inventory cost (IC), yet it was observed to be well-managed. Notably, its commendable performance stemmed from effective cost control during the ordering process, which entailed calculations based on reported order quantities typically spanning 15 to 30 days' worth, aligned with product turnover rates. Although waste materials are not integrated into the system, they are managed through inspections and estimations of branch orders, potentially contributing to shortages that impact branch operations (Kwan et al., 2019).

Consequently, it is a diagram delineating the achievement of operational performance and reputation in retail establishments with customers. Our findings delineate two essential components: the first component encompasses number of each item on the program, encompassing appropriate inventory control (specifically, an appropriate replenishment inventory policy). This component holds pivotal importance, as inappropriate inventory control may precipitate adverse consequences, including heightened total inventory costs, surplus inventory levels, compromised service standards, diminished product availability, and instances of shortage or scarcity. The second component pertains to physical inventory (referred to as actual inventory), where any discrepancies in inventory management can lead to shortages or scarcity. Ultimately, both inappropriate inventory control practices and inventory inaccuracies can exert notable ramifications on the profitability and financial standing of a business.

Conclusion

This study aims to investigate 13 key performance indicators sourced from a comprehensive literature review on inventory management. The primary objectives include analyzing the relationships among these indicators and evaluating their relative importance. The research adopts a qualitative approach, employing survey as the chosen method. Our finding presented that the indicators deemed most significant by respondents, when compared to others, were "Day on Hand (DOH)," "Product Availability (PA)," and "Shortage of Scarcity (ST)." Our study findings revealed that a majority of respondents believe they can effectively manage DOH and PA. However, they also expressed the view that addressing the management of ST could be enhanced, possibly necessitating further development strategies. Furthermore, our research identified that the indicators most in need of development and improvement guidance were related to "Adjust Stock (AS) and "Overstock (OS).

Recommendations

The results of this research serve as fundamental data that is beneficial academically. In the future, other researchers can build upon this research in interesting gaps. For example, they can explore the trends in perceptions of managers or department heads in pharmacy chain stores regarding the importance of each indicator or further advance the assessment of indicator importance after gaining insight into respondents' perspectives. This includes applying or comparing the significance of each indicator in pharmacy chain store models derived from the research with other retail businesses. Additionally, from a practical perspective, organizations can leverage indicators associated with inventory management to improve performance and promote awareness of inventory management methodologies. They can pinpoint indicators that necessitate greater emphasis and leverage these findings to formulate pertinent strategies for organizational growth in inventory management, ultimately enhancing customer satisfaction and bolstering competitiveness within the industry.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Acknowledgements or Notes

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