

## RESEARCH

# Operations management for public services: Imperatives and implications for empirical research

**S. G. Deshmukh\***

Mechanical Engineering Department, Indian Institute of Technology Delhi, New Delhi, India

**\*Correspondence:**S. G. Deshmukh,  
deshmukh@mech.iitd.ac.in**Received:** 10 June 2024; **Accepted:** 06 August 2024; **Published:** 08 September 2024

Operations management (OM) offers immense opportunities for application in the domain of public services. A typical framework of “input-process-output” can also be applied to public services. This theory has evolved with the inclusion of service orientation, especially in an emerging economy such as India. Growing awareness among citizens, pressure on governments to perform, and increasing use of technology have made the application of the OM perspective in public services more challenging. The traditional theories of OM need a relook and reorientation in the context of public services. Theories give researchers different “lenses” through which to look at problems and issues in public services, thereby focusing attention on various aspects of the application and providing a framework within which to conduct empirical analysis. Public services have various expectations and aspirations based on societal and environmental considerations. Customer satisfaction and social value are less well understood in public services compared to their counterpart in the corporate sector. An attempt is made in this paper to look at some use cases wherein the imperatives for empirical model building are explored. A set of insights is developed based on the use case. The implications for both practitioners and theoreticians are also offered.

**Keywords:** operations management, public services, innovations, theory building, practices

## 1 Introduction and past studies

As a mature discipline, operations management (OM) has evolved into an interdisciplinary domain blending concepts and frameworks from strategy, organizational behavior, finance, marketing, the theory and practice of management, economics, and international businesses. The OM has immensely contributed to enhancing competitiveness by addressing a variety of issues. OM is concerned with managing inputs of processes, people, and resources through a transformation process model to provide the required output of goods and services (1). Service operations management is concerned with both the output or outcome of “the service” in the sense of “customer service” and the service organization itself—in the way it configures, manages, and integrates its activities (2).

OM concepts, tasks, and components are relevant to public services. Public organizations should acknowledge that they

are service organizations, so they should engage with service operations management theory and framework.

A typical list in the PS may include food supply for the masses, health, education, judiciary, public order and safety, economic affairs, environmental protection, housing, and community amenities. Citizens in vibrant democracies such as India depend mostly on the state for the provision of basic services, viz., food delivery, education, health, and infrastructure. This is due to the limited paying capacity, or the role envisaged for the state government. Thus, the role of the state, exemplified by its elected representatives and public officials, takes center stage in the governance and delivery of public service.

The delivery of such services is complex. The societal expectations, especially in an emerging economy such as India, are huge. The economy is on a path of rapid growth and expectations. **Table 1** gives pointers toward aspirational economies such as India. It is to be noted that

**TABLE 1** | Aspirational economy of India.

i.	Aspire to become US\$ 5 trillion economy
ii.	Creation of massive employment generation opportunities
iii.	Capturing a major share of global logistics market
iv.	Reduction in logistics cost as a percentage of GDP (presently from 14% to a target of 9 %)
v.	Enhance merchandise exports
vi.	Invest in huge capacity building at various levels

such an aspirational economy has to grow within a broad democratic framework.

Typically, OM has and continues to address issues such as quality, productivity, and responsiveness through its own toolkit. Issues such as facility location and aggregate planning, including forecasting, inventory, distribution, and in general supply chain management, have been adequately addressed. However, addressing issues in the public service domain, especially in emerging economies such as India, offers a huge opportunity for both practitioners and researchers. For example, supply chains in the public sector have a specific, complex nature, and their processes are subject to normative, political, and social pressures. In this context, an attempt has been made in this paper to articulate some of the issues.

The objectives of this paper are to:

- (a) understand and appreciate imperatives for research in operations from a public services viewpoint.
- (b) highlight opportunities for conducting empirical research for large-scale public service.

The paper is organized into five sections. In Section 2, imperatives for research are mentioned with adequate support from the literature. A case of public distribution is elaborated in Section 3.” With reference to this case, implications for empirical research are articulated in Section 4. Finally, concluding remarks and recommendations are given in Section 5.

## 2 Imperatives for research

### 2.1 Context and past studies

The relevance of contextual research is to be appreciated. Such research is strongly rooted in a specific contextual situation. Our thinking and way of working are shaped by the environment and the context within which we operate. The research is governed by “context.” Thus, context acts as an imperative for meaningful research. The context in the Indian environment for public services is as follows:

1. The government acts as a large service industry.

2. The government acts as an enabler of various initiatives.
3. The government is supposedly committed to improving the quality of life for citizens.
4. The government is responsible for providing public services.

According to Radnor and Bateman (3), OM methodologies are “context-specific” and this means discipline needs to adapt, rather than dismiss, the context. Growing awareness among citizens, pressure on governments to perform, and the increasing use of technology have made the application of the OM perspective in public services more challenging. The traditional theories of OM need a relook and reorientation in the context of public services. Theory plays a vital role in research by providing explanation, understanding, and meaningfulness to research. Theory helps to identify unexplored research areas, especially in public services. This exploration may be through empirical studies.

Flynn et al. (4) elaborate on the need for empirical research in OM and provide a starting point to use empirical data and provide a systematic approach for conducting empirical studies. According to them, the reason for empirical research being risky may be due to its perceived “soft,” tag compared with “hard” tag associated with mathematical modeling.

Given the rise of data available (thanks to IT, initiatives like big data), there is a growing need being felt to use these data to improve decision-making ability. Fisher et al. (5) stress the desirability of empirical research in OM and also prescribe a few qualifiers for good empirical OM.

Gupta et al. (6) and Roth and Manor (7) highlight growing importance of empirical studies in OM with special reference to the Production and Operations Management journal. The authors provide a taxonomy for empirical research–based on their primary purpose (theory building, theory verifying, application, and providing evidence), data collection approach, data analysis technique, and themes in OM.

### 2.2 Public systems

Typically, public systems are established to provide basic levels of wellbeing for citizens. Unlike a free economy environment, PS assumes a strong significance within the democratic set-up characterized by the state or central government, administrative set-up (including bureaucracy), public sector units (where the investment is by the government), program-executing agencies, NGOs, civil societies, and the general public.

The characteristics of public systems can be listed as follows:

1. Large-scale systems
2. People at heart.

3. The core issue is how to deploy resources efficiently and effectively to accomplish the stated goals.

It is a critical requirement in public systems to ensure that government agencies deliver their mandated results in a fair and consistent way. In such a setup, public service managers are responsible for the design and delivery of services to service beneficiaries, managing operational resources, and having a focus on continuous improvement.

Public systems may include programs for employment, food and cash assistance, and systems for public health, transport, justice delivery, and law and order. Such systems utilize considerable resources and have a huge impact on society, the environment, and the development of a nation. Public systems need to be optimized so that their benefits can reach every citizen of the country in a more effective manner. It is in this context that the role of the OM framework comes into play. Public systems enable the delivery of services for the public at large.

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## 2.3 Public service OM

The key principles of the OM framework may include:

- (a) Developing mechanisms for quality service delivery
- (b) Responding to the needs of vulnerable or marginalized sections of society (typically those who are at the bottom of the pyramid)
- (c) Designing a variety of interventions to enhance resource utilization (since resources are limited in countries like India)
- (d) Installing flexibility, adaptability, and responding to contextual situations; and promoting a culture of performance focus vis-à-vis accountability within the public service domain

Looking at the investment, huge potential impact, and criticality of operations, public services require OM interventions. The focus of public service OM (PSOM) is on drastic improvement with a large-scale impact in view. A variety of applications can be cited where PSOM can play a significant role. **Table 2** gives an indicative list of such applications.

In this paper, the first application domain in **Table 2** (i.e., Public distribution system (PDS)) is taken for further exploration.

**TABLE 2 |** Engagement of OM for indicative public services in India.

S. n.	Application domain	Brief description
1.	Public distribution system (PDS)	This is one of the largest food distribution systems, especially for the people at the bottom of the pyramid
2.	COVID vaccine distribution	The design and delivery of the COVID vaccine offered interesting challenges and opportunities
3.	Conduct of elections	In a vibrant democratic setup, elections attract a significant attention in the public service domain

**TABLE 3 |** PDS at a glance.

Targeted population	75% Rural + 50% Urban
Number of fair-price shops	500,000+
Food grains transported by Food Corporation of India (FCI) /year	42 to 45 million tons
FCI-owned/hired depots	2,200+
Movement through	Rail, road and waterway (80% by rail)

Source: [https://nfsa.gov.in/portal/PDS\\_page](https://nfsa.gov.in/portal/PDS_page).

## 3 Public distribution system

The government of India have adopted a range of policies to strengthen food security. One of the key responses to food insecurity and hunger in India is the distribution of food grains through the government-controlled PDS. The PDS has evolved into the largest universal distribution system in the world for the supply of subsidized food grains (8). Through a partnership between central and state governments, the food safety net program aims to supplement essential household supplies including wheat, rice, sugar, and kerosene. It may be noted that malnutrition is one of the biggest problems in India. Thus, the functioning of the PDS, which provides subsidized food to hundreds of millions of people, is critically important. PDS plays a vital role in eradicating hunger and ensuring food security—helping farmers sell their produce at remunerative prices as well as the poorer sections of society to buy food grains at affordable rates.

The responsibility of procurement, storage, transportation, and bulk allocation of essential commodities to the states, rests with the Central Government while the operational responsibility of allocation within the state, identification of eligible families, issue of ration cards, and supervision of the functioning of Fair Price Shops (FPS) rests with the state governments. With a network of more than 500000 FPS, the PDS is the largest distribution machinery of its type in the world (9).

While the provision of food subsidies is an important element of the food security system in India, an equally important role is played by food procurement and buffer

stock operations. Agricultural production is subject to climatic swings and market forces, and there are likely to be wide fluctuations in food grain prices. To bring about price stability, it is necessary to build and maintain an adequate level of buffer stock. Therefore, a study related to the PDS is socially relevant and inevitable. The PDS is helpful in:

- i. ensuring the food and nutritional security of the nation.
- ii. stabilizing food prices and making food available to the poor at affordable prices.
- iii. maintaining adequate buffer (safety) stock in the warehouse so that the flow of food remains active even during periods of less agricultural food production, thereby ensuring the availability of food to the masses.

The benefits of PDS were well recognized in India. The PDS in India has been operational for more than five decades. Several developing countries, including India, achieved food self-sufficiency because of well-organized PDSs for agricultural produce. The PDS makes food accessible and transfers income in the form of subsidies. Singh et al. (10) have developed a conceptual model for the PDS through technology interventions.

**Table 3** presents the salient features of the PDS in India.

A large-scale system such as PDS needs to be designed and operationalized through the classical frameworks used in OM. Input-process-output-outcome (IPOO) is a typical framework used in OM for capturing and visualizing all of the inputs, outputs, and process steps that are required to transform inputs into outputs. According to the IPOO model (11), the process for a PDS can be divided into four stages: the input, the process, the output, and the outcome, as shown in **Table 4**.

In the input stage, many resources, such as financial and human, are provided by governments and agencies. The process stage refers to the management of public distribution through a network of facilities, people, and other resources. The output stage reflects the results of the input and process stages related to public distribution, resulting in the delivery of goods (grains or other commodities) to the public. Finally, the outcome stage reflects the citizens' evaluation, such as whether they are satisfied with the goods or services delivered.

From a modeling point of view, one can conceptualize a hybrid approach where both the quantitative and qualitative models can be synergistically combined with empirical research to assess the impact and quality of outcomes of the PDS.

The distribution of food from various sources to demand nodes (fair-priced shops) via a huge network is an interesting problem to be addressed by the OM. This can be considered a variant of a classical transportation problem. A variety of LP (linear programming)-based models can be visualized for the same.

A skeleton of one such problem is shown below:

Objective function:—Minimize the Total Transportation Cost

Subject to:

Total Inventory of  $i^{\text{th}}$  warehouse  $\leq$  Capacity of  $i^{\text{th}}$  warehouse. . . . . (1)

Total supply to  $j^{\text{th}}$  Fair Price Shop  $\geq$  Demand of  $j^{\text{th}}$  Fair Price Shop (for each commodity). . . (2)

Total supply from  $i^{\text{th}}$  warehouse  $\leq$  Opening balance of  $i^{\text{th}}$  warehouse (for each commodity) (3)

District restrictions to be satisfied (such as minimum or maximum quantity to be distributed, limits) on type of food commodity distributed etc. (4)

A decision support system can be developed to address a variety of "What If" scenarios through the above model. These scenarios may include:

- i. What if additional supply point(s) were introduced?
- ii. What if the capacity of supply point increased/decreased?
- iii. What if the demand increased/decreased?
- iv. What if the distance increased/ reduced?
- v. What if an intermediate storage point is introduced?
- vi. What if a certain link connecting supply point  $i$  and demand point  $j$  is broken?

The model [equations (1) to (4) above] helps in minimizing the total cost of distribution. The sensitivity of the model can be explored by playing various scenarios and by adding or deleting a variety of constraints. Such a model has been developed and implemented in some of the Indian states. However, it may be noted that modeling is just one part of the understanding of the working of overall PDS.

## 4 Implications for empirical research and recommendations

OM has a long tradition of combining analytical models and optimization methods from operations research and economics to help managers improve the efficiency of their operations. With the rise of supply chain management and service management, models incorporate more sophisticated decision processes of customers, decentralized business units, employees, and competition (12). Applying these models requires an empirical validation of some of the assumptions required by these models as well as an estimation of some of the parameters.

Thus, there is a need for conducting empirical research on measuring the impact of such PDS since it involves a huge commitment of resources (both financial and manpower) and affects millions of people throughout the length and

**TABLE 4 |** IPOO framework for PDS.

	Input	Process	Output	Outcomes
Component	Public fund (money), manpower, space, Grains received from the farmers	Rules and regulations for the distribution of food, Administration of various entities (warehouses, transport services, fair process shops, etc.)	Delivery of goods and services, Expenditure on public distribution.	Quality of food received through PDS Satisfaction of public Reduction in hunger Enhance the income base of the weaker section. Meeting of Sustainable Development Goals
Enabled through	Descriptive models	Normative models	Prescriptive and predictive model (Modeling and experimentation)	Empirical models (aimed at assessing the quality of outcomes)

**TABLE 5 |** Steps involved in empirical research (ER) in PDS.

Step 1	Posing of appropriate research questions (RQs) encapsulating the purpose/objectives of the research Typical RQs relevant to PDS: i. What are the determinants of “Responsiveness” in PDS? ii. What are the dimensions of “Flexibility?” iii. What is the interplay between technology and people issues in the context of PDS? iv. What are the issues in designing performance measurement?
Step 2	Design for research and ways of answering RQs posed in step 1 with appropriate use of resources (such as time, budget, manpower, etc.)
Step 3	Collection of data (both primary and secondary) through field studies, surveys, and published reports
Step 4	Methodology for the analysis of data (statistical analysis, hypothesis testing, regression, cluster analysis, etc.)
Step 5	Interpretation and inferences
Step 6	Generalizations and articulation of limitations of the study

breadth of the nation. In this context, the role of empirical research comes into play.

Terwiesch et al. (12) have given an overview of empirical research in operations management and proposed various dimensions (such as objective of the paper, data sources, identification strategy, and estimation method) along which empirical research can be carried out. In general, empirical research involves findings and conclusions based on valid data or evidence. These pieces of evidence are collected using either or both qualitative research and quantitative research. One may draw inferences based on direct observations and assessment instead of using logic alone. ER keeps work authentic, formal, and verifiable, thus increasing the quality and depth of information. ER is quite flexible.

As a recommendation, the following steps (as in [Table 5](#)) are suggested for empirical research in the domain of PDS.

The key characteristics of ER may include the following: Specific RQs to be answered: Definition of the population, behavior, or phenomenon being explored, and articulation of the process used to study this population or phenomenon, including selection criteria, controls, and testing instruments (such as surveys).

Empirical research may explore causal relationships between policies, interventions, and outcomes. It may also

**TABLE 6 |** Benefits of empirical research.

1.	ER aims to explore why and how something works (or does not work) the way it is designed. For example: amount of subsidy given to farmers
2.	Possible to replicate or prevent something that has happened
3.	Real-life experiences are captured; hence ER is reliable and authentic
4.	Less bias in data being collected since the researcher may be actively involved
5.	ER acts as a feeder to develop/interpret the theory
6.	ER enables further studies. The outcome study may dictate that the results of modeling need revisit
7.	ER may be used to document state-of-the-art in OM
8.	ER may provide a baseline for conducting longitudinal studies

form a basis for exploring a variety of “what if” questions. An indicative list of benefits is presented in [Table 6](#).

Customer satisfaction and social value are less well understood in public services compared to their counterpart in the corporate sector. The typical performance metrics need a relook through ER in the context of public services. The impacts of strategic interventions need to be studied through ER. Similarly, the role of strategy and its relevance needs to be reinterpreted in the context of public services. The ER will help in making an objective assessment of the outcomes. It may be relatively easy to measure outputs but measuring the outcomes is a challenge to both academicians and practitioners.

It is to be noted that:

- (i) Public service OM is a valid field to be explored, especially in contextual situations like PDS.
- (ii) There is a need to synergize analytical and empirical research in the public service domain.
- (iii) The matured methodologies of empirical research in OM can be applied to enhance the effectiveness of public services.
- (iv) Within the framework of IPOO, empirical research occupies a significant position to study the outcomes of various interventions,
- (v) ER can be used to strengthen theory-building. Theory, in turn, offers a platform to explore various

assumptions and approaches used in analytical work through ER.

## 5 Concluding remarks

A variety of issues are explored within the domain of public services. The need for OM interventions and frameworks is highlighted. A case is made for the use of ER within the context of one of the high-impact areas for research, namely the PDS.

The PDS has been effective in reducing poverty and hunger, as well as strengthening the income base of weaker sections through increased access to it over the years. PDS costs the exchequer hugely in the form of food subsidies; hence, it is necessary to evaluate the impacts and outcomes in an objective and transparent manner. Empirical studies coupled with analytical studies will play a significant role in enhancing our understanding of the PDS vis-à-vis the public services OM in general.

This area offers tremendous opportunities for both quantitative and qualitative research. Through empirical research, meaningful interventions can be visualized, and their impact assessed to strengthen the theory-building process.

## Author contributions

The author confirms being the sole contributor to this work and has approved it for publication.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

- Slack N, Brandon-Jones A, Johnston R, Betts A. *Operations and process management: Principles and practice for strategic impact*. Harlow: Essex, Pearson (2012).
- Johnston R, Clark G. *Service operations management*. Harlow: FT/Prentice Hall (2008).
- Radnor ZJ, Bateman N. The role and substance of public service operations management. In: Radnor ZJ, Bateman N, Esain A, Kumar M, Williams SJ, Upton DM editors. *Public service operations management: A research handbook*. Milton Park: Routledge (2016). p. 1–10.
- Flynn BB, Sakakibara S, Schroeder RG, Bates KA, Flynn EJ. Empirical research methods in operations management. *J Operat Manag.* (1990) 9:250–84.
- Fisher M, Olivares M, Staats BR. Why empirical research is good for operations management, and what is good empirical operations management? *Manufact Serv Operat Manag.* (2020) 22:170–8.
- Gupta S, Verma R, Victorino L. Empirical research published in production and operations management (1992–2005): Trends and future research directions. *Prod Operat Manag.* (2006) 15:432–48.
- Roth AV, Manor LJ. Insights into service operations management. *Prod Operat Manag.* (2003) 12:145–63.
- Kishore A, Chakrabarti S. Is more inclusive more effective? The ‘new style’ public distribution system in India. *Food Policy.* (2015) 55:117–30.
- Planning Commission. *Performance evaluation of targeted public distribution system (TPDS)*. Performance evaluation organization. New Delhi: Planning Commission (2005).
- Singh SS, Jenamani M, Dasgupta D, Das S. A conceptual model for Indian public distribution system using consortium blockchain with on-chain and off-chain trusted data. *Inform Technol Dev.* (2021) 27:499–523.
- Brown M, Svenson R. Measuring R&D productivity. *Res Technol Manag.* (1988) 31:11–5.
- Terwiesch C, Olivares M, Bradley R, Vishal Gaur S. OM forum—a review of empirical operations management over the last two decades. *Manufact Serv Operat Manag INFORMS.* (2020) 22:656–68.