

The Effect of DRP Automation on Supply Chain Management in the Egyptian FMCG Industry

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Abstract

This paper examines the automation of supply chain management through the implementation of Distribution Requirements Planning (DRP) automation project using Enterprise Resource Planning (ERP) system. A central question is addressed in this paper: from a resource-based view, what is the effect of the DRP automation through ERP system on the supply chain management in the Egyptian Fast-Moving Consumer Goods (FMCG) industry? Adopting a case study methodology in a leading Egypt-based manufacturer 'Juhayna Food Industries', this study is the first of its kind to provide a thorough analysis of the implementation of a DRP automation project using an ERP system and its effect on supply chain management, focusing on the informational flow of goods in the Egyptian FMCG industry. The study demonstrates that the automation of DRP using ERP systems has a positive and significant impact on supply chain functions including supply and demand planning, procurement, production, warehouses, and logistics in the Egyptian FMCG industry, improving data accuracy and efficiency. This research will help FMCG companies in their planning and distribution practices for the supply chain management of their products.

Keywords: Supply Chain Management, Distribution Requirements Planning (DRP) automation, Enterprise Resource Planning (ERP) system, Egyptian FMCG Industry, Juhayna Food Industries

1. Introduction

Being in the technological development era is forcing all industries and departments to automate all the time-consuming daily processes and reach the required efficiency and effectiveness. The term "automation" refers to the conversion of any processes that take a lot of time, effort, and manual human intervention into a systematic process with the lowest feasible costs (De Almeida, 2019). The importance of developing the automation of the companies' systems in their different departments has started to be recognised by the FMCG industry in Egypt and on an international level. Supply chains are becoming increasingly reliant on information sharing, aided by automation and newly developed technologies. In fact, new technologies enable collecting and sharing precise data and information easier and faster, and supply chains are increasingly working in a globally connected context. Previous research demonstrated the importance of ERP systems in supply chain performance (Nitsche et al., 2021; Palanivel & Karkuzhali, 2018; Ullah et al., 2018; Izhar et al., 2018; Shatat & Udin, 2012). Most of the processes of supply chain management in all its departments depend on the use of ERP systems, aside from Excel spreadsheets. The web survey of 140 executives, commissioned by BluJay Solutions, a supply chain software provider, found that 67.4% of the executives depend on Excel spreadsheets in their supply chain activities. Excel spreadsheets have been and remain a powerful tool for sorting and calculating data, but the reliance on them for supply chain planning can be problematic from a risk perspective (Lopez, 2018). A recent empirical study also investigated the impact of integrated supply chain forecasting on supply chain performance in the FMCG sector in Egypt (Abdel-Shafie & Elgazzar, 2021). Internal and external challenges face supply chain management in the Egyptian FMCG business. Complex regulations and duties, as well as a multilayered distribution system, all have an impact on the final price of goods. The cost of labour, law, and regulation are all affected by political circumstances (Abdel-Shafie & Elgazzar, 2021). Facing these challenges, the purpose of this research is to answer the following question: from a resource-based view, what is the effect of DRP automation through ERP systems on supply chain management in the Egyptian FMCG industry? This research is the first of its kind to present an in-depth case study about the effect of implementing a DRP automation project using an ERP system on supply chain activities (planning, procurement, production, warehousing, and logistics), focusing on the informational flow of goods in a leading Egyptian FMCG company 'Juhayna Food Industries' (milk and juice category).

2. Literature Review

This section presents relevant elements concerning supply chain management, supply chain automation through ERP systems, and an overview of the Egyptian FMCG industry

2.1. Supply Chain Management

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers but also transporters, warehouses, retailers, and even customers themselves (Chopra & Meindl, 2013). Supply chain management integrates all the business departments and activities required to convert unprocessed materials into finished goods. Those activities and operations include sourcing the raw materials, producing the products, assembling the final parts, and distributing the finished goods to the end consumers, including all the storing, warehousing, and logistics activities. Moreover, supply chain management includes managing the return flows of products and whether their components can be reused, which is considered a closed-loop supply chain. Those practises are usually managed by different independent companies working together, which is considered an end-to-end supply chain (Zijm et al., 2018). The supply chain has six main functions and processes that form effective supply chain management: planning, sourcing and procurement, production, warehousing, distribution, and logistics. Supply Chain Integration (SCI) aims to reduce operations that do not add value to minimise the investment costs, operating costs, and time wasted in supply chain activities. Moreover, it will increase customer responsiveness and flexibility in the supply chain, reduce costs, and, hence, improve the performance of the organisation (Abdel-Shafie & Elgazzar, 2021).

2.1.1. Distribution Requirements Planning (DRP)

Distribution Requirements Planning is a daily process in producing firms that manages to distribute the company's finished goods to end customers with the right products in the right quantities in the right place and at the right time. Distribution Requirements Planning is responsible for planning, executing, and managing the commodity flow from producer to consumer. DRP is a systematic technique for increasing the efficiency of the product distribution process by planning which products, in what quantities, and where they will be supplied ahead of demand. DRP is a method of calculating the amount of replenishment for a certain length of time. By avoiding product shortages in distribution sites, the DRP helps to cut ordering, shipping, and inventory expenses (Rizkya et al., 2018). Distribution Requirements Planning (DRP) is a method for processing stock replenishment in a multi-level distribution environment and is a form of inventory control system. In the same manner that Material Requirement Planning (MRP) applies time-phased logic to sub-assemblies and components in a manufacturing bill of materials network, the DRP does the same for products in a distribution network. DRP is an "Implosion" process that manages inventory distribution from the lowest levels of a network to the central distribution centre (DC) using a centralised push system, whereas MRP is an "Explosion" process that schedules product components using a Master Production Schedule (MPS) (Ngatilah et al., 2020). Companies experience a lot of problems related to redundant costs as a result of errors and

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miscalculations of time and quantity for the delivery process. By acquiring accurate forecasting, firms can deal with these problems when they implement the DRP system in an accurate and efficient way (Pramono et al., 2021).

2.1.2. Inventory Management

An organisation's inventory is the supply of raw materials, partially produced goods known as work-in-progress, and finished commodities it has on hand to meet its operating requirements. It is a significant investment as well as a potential source of waste that should be carefully managed. Business's inventory is defined as a stock of goods kept on hand in anticipation of future demand (Sohail & Sheikh, 2018). Every business seeks to maintain optimal inventory levels in order to satisfy its needs and avoid overstocking or understocking, which can have a negative influence on financial results. Inventory is continually changing, and managing it necessitates a regular and meticulous examination of external and internal elements, as well as control through planning and review. Lead time, economies of scale, and uncertainties in the form of safety stock are the three main reasons for holding inventory (Samanta, 2015). The effectiveness of inventory management is affected by planning, storing records, employees skills and experiences, and funding (Chan et al., 2017). Because inventory turnover is one of the key sources of revenue production and subsequent earnings for the company's shareholders and owners, inventory is one of the most valuable assets that most organisations have (Palanivel & Karkuzhali, 2018).

2.2. Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) is a core business application for practically every single medium and large enterprise (Duranti, 2017). ERP systems are made up of many software modules that allow businesses to automate and integrate the majority of their business processes by accessing and sharing common information, data, and procedures in real time across the organisation (Ali & Miller, 2017). Since it optimises and enhances management processes, data security, scalability and traceability of processes, and task automation, the implementation of an ERP ensures success and is reflected in the efficiency and productivity of the processes in the various areas that make up a company (Govea Souza, 2021). There are lots of famous ERP systems that are used worldwide and especially in Egypt, such as SAP, Oracle, Microsoft, Sage, and Odoo, by several huge companies to manage their databases.

2.2.1. Supply Chain Automation through ERP systems

According to (Vanner, 2021), supply chain automation is the use of digital technologies to improve efficiencies, connect applications, and streamline processes within supply chain operations. ERP systems, robotics, artificial intelligence (AI), and machine learning (ML) can all be used to automate supply chain management in various ways. Currently, all supply chain management tasks rely on ERP systems in addition to Microsoft Excel to carry out everyday operations and processes while linking all data processing across all divisions of the firm. Large organisations may simply implement ERP system automation since they have enough data to complete the process, and it will be more beneficial to do so (De Almeida, 2019). Supply chain automation includes the physical flow of products in addition to the

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informational flow within the main firm and with supply chain partners, which can be implemented using ERP systems (Nitsche, 2021). The ERP system is viewed as an important driver in the performance of supply chain management (Nair et al., 2021). This shows the huge effect of supply chain automation on a company's performance and expansion while supporting stakeholder interests.

2.2.2. Effect of DRP Automation using ERP system on Supply Chain Management

Inventory management inaccuracies are a significant issue in supply chain management. Despite the fact that many businesses have automated their inventory management with ICT tools, inventory levels in information systems and actual physical inventory levels frequently differ. The disparity between these inventory levels is known as inaccuracy, and it can have a significant impact on a company's performance and efficiency (Apiyo & Kiarie, 2018). ERP system implementation has resulted in improved performance because it has provided enormous benefits to organisations such as increased productivity, improved access to accurate and timely information, improved work flow, reduced reliance on paper, information sharing, absolute control, lower inventories, reduced product development cycles, improved customer service, increased efficiency (productivity), enhanced profitability, and improved effectiveness through better customer services, as well as coordinating and integrating information across departments and automating corporate processes (Ullah et al., 2018). The ERP system's sales and inventory module covers all aspects of sales and order management, including researching sales data, computerising exchanges, screening execution, tracking costs, and even overseeing client credit and readiness. This will allow any item in the inventory to be located in real time. The automatic price and profit calculation will save time and effort while also improving the business's efficiency and accuracy. ERP will systematically schedule distribution and arrange for shipping and delivery, as well as monitor the route through convoy supervision and even replenish that product (Izhar et al., 2018).

2.3. Egyptian FMCG Industry

FMCGs (fast-moving consumer goods) are products that sell quickly due to their low price. Consumers buy them frequently in large quantities. Because of strong customer demand or because they are perishable, FMCGs have a limited shelf life. The FMCG industry in Egypt is in an uncertain business environment marked by high levels of competition and dynamic, fast, and complex variables. As a result, FMCG companies tend to come up with new plans and solutions all the time, affecting all managerial decisions (El-Tawy & Gallear, 2012). Inbound logistics, product transfer and taxes, pricing changes, and interest rates are all challenges for Egypt's FMCG industry. The cost of labour, as well as laws and regulations, are all influenced by the political climate. In addition to a lack of trust and commitment among supply chain partners, there is an inefficient real-time data assumption, a lack of confidence in formulating sales forecasts, and the power of retailers and wholesalers working together (Abdel-Shafie & Elgazzar, 2021). Household FMCG expenditures in Egypt are placed second with a value of US\$27.6 billion, which represents nearly 34% of the family income (KPMG Africa report 2016, Capmas 2017).

2.4. Theoretical Framework: The Resource Based View

Sustainable competitive advantage comes from resources and capabilities controlled by the company that are valuable, rare, and not substitutable. These resources and capabilities could be considered sets of tangible and intangible assets, including business management skills, organisational processes, and the information that they control (Barney et al., 2001). In this perspective, this study intends to investigate the effect of DRP automation on supply chain management, focusing on the informational flow of goods in a leading Egyptian FMCG company 'Juhayna Food Industries' (milk and juice category).

3. Research Methodology

The research methodology is based on a qualitative approach adopting a case study research method (Yin, 2009). The case study research method was selected in this paper as investigating the effect of supply chain automation through ERP systems in the Egyptian FMCG industry is a contemporary phenomenon that needs in-depth analysis in the Egyptian context (Nitsche, 2021; Abdel-Shafie & Elgazzar, 2021; Apiyo & Kiarie, 2018; Ullah et al., 2018; Izhar et al., 2018) in a real-life case (Yin, 2009). The case study methodology is suitable for the investigation of contextually rich events or phenomena that focus on contemporary rather than historic information, contrary to other research methods (Schell, 1992).

3.1. Presentation of the Case Study

Juhayna Food Industries is a leading Egypt-based manufacturer specializing in the production, processing, and packaging of dairy, juice, and cooking products. Since it was founded in 1983, it has established itself as a leader in the dairy and juice industries in Egypt and gained market share in the Middle East.

TIBA is Juhayna's commercial arm and main distribution network. TIBA is a crucial component of the company's vertical integration strategy. With one of the largest distribution fleets in the Egyptian food and beverage industry, TIBA owns around 900 vehicles capable of transporting both refrigerated and non-refrigerated products nationwide, 38 distribution centres, and 136,000 retail outlets. Their core objectives are to continuously maximize the storage capacity of their trucks and the reach of their network.

Juhayna was honored as one of the top 100 listed Egyptian companies in 2017 for the third year in a row. This award underscores Juhayna's leadership in the industry and its ongoing efforts to deliver the best goods with the highest international standards. The company recently automated its distribution requirements planning (DRP) using an ERP system (SAP). This shows that Juhayna's case is profoundly motivating for an in-depth investigation.

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3.2. Data Collection

In this research, data were collected through two main methods: semi-structured interviews and direct observation.

3.2.1. Semi-structured Interview

Twelve semi-structured interviews were conducted with the supply chain teams and team leaders that are involved with the project of DRP automation on SAP (Supply and Demand Planning, Procurement, Production, Warehousing, and Logistics). Most of the interviews were conducted with the Supply and Demand Planning department, as it is the main supply chain department responsible for the distribution process and carrying out the project on SAP.

3.2.2. Direct Observation

A three-month observational study (from July 4th to September 30th, 2021) was carried out to observe the supply chain departments and the relationships between them during and after the implementation of the DRP automation project through the ERP system (SAP).

Secondary data (e.g., Excel reports) were also reviewed to analyze the information flow of goods and compare the values before and after their implementation.

3.3. Data Analysis

Most interviews were recorded (a total of eleven hours), which were translated in order to accomplish the analysis of the data. The data were managed and analysed manually. The authors examined the implementation process of the DRP automation project and its effect on supply chain activities (planning, procurement, production, warehousing, and logistics).

4. Findings and Discussion

4.1. The implementation of the DRP automotation project

Distribution Requirements Planning (DRP) aims to match the needs of demand on time and in the right place. The DRP automation project at Juhayna Food Industries focuses on the demand-on-time needs of its distribution centres (TIBA). The project aims to decrease the human interaction with Excel in taking the decision of how much quantity of each product at Juhayna should be distributed from the factories' warehouses to Juhayna's distribution centres. The distribution strategy at Juhayna Food Industries is based on coverage in days for each distribution center. Before the DRP Automation on SAP project, the supply and demand planning department used to go through a daily process on Excel after extracting the data from the existing system to observe the warehouse stocks of the dry products by Stock Keeping Unit (SKU), the milk and juice products, and calculate through different scenarios of calculations in Excel how many pallets they should distribute from the factories' warehouses to the distribution center. This process required different complicated calculations on Excel to deliver accurate values of pallets to be distributed from each product and to take a wise decision for the distributed quantities with daily modifications in the calculations, so there are

no precise quantities to be distributed daily. The calculations and scenarios on Excel took into consideration a lot of constraints, such as supply fulfilment, the number of pallets that are available to deliver, the factories' stocks, the distribution centres that are out of stock, the distribution centres that are at risk of going out of stock, the capacity of each distribution center, the stocks that are about to be released from the quality inspection, the weekly plan of each distribution center, and truck filling. The aim of the DRP automation idea is to increase the accuracy of the quantities that are planned to be distributed and to decrease the time and human efforts with Excel in delivering the right values of distribution in order to take easy and fast decisions for the distribution process.

Moreover, Juhayna uses the well-known ERP system SAP, which is a widely used enterprise resource planning (ERP) software that creates a centralized system for businesses that enables every department to access and share common data to create a better work environment for each employee in the different departments of the company (supply chain, finance, sales, etc.). The DRP automation on SAP project is being planned and applied at Juhayna Company between the supply and demand planning department and the in-house SAP consultant to carry out the project technically. The automation idea is based on customized transactions on SAP that link between the on-ground stocks, sales month to date, supply fulfilment, capacity of each DC, sales achievement, sales projection, and the unrestricted stocks in the quality inspection, and the system calculates the distribution of the stocks that are available to deliver based on the coverage in days. After implementing the DRP automation project, there is no need to calculate the pallets that should be delivered daily on Excel through complicated calculations that need multiple modifications to be accurate; instead, the Supply and Demand planning team will extract accurate values of pallets that should be distributed to the distribution centres from SAP without making further calculations or modifications on Excel or through minutes of time. As a result of the project's implementation, several supply chain functions were affected.

4.2. The effect of the DRP automation on the Supply Chain functions

Table 1 presents how the automation of DRP using an ERP system enhanced supply chain functions in terms of data accuracy and efficiency.

Table 1: Findings Summary

Supply Chain functions	Before DRP Automation	Effect After DRP Automation
Supply & Demand Planning Distribution Requirement Planning (DRP)	<ul style="list-style-type: none"> Inaccurate values for distribution that require daily modifications on Excel Complicated Excel calculations that take time & effort to be planned and generated to calculate the DRP accurately DRP plan execution before automation used to take three hours daily before sending it to the Distribution Centers. Following sales fluctuations in planning the DRP reaches nearly 130% sales achievement every month 	<ul style="list-style-type: none"> More accurate values for the DRP are extracted directly from SAP & sent to the Distribution Centers & logistics (the estimated DRP accuracy rate after automation is between 80-85%) Less use of Excel's modifications DRP plan execution takes maximum 30 minutes daily before sending it to the Distribution Centers, which enhances the process efficiency Less human interference More control on the distribution and inventory management process Mitigation between the distribution branches More control over the supply fulfillment by Stock Keeping Unit (SKU) by branch Improvement in the percentage of out of stock in the Distribution Centers More control over the sales if they are overachieving to reach maximum 110% of sales achievement every month Fresher stocks
Procurement Material Requirement Planning (MRP)	<ul style="list-style-type: none"> Inaccurate material planning because of following the sales fluctuations Increased material orders than bearable limit to match the increasing sales achievements Complications in managing the lead time Unnecessary materials orders and materials overstocking when the sales are decreasing 	<ul style="list-style-type: none"> More accurate and smoother material planning Safety stock of materials is maintained Accurate ordering of materials quantities
Production Master Production Schedule (MPS)	<ul style="list-style-type: none"> MPS is updated weekly as the production requirements are updated & modified weekly due to sales pulling from the safety stock 	<ul style="list-style-type: none"> More reasonable & clearer view of production requirements More accurate plan for the MPS and the production lines two weeks forward Materials are sufficiently available for production
Warehouses Capacity Management	<ul style="list-style-type: none"> Factories' warehouses are always overstocked Safety stock reaches seven days coverage of finished goods 	<ul style="list-style-type: none"> Factories' warehouses are only holding the safety stock Newly produced products are being transported to the Distribution Centers directly Distribution Centers are accurately filled and smoothly managed. Safety stock now carries fifteen days coverage of finished goods
Logistics Truck Filling	<ul style="list-style-type: none"> The truck filling plan is planned from the DRP one day only before the distribution 	<ul style="list-style-type: none"> Accurate weekly truck filling plan of the DRP to move the products from the factories to the Distribution Centers based on the unrestricted stocks in the quality inspection and the date of their restriction

4.2.1. The Supply and Demand planning Department: Distribution

The DRP's accuracy increased after automation. More accurate values for the DRP are extracted directly from SAP and sent to the distribution Centers and logistics (the estimated DRP accuracy rate after automation is between 80 and 85%). In this way, the Supply and Demand planning team will have more control over the distribution, inventory management process, mitigation between the distribution branches, control over the supply fulfilment by Stock Keeping Unit (SKU) by branch, improvement in the percentage of out of stocks, more control over the sales if they are overachieving, and the stocks will be fresher considering the production date and the shelf life. There will also be less use of Excel's modifications, less human interference, and enhancement in the DRP execution process efficiency as it takes only 30 minutes maximum instead of three hours on a daily basis. There will also be more control over the sales achievement, which will reach 100–110% instead of 130%.

4.2.2. Procurement Department: Material planning

Before the DRP automation on SAP, the procurement department used to plan its materials, taking into consideration sales achievements and filling out stocks. So, when sales were increasing, the procurement department used to order more materials than the allowable limit while having complications managing the lead time. And when the sales are decreasing faster than normal in certain products in specific seasons, the procurement department ends up ordering unnecessary orders and gets overstocked with materials that will not be used, as there is no accurate planning of materials when they follow the sales fluctuations. After the DRP automation and controlling the sales achievements, the materials are being planned more accurately while maintaining the safety stock, so the material planning will be smoother and the factories will always have sufficient materials to produce.

4.2.3. Production Department: (Master Production Schedule)

Before the automation, the planning department used to update the production team weekly with the production requirements and modify them as the sales used to pull from the safety stocks in the factories. The planning department wanted to maintain the safety stocks without the sales pulling from them. After the DRP automation and controlling the sales achievements, the production team has a more reasonable and clearer view of the production requirements, so it can accurately plan its MPS and the production lines two weeks ahead, and the materials are sufficiently available.

4.2.4. Warehouses: Capacity Management

Before the automation, the DRP was used to calculate the capacity of the warehouses. As a result of the overproduction to coordinate with the sales, the factories' warehouses used to be overstocked, so the factories used to stop the production process, as if they continued producing, there would be no room for further stock. After the DRP automation, the factories' warehouses only hold the safety stock that is maintained to be fifteen days of coverage instead of seven days, and any newly produced products are being transported to the

distribution centres. So, the factories' warehouses are empty and not overstocked, while TIBA's stocks are accurately filled and are smoothly managed.

4.2.5. Logistics: Trucks Filling

Before the automation, the logistics used to know their truck filling plan from the DRP one day before the distribution. After the DRP automation, the logistics department can have an accurate weekly plan of the DRP from the supply and demand planning department to move the products from the factories to TIBA based on the unrestricted stocks in the quality inspection and the date of their restriction.

Therefore, the case study showed how DRP automation using an ERP system affected supply chain functions positively in terms of data accuracy and efficiency. In line with recent studies, ERP systems can enhance supply chain processes with improved service quality and faster response times to customer demands, information sharing and exchange, and the continual provision of accurate, timely, and relevant information (Chopra et al., 2022; Setiabudi et al., 2021). The current business demand is for unconventional and innovative ways to achieve competitiveness and efficiency in day-to-day supply chain operations, which can be achieved through proper supply chain management using ERP systems that help decrease cycle time and enhance supply chain agility and efficiency (Singh et al., 2020). The implementation of ERP aids management in monitoring, allowing each unit to perform more effectively and efficiently (Laulita et al., 2022; Zhao & Tu, 2021). Moreover, information quality is a critical factor. Information quality has to do with how well a system works, how satisfied users are, and how much money they save. Information quality is defined by characteristics such as information collected from a system, its correctness, relevance, timeliness, and completeness (Rahmadani, 2020).

From a resource-based view, the case study at Juhayna Food Industries Company presented an in-depth investigation of how a better information management of goods through a DRP automation project using an ERP system could enhance the efficiency and effectiveness of supply chain management. This could allow organizations to sustain their competitive advantage.

5. Conclusion

This study demonstrates that the automation of DRP using ERP systems has a positive and significant impact on supply chain functions including supply and demand planning, procurement, production, warehouses, and logistics in the Egyptian FMCG industry, improving data accuracy and efficiency. Adding up to (Nitsche et al., 2021; Abdel-Shafie & Elgazzar, 2021; Apiyo & Kiarie, 2018; Ullah et al., 2018; Izhar et al., 2018), this study is the first of its kind to provide a thorough analysis of the implementation of a DRP automation project using an ERP system and its effect on supply chain management, focusing on the informational flow of goods in the Egyptian FMCG industry. This research will help FMCG companies in their planning and distribution practices in supply chain management of their products by saving more time and effort and having precise data through an automated ERP system.

This research has some limitations; the study is based on a single case, according to the research objective, to examine in depth the effect of the DRP automation on supply chain management. The research is focused specifically on the Egyptian FMCG industry. As a result, investigations at the international and industry levels would be valuable to assess the generality of findings from other nations and industries. Large-scale quantitative studies might also be interesting. Future research can include in-depth investigations in the Supply (Requirements) Automation, the Integrated Business Process (IBP) Automation in the Planning Department, and the Material Requirements Planning (MRP) Automation in the Procurement Department.

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Disclosure statement

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