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Technological Innovations, and Policy Dynamics"**



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Contents

i Foreword by the Editor

Articles

1 Reskilling Public Enterprise executives in Eastern Europe

Victoria C. M. P. Bou

26 Privatisation of water: New perspectives and future challenges

Carlos Gonzales

39 Using Machine Learning to improve the performance of Public Enterprises

Naresh C. Saxena

52 Using Natural Experiments in Public Enterprise Management

Saran S. Singh

64 Enhancing food security through Public Enterprise

Mary C. Smith

Foreword by the Editor

In the ever-evolving landscape of public enterprises, the 27th volume of *Public Enterprise* encapsulates the diverse and dynamic nature of public enterprise management, bridging the gap between traditional methodologies and the burgeoning demands of the modern world. Through a compilation of five meticulously researched articles, we delve into the intricate interplay of traditional practices and cutting-edge technologies, explore the transformative potential of quantitative research, and confront the challenges of ensuring equitable access to essential resources. Each article stands as a testament to the journal's unwavering commitment to advancing the discourse in public enterprise management, offering both theoretical insights and practical implications.

Public enterprises, often characterized by their unique position at the intersection of public policy, economics, and management, are pivotal in shaping the socio-economic fabric of nations. As engines of development and instruments of public welfare, these entities have the profound ability to influence the lives of millions. However, managing these complex organizations requires an understanding that transcends traditional management theories, necessitating a multidisciplinary approach that embraces change, innovation, and ethical responsibility.

This edition's eclectic range of articles not only reflects the multifarious nature of public enterprise management but also underscores the importance of adaptability in an era marked by rapid technological advancements and shifting global paradigms. From the infusion of machine learning in executive decision-making to the critical role of public enterprises in food security, each piece contributes to a deeper understanding of the challenges and opportunities that lie ahead.

1. **Reskilling Public Enterprise Executives in Eastern Europe:** Victoria C. M. P. Bou's study delves into the transformative potential of yoga for public enterprise executives in Eastern Europe. Amidst the region's transition from traditional bureaucratic mentalities to innovative leadership models, the article illuminates yoga's role in enhancing executives' helping behaviour and cultural intelligence. It presents a compelling case for integrating traditional practices into modern leadership training, underscoring the need for holistic approaches in executive development within emerging markets.
2. **Privatisation of water: New perspectives and future challenges":** Carlos Gonzales artfully navigates the global water market's allure for private entities, driven by the consistent demand for water and its vital role in our lives, regardless of economic

fluctuations. The article critically examines the increasing reliance of governments on the private sector's management and financial prowess to enhance water sector efficiency. However, it also presents a nuanced view of the realities, acknowledging that the anticipated benefits and scale of private sector involvement in water services have yet to be fully realized.

3. **Using Machine Learning to improve the performance of Public Enterprises:** This insightful piece by Naresh C Saxena traverses the realm of machine learning (ML), a branch of artificial intelligence, and its burgeoning role in public enterprises. The article provides a comprehensive overview of ML's diverse applications, from predictive analytics to public service improvements. It also addresses the intricacies and challenges of ML implementation in the public sector, including ethical considerations and the need for a synergy between IT professionals and public enterprise executives to harness ML's full potential.
4. **Using Natural Experiments in Public Enterprise Management:** Delving into the adoption of mathematical models in economics and management, the article by Saran Singh discusses the quest for precision and predictability akin to that in the physical sciences. It critically examines the challenges and limitations of applying experimental methods in social sciences, contrasting them with natural sciences and highlighting the unique complexities of human behavior and social phenomena.
5. **Enhancing Food Security through Public Enterprise:** Mary C. Smith's article offers an in-depth analysis of the critical role public enterprises play in enhancing food security. By investing in agricultural infrastructure and ensuring the accessibility and affordability of food, public enterprises significantly contribute to national well-being. The article sheds light on the challenges of targeting food distribution to the poor and the corruption within public enterprises, emphasizing the need for effective public distribution systems and collaboration with NGOs to improve food security.

As we conclude this edition of *Public Enterprise*, it is imperative to reflect on the broader implications of the insights gleaned from these articles. The ever-changing landscape of public enterprise management demands a proactive approach, one that anticipates and adapts to new challenges while staying true to the core principles of public welfare and social justice. The articles in this volume collectively highlight the need for public enterprises to not only embrace

technological advancements and innovative research methodologies but also to remain cognizant of their social responsibilities and the ethical dimensions of their operations.

In an era where public trust in institutions is increasingly fragile, the role of public enterprises becomes even more critical. They are not merely economic entities; they are custodians of public resources and trust. As such, they have the unique responsibility to lead by example in transparency, accountability, and ethical conduct. The insights from this edition underscore the necessity for public enterprises to be more than just economically efficient; they need to be socially responsive and morally grounded.

Moreover, this edition highlights the importance of interdisciplinary research and collaboration in addressing the complex challenges faced by public enterprises. The diverse range of topics covered in this volume demonstrates the multifaceted nature of public enterprise management. This diversity is not just a feature but a strength, offering a holistic view that can inspire innovative solutions and strategies.

In summary, the 27th volume of *Public Enterprise* offers a rich tapestry of research that is both intellectually stimulating and practically relevant. It invites readers, scholars, and practitioners to engage in a thoughtful exploration of the myriad aspects of public enterprise management. As we move forward, it is our hope that this edition will spark new conversations, inspire further research, and contribute to the ongoing evolution of public enterprise management in a way that benefits not just the academic community but society at large.

David Tavželj

Reskilling Public Enterprise executives in Eastern Europe

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Abstract

In Eastern Europe, the competencies needed by public enterprise executives are evolving as the formerly monopolistic public sector is being exposed to domestic and global competition. Through the lens of mindfulness, this study investigates whether the ancient practice of yoga can support enhancement of helping behaviour and cultural intelligence of business executives in a transitional economy. The study found that yogic practices significantly increase participants' helping behaviour as also their cultural intelligence. The results support the partial mediation model with approximately two thirds of the effect on helping behaviour coming from higher mindfulness and the remaining one third coming directly from the practice of yoga. In case of cultural intelligence, 88 per cent of the increase in comes through mindfulness while the remaining 12 per cent can be accounted for directly from yogic practices. Public enterprises in emerging markets could view yoga not as a woke activity or a trivial pursuit but as a support for bringing about useful attitudinal changes among their executives.

KEYWORDS: Helping behaviour; Cultural intelligence, Yoga, Mindfulness

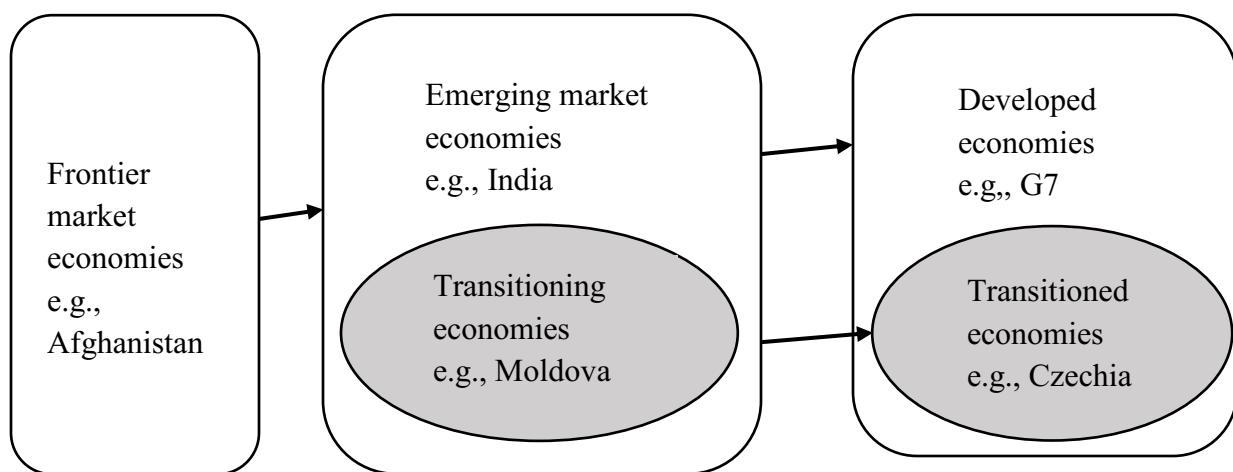
Introduction

A subset of emerging market economies are transition economies. An economy that is shifting from a centrally planned to a market economy is referred to as a transition economy, also known as a transitional economy. Transition economies experience a range of structural changes, such as the elimination of trade barriers and price controls, as well as economic liberalisation. To aid in macroeconomic stabilisation, a financial sector is established, and private capital flow is promoted. The formation of new institutions, including independent financial institutions, and the alteration of the nature of already-existing institutions are typical characteristics of the transition

process. The state's function has undergone a dramatic transformation. Transition can be described as a functional restructuring of state institutions from being a provider to an enabler (Roland, 2004).

Over the years the number of transition economies has been progressively reducing as many of them have transitioned and become developed economies. The countries whose economies have transitioned are Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia. As of now the transition economies include Botswana, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan, Albania, Armenia, Belarus, Bosnia and Herzegovina, Georgia, North Macedonia, Moldova, Montenegro, Russia, Serbia and Ukraine. The position of transition economies in the world order and their evolution is given in Figure 1.

Figure 1. Transition of economies



In these economies ownership of the demand and supply adjustment is being transferred from planning process at the national level to free transactions in the market. Income distribution is shifting from contributions made to the workforce to acquisition of profits and wages (Iwasaki, 2020). As formerly planned economies have undertaken fundamental transitions toward market-based economies since the 1980s, improved knowledge about behaviour of public enterprise executives in these countries has become more important (Peng & Heath, 1996). These countries offer attractive grounds to the researchers in the field of organisation and human resource management to test and hone existing theories and to develop new ones.

As most managers of state-owned firms were selected for their position because of their political loyalty, they are simply not equipped to work in the context of markets because of their

lack of knowledge, skills, and experience in such an environment (Sharma, 1993). It has been observed that in transition economies, the firms that offer training programs to their executives seem more likely to trigger an innovation than firms that do not provide such programs (Abdelkhalek et al., 2022). With the help from the West, there are massive training efforts in every planned economy in transition attempting to upgrade managerial skills of managers. Much of what is being taught may not translate into instant improvement because of the different context that produced Western management expertise in the first place (Boyacigiller and Adler, 1991).

Skills required for business executives in a centrally planned economy were not the same as that for business executives in a free market economy. In a socialist economy, due to controlled prices and perennial shortages of various types of goods and services, the customers were treated as supplicants (Kornai, 1980). Now, the public enterprise executives have to build trust and loyalty in the customer and offer a personal touch to the customers. Secondly, the centrally planned economies had been closed to the world. Now, public enterprise executives have to deal with the intricacies of human interactions across cultures. Such intercultural competence, sometimes known as cultural intelligence or CQ includes the ability to comprehend a counterpart's key cultural norms, the desire to listen, watch, and alter one's behaviour or communication preferences as also the ability to reflect on and change interaction approaches and expectations based on the circumstances. This research investigates whether the ancient practice of yoga can support enhancement of helping behaviour and cultural intelligence of mid-level business executives in one of the transitional economies.

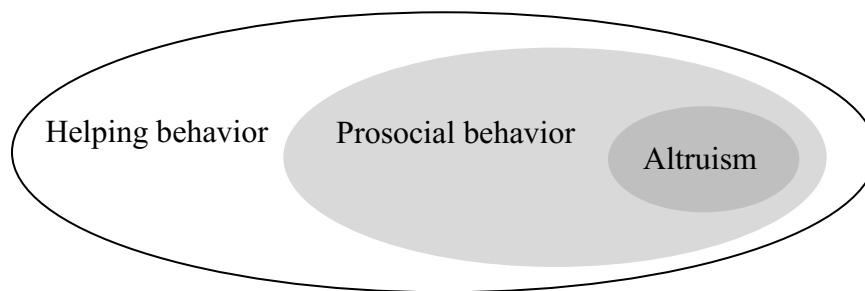
Despite the differences among these countries, there are a number of compelling reasons that we can consider them as one group of countries. First, their common experience under the central planning regime and communist ideology suggests that "they are all members of a broader, clearly identifiable class of social-political-economic systems" (Kornai, 1992, p. 5). Second, their phenomenal transitions toward market-based economies, albeit with different speed and pace, have led to similar changes in their institutional infrastructure, such as weakened bureaucratic controls and tolerance of global competition (Mizobata and Iwasaki, 2023). Common heritage and transitions as well as similar adaptive strategies for firm growth have led researchers to group them as transition economies.

Our study area is Moldova which came into existence as an independent country consequent to dissolution of the Soviet Union.

Helping behaviour

Helping behaviour is not a generalized love for humankind. It is not just a feeling but involves action. Quite often in management literature helping behaviour is used interchangeably with pro social behaviour. Often terms like ‘altruistic helping behaviour’ is used. Conflating the three terms is to rob them of richness of their meaning. Altruism is a subset of prosocial behaviour while prosocial behaviour is a subset of helping behaviour. An example of helping behaviour that would not be considered PSB is a manager who goes extra lengths to help a customer, because in this behaviour the act is motivated by professional obligations. The term Altruism is reserved for cases where the helper tries to improve the welfare of another person as an end in itself (Nagel, 1970). While altruism is entirely selfless, prosocial behaviour and helping behaviour is often based on a mixture of selfless and selfish motivations. The aim of prosocial behaviour and helping behaviour could be reducing one’s own distress when witnessing another person’s condition or it could be to receive social approval. While altruism usually involves self-sacrifice, prosocial behaviour and helping behaviour include win-win situations also. Thus, cultivation of helping behaviour will be of benefit to the society as also the employer even if the motivation of the business executive is not purely selfless. Figure 2 is a Venn diagram showing altruism, prosocial behaviour and helping behaviour.

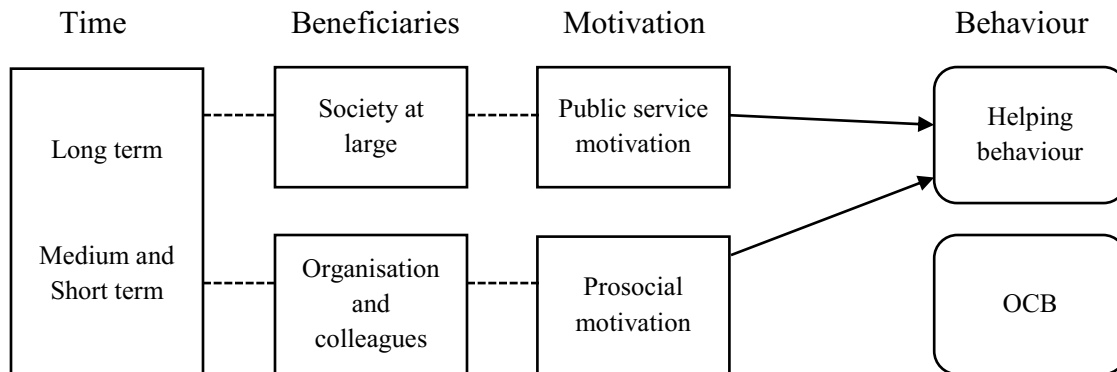
Figure 2. Venn diagram of Helping behaviour (adapted from Hemingway, 2013)



Helping behaviour overlaps with organisational citizenship behaviour but the two concepts are significantly different in terms of temporal focus, beneficiaries and motivation. Organisational citizenship behaviour mainly aims at going the extra mile and doing something good for fellow workers and the organisation. Helping behaviour can lead to doing something good for society not only at the expense of one’s free time but also breaking work-related rules. Usually, helping behaviour benefits the employer; in rare cases it can harm the employer in the short run, e.g., in case of whistle blowing. While organisational citizenship behaviour has prosocial motivation,

helping behaviour has public service motivation also. Figure 3 shows the differences between the two concepts.

Figure 3. Schematic overview of similarity and difference between Helping behaviour and OCB



Cultural intelligence

Intelligence is what separates humans from animals and higher levels of intelligence is required for success in various aspects of life including business. Scholars have been trying to classify people into intelligence groups by examining their behaviour in everyday life for ages. In 1850's an English polymath Herbert Spencer tried to create a theory of intelligence but did not get very far (Richardson, 2022, p. 2). Sir Francis Galton (1869), another English polymath, was the first to attempt to develop a standardised test for assessing a person's IQ, but he abandoned the project in the mid-1880s. Much later the Binet-Simon test released in 1905 by French psychologists Alfred Binet, Victor Henri, and Théodore Simon received wide recognition. The psychologist William Stern (1912) coined the abbreviation IQ for the German term *Intelligenzquotient*, which he used to describe a scoring technique for intelligence tests.

Over a century a number of meta-analytic evaluations have proved that general intelligence tests are reliable indicators of work performance across a wide range of occupations (Richardson and Norgate, 2015). However, intelligence being complex, enigmatic and arguably even indescribable, the business scholars have always been sceptical with the idea of IQ measurement being conclusive when even laypersons would recognise that, intelligence is perhaps the most intricate function of the human mind.

For the past half century or so, advances in neuroscience seem to indicate that different parts of the brain relate to different types of intelligences. In his famous book *Frames of Mind: The Theory of Multiple Intelligences*, Howard Gardner (1983) divided intelligence into various

modalities of intelligence: linguistic, logical-mathematical, musical, spatial, kinaesthetic, interpersonal, intrapersonal and naturalistic. The theory has been subject of criticism by mainstream psychologists due to reliance on subjective judgement and insufficient empirical evidence. Psychometric studies have consistently discovered high correlations between different elements of intelligence undermining Gardner's theory over multiple intelligences. Gardner has been defending his theory through sequels to his book (Gardner, 1993; 2000), rebuttals to criticisms in academic journals (Gardner and Moran, 2006) and video interviews. Gardner and other experts have been adding other types of intelligences and there is a continuing debate as to whether a particular type of intelligence actually exists.

Few years later in the best-selling social science book of all time, *Emotional Intelligence: Why it can matter more than IQ* the author Daniel Goleman (1995) took a dim view of the entire psychometric tradition, as indicated by the book's subtitle. The author argued that group of skills and abilities — those dealing with people and emotions — has been largely overlooked in mainstream psychology. Goleman emphasised the significance of recognising one's own emotional life, regulating one's feelings, understanding other people's emotions, working with others, and having empathy for others. Yet another key contribution of research on multiple intelligences was the identification of social intelligence, a notion that dates back to Edward Lee Thorndike's (1920) study, who defined it as the ability to comprehend people and act and behave wisely in relationships with them. Social intelligence (SQ) as a concept had sporadic development and turned out to be a late bloomer. Some authors define SQ as the capacity to get along with others, social knowledge, ease with others, empathy for others, and insight into others. The term SQ refers to a broad category of social interaction abilities. In essence, high SQ symbolises a person's ability to act, such as collaborating and problem-solving with others.

The concept of cultural intelligence (CQ) has evolved relatively recently with its roots in Gardner's concept of interpersonal intelligence. It takes self-awareness and other-awareness further ahead referring to one's ability to adapt to new cultural environments depending on a variety of factors such as cognitive, motivational, and behavioural characteristics. Intending to expand understanding of intercultural interactions, P. Christopher Earley (2002) introduced CQ as an intellectual construct that represents adaption to various cultural situations. Along with Soon Ang, he refined it further in the book *Cultural Intelligence: Individual interactions across cultures* providing a conceptual framework for exploring the relationship between human intelligence and

culture and organisational behaviour. Earley and Ang (2003) posit that the differing levels of CQ are responsible for different levels of success when people engage cross-culturally. During the same period David Thomas and Kerr Inkson (2004) worked on a complementary framework of (CQ) presented in their book *Cultural Intelligence: People skills for global business*. The authors prescribe a three-stage process for enhancing one's CQ. The steps entail learning the important principles of cross-cultural interactions, such as what cultures are, how cultures differ, and how cultures influence behaviour; practising mindfulness and paying attention to cues in a reflective and creative manner; and developing a repertoire of behavioural skills that can be adapted to various situations.

CQ is not an adaptation of EQ or SQ. EQ research does not provide a comprehensive understanding of cross-cultural context or how the notion could be expanded to encompass it. The formulations of SQ are relatively void of cultural richness. SQ demonstrates an ability to assess and manage others presuming universality of content and processes. SQ takes a universalist stance without considering the ecological and social forces that impact thought process. While not all psychological processes are culture-bound, etc aspects of CQ reflect general cognitive abilities that can be used in a variety of situations. CQ refers to one's competence for effective adaptation to new cultural settings and to deal with people with different cultural background.

Can yoga help?

Yoga is a discipline whose history extends back thousands of years. The practice originated in India and has been adapted in other countries in various ways. The ancient Indian book *Gita* was composed sometime in the second half of the first millennium BC and has been translated from Sanskrit to several languages. Of late yoga as explained by *Gita* has been a subject for western management scholars as well (e.g., Turci, 2021). Yoga has a wide range of meanings due to its use in a wide variety of contexts. *Gita* gives a number of definitions describing yoga as “evenness of mind” (Chapter 2; verse 48); “skill in action” (v 50); “renunciation of selfish purpose” (Chap 6; v 2); “harmony in all that we do” (v 16); and “unlinking of the link with pain” (v 23). Sometime between third century BC and third century AD, sage Patanjali compiled the ‘Yoga Sutras’, the original textbook of classical yoga (Stiles, 2021). This is a secular text that has become preeminent in teaching yoga. Other texts that have followed refer to it as being the heart of yogic thought. The eight limbs of yoga in Yoga Sutra are:

“Yama (Selfless values): Non-violence, truthfulness, non-stealing, self-restraint and greedlessness.

Niyama (Self-discipline): Cleanliness, contentment, austerity, self-study and acceptance.

Asana (Postures) Body positions that open energy channels and develop physical stability for meditation and other advanced practices.

Pranayama (Breathing practices) Cardiovascular control to enhance the flow of vital energy through retraining the respiratory organs.

Pratyahara (Withdrawal of senses) Withdrawal of sensory inputs, coming from the five senses into the physical being.

Dharna (Concentration): Creation of one-pointedness of the mind.

Dhyana (Meditation): Uninterrupted flow of concentration.

Samadhi (Merger of individual consciousness with universal consciousness): Highly esoteric practice that cannot be taught. Not practiced in the West.”

Modern yoga, which bridges, the realms of Indian spirituality and European physical culture has been moulded in conformity with contemporary aspirations and inclinations that are the common heritage of a cosmopolitan culture (Sarbacker, 2021). Of the eight limbs of yoga, three - physical postures, breathing practices and meditation - are popular in the West. It is generally accepted that the primary goal of yoga is to maintain physical fitness and to cultivate balance, calm, harmony and awareness (Feuerstein, 2011). In 2014 in recognition of the worldwide appeal of yoga, the UN proclaimed 21 June as the International Day of Yoga. Many top businesspersons have attributed their business success to regular yogic practice. Most of these eminent businesspersons practise yoga seven days a week - Ariana Huffington of Huffington Post, Sergey Brin of Google, Jeff Weiner of LinkedIn, Ratan Tata of Tata Sons, Beyoncé of Parkwood Entertainment and William Clay Ford Jr. of Ford Motor Company to name a few. As a student backpacker, Steve Jobs learnt yoga in India and was influenced by a book ‘Autobiography of a Yogi’ that reformed his wayward life at the time. This was the only book that he had downloaded on his personal iPad 2 (Foxen, 1997). During the Covid-19 epidemic, research on yogic practices accelerated.

Scholars believe that health, peace and joy are not the main goals of yoga practice; the ultimate objective of yoga is to unleash dormant powers within the human body and mind, which leads to care for the well-being of others (e.g., Büssing et al., 2021). In the West, yoga is most

recognised for its postures. Several studies indicate practice of yoga leading to increase in Helping behaviour. In an experiment for studying the effects of a 10-week yoga course as an alternative for traditional school sports in German secondary schools, Michael Jeitler and colleagues (2020) found increase in helping behaviour among those opting for yoga. The results of this quantitative analysis agree with qualitative studies, e.g., Lisa Conboy and colleagues (2013) and Bethany Butzer and colleagues (2017).

For historical reasons an impression remains in the West that yoga as a part of Indian tradition is inward looking. The “comparative method” developed in mid-19th century had achieved a good deal of success in linguistics but its application to culture had led to much oversimplification and distortion. The influence of orientalists among historians and philosophers created a diptych wherein westerners were supposedly outward looking and easterners were insular inward looking. A famous example of this view is Mathew Arnold’s (1867) oft-quoted epic poem:

The East bow'd low before the blast; In patient, deep disdain;
She let the legions thunder past; And plunged in thought again.

Indian nationalists as also Western socialists have always believed that orientalists’ claim is erroneous Jawaharlal Nehru (1946) in his book *The Discovery of India* written while serving a jail sentence under the British colonial rule alleges that westerners would like India to remain plunged in thought and entangled in speculation, so that the westerners may possess this world and the fulness thereof. The idea of ‘Vasudhaiva Kutumbakam’ as introduced in many Indian writings like the Maha Upanishad and the Rig Veda more than three thousand years back is:

The world is a family:
One is a relative, the other stranger; say the small minded.
The entire world is a family; live the magnanimous.

This principle has influenced the texts that followed and is quoted in texts of 1000 BC to 500 BC as “loftiest thought” (Moses, 2002, p 12). This adage had an impact on other Asian cultures and has been called an illustration of "dynamics of boundarylessness of a Himalaya Sphere phenomenon, viz. Chinese culture with Indian input” (Tan, 2015, p. 17). Yoga being an intrinsic part of Indian culture is inward looking only in the sense that it considers inwards as real as outwards.

Numerous empirical studies have demonstrated the therapeutic effects of yoga practices on a wide range of physical and mental health indices (Büssing et al., 2012). The growing interest in

yoga and its possible applications in health, psychology, and other fields is noteworthy as it symbolises a unique interaction between two branches of human knowledge: modern practical science and age-old contemplative practices. Yet, the research on the effect of yoga on intelligence is not even a trickle as compared to the flood of studies on therapeutic effects of yoga. Yogic practice is likely to have a positive effect on CQ because yoga's "approach is from outward to the inwards depths and vice versa, all forming a continuity" (Raju, 1985, p. 337); but the empirical evidence has been lacking as yet.

Mindfulness mediation

Businesses operate by its executives making decisions, usually based on incomplete information and often rapidly. Decision making in business settings remains an important component in any executive training programme. Awareness of the feeling that drive one's reaction can help prevent bad decision making. Historical roots of this awareness lie in the ancient Buddhist tradition called mindfulness (Thich, 1999). The concept was introduced to psychology and management literature by Ellen Langer (1989; 1997). Western scholars, however, subtract mindfulness from its spiritual roots and consider it a cognitive process. As a result of its disassociation from any specific religious system, modern mindfulness practices are fundamentally appealing to a wide range of people in secular societies (Monteiro et al., 2014). Empirical research finds mindfulness related to environmental consciousness (Arslan et al., 2022; Benos, 2022). Reviewing Yuval Noah Harari's (2018) bestseller *21 Lessons for the twenty-first Century*, Bill Gates (2018) states that an important message of the book is that "life in the 21st century demands mindfulness — getting to know ourselves better" (p. 4). Research on mindfulness is gaining steam in Psychology and Management Science. This research examines whether yogic practice enhances mindfulness and examine whether mindfulness – a discriminating awareness of and heightened attention to present reality – mediates between yoga and helping behaviour and between yoga and CQ.

Yoga entails focus is on mind-body awareness, not on the alignment details of the physical posture. Another characteristic of yoga is its emphasis on observing rather than reacting. It is to be expected that practicing yoga will improve mindfulness – an enhanced attention to and receptive awareness of the present that includes acceptance and non-judgement. Several empirical studies have confirmed this hypothesis. In a study of 46 staff and students of two New York colleges it was found that yoga intervention is a viable method for increasing levels of mindfulness (Shelov

et al., 2009). Recently, similar results were found in studies on students in Germany (Epe et al., 2021) and Turkey (Erkin & Şenuzun Aykar, 2021).

Buddhist religious leaders like the Dalai Lama (2002) are convinced that mindfulness enhances helping behaviour. There are several mechanisms through which mindfulness might increase helping behaviour (Donald et al., 2019). Research has revealed that mindfulness leads to rise in sustained attention (Chiesa et al., 2011). In a social setting, greater attentional capacities could increase the probability of a person observing the needs of others and responding to them (Brown & Ryan, 2003). Mindfulness is associated with higher level of awareness of bodily sensations, or what the psychologists call interoceptive awareness, i.e., identifying, accessing, understanding and responding appropriately to the patterns of internal signals. Neuroscientific research shows that a region of the brain, the insula, is impacted by interoceptive awareness. The insula processes others' emotional experiences as well (Singer et al., 2009). It follows that the greater interoceptive awareness is likely to increase individuals' awareness of the others' needs and encourage appropriate response.

Mindfulness may improve an individual's affective experience, that is, experience that will present its objects in a more positive and less negative ways (Lutz et al., 2008). Moreover, mindfulness may improve affect regulation. When confronted with the suffering of others, a mindful person is less likely to turn away to avoid her own personal distress inhibiting helping behaviour. This change in affect may also result in increased helping behaviour. Mindfulness reduces biases of all types and this reduction could also induce helping behaviour. Buddhist scholars as also psychologists believe that mindfulness alters one's view of self from a firm unit to a flexible non-attached entity. With lesser attachment to the self an individual is more likely to help others, including 'outgroup others'.

Theorising in the field of mindfulness has moved ahead of empirical research. While it is not clear the exact mechanism or mechanisms through which mindfulness affects helping behaviour, there is little doubt that the effect of mindfulness on helping behaviour is positive. C. Daryl Cameron and Barbara L. Fredrickson (2015) examined effect of mindfulness on 313 participants in the US and found significant positive effect on helping behaviour. The authors conclude that when we decide to help others, present focused attention and nonjudgment "both sustain our intention and reap the richest emotional consequences" (p. 1217).

Over the last quarter of a century, mindfulness has been successfully applied to cross-cultural communication (Ting-Toomey & Dorjee, 2018) and international management (Thomas, 2002). The way mindfulness works is by giving people the chance to explore a variety of behavioural choices based on information of how different cultures differ and how culture influences behaviour (Thomas, 2006). Mindfulness is a universal practice “because awareness itself could be seen as the final common pathway of our humanity, across all cultures”. (Kabat-Zinn, 2021, p. 1557). To be successful in cross-cultural encounters, one must exercise metacognitive approach of mindfulness – paying attention in a reflective manner while keeping track of one's own feelings, thoughts, and actions. It removes a rigid or fixed worldview, allowing one to make meaning of cultural contexts, events, and actions within their own frame of reference. Effective managers “mindfully work through this sense-making process on a daily basis” (Bird & Osland, 2006, p. 123).

There are several possible mechanisms through which mindfulness could impact CQ. Empathy is a facet of mindfulness that processes others' perspectives and positions. It is reasonable to assume that a critical relationship between empathy and CQ would exist. Another facet of mindfulness is open-mindedness. The personality trait of openness to experience is called ‘intellectance’. Individuals who are high on intellectance are likely to be more knowledgeable about other cultures. This ability would enable adjustment to new surroundings that require attention to signals and cues of the new environment. There is likely to be positive relationship between openness to experience and CQ. Yet another facet of mindfulness, the use of all senses, includes reflecting upon one's doing and the milieu, thus managing one's consciousness. This facet helps in developing a suitable mental map for a specific cultural interaction. Mindfulness, therefore, is likely to impact CQ positively; but since CQ is a relatively new concept, not much empirical evidence is available as yet. In a study of Canadian professors teaching in China, Cray, McKay and Mittelman (2018) found a positive correlation between mindfulness and cultural intelligence.

Hypotheses

Based on the review of literature cited in the previous sections, we propose the following hypotheses:

H1 Yoga will be positively related to helping behaviour.

H2 Yoga will be positively related to cultural intelligence.

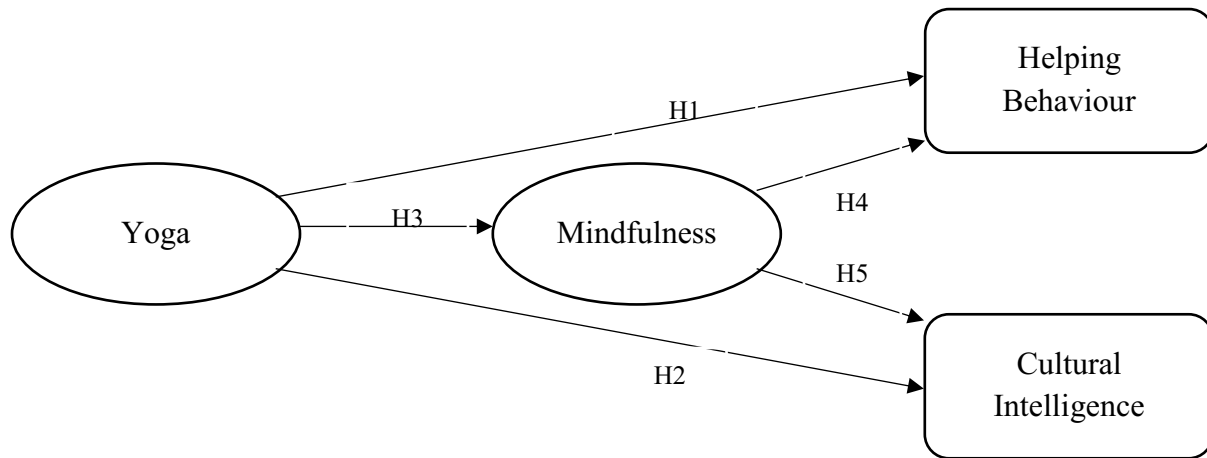
H3 Yoga will be positively related to Mindfulness.

H4 Mindfulness will mediate the relation between yoga and helping behaviour.

H5 Mindfulness will mediate the relation between yoga and cultural intelligence.

The five hypotheses are shown in figure 4.

Figure 4. Mediation model of determinants of helping behaviour and cultural intelligence



Methods

Design and sampling

A quantitative rather than a qualitative technique because the purpose of this research is to evaluate the hypotheses described above deductively and to quantify the direct effects and the mediation effects. The effects of yoga practise on business executives in Montenegro were studied using a Randomized Controlled Experiment. This was not a clinical trial as no specific pathologies were being treated. No measurements were made by clinical instruments. All the participants of Executive Masters of Business Administration (EMBA) programmes the country's business schools were requested to take part. Because an EMBA programme requires an undergraduate degree with good grades as also no less than three years of managerial experience, all of the students had prior management experience and were well-educated. Average age was 35 years 10 months and average work experience prior to joining EMBA programme was 5 years and 9 months.

Of those who expressed interest, a computer programme selected 260 students, 224 turned up to fill out the background information and initial evaluation questionnaire. The personal information of the participants was encrypted using a secure key code. Individuals could request a personal report with their results after the tests were completed. Faculty and administrators were

not given access to questionnaires or study data. Following baseline measures, the participants were assigned randomly to either the first batch (intervention group) or the next batch (control group) using a computer-generated randomisation sequence, and the participants were notified via automated emails. Five of the 112 individuals in the intervention group lost interest and did not complete the yoga course, and two of those who did complete the course did not come to the final test, bringing the number in the treatment group down to 105. Four students from the control group did not come to the final test, thus reducing the number in the control group to 101.

Measurements

Yoga classes were scheduled every day for 90 minutes, seven days a week for twenty weeks. Classes included 5 minutes of warm-up, 45 minutes of asanas (physical poses), 20 minutes of pranayama (breathing exercises), and 20 minutes of meditation. Those who could not spare that much time on a particular day, were advised to do a shorter version at home and report at the next time they participants came to the class. This was a general yoga teaching programme, not designed specifically to increase mindfulness, helping behaviour or cultural intelligence. The average yoga training per participant was 8069 minutes for the entire programme which comes to 0.96 hours per day.

This research uses ‘Helping Attitudes Scale’ devised by Gary Nickell (1998) which has been a popular scale for the last two decades. It is a measure of respondents’ feelings, beliefs, and behaviours related to helping. Each of the 20 items is responded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Some of the items are reverse scored. The scores for the items (some of which are scored in reverse with 5 points for strongly agree to 1 point for strongly disagree) are added up to get an overall score. The score has been normalised (ranging between minimum 20 and maximum 100) by dividing by 20.

The pioneers in the field of CQ Christopher Earley and his wife Elaine Mosakowsky (2004) have designed “a self-scored diagnostic tool for measuring cultural intelligence that consists of three components: cognitive, physical and emotional” (p. 143). At the time this tool was considered “rather primitive and lacking empirical validity tests” (Alon & Higgins, 2005, p. 503). The scale has since been improved by including many items for psychometric refinement and validated by a team of international business executives (Van Dyne et al., 2015). An abridged version is also available which has been used by us. CQ was measured using a 9-item abridged CQ scale but with peer group evaluation instead of self-evaluation. MBA education lays emphasis on group work

and the class is usually divided into groups of 3 or 4 students. This makes peer-evaluation simple and removes the same-source bias as well. Responses were recorded on a 7-point Likert rating scale (1 = completely disagree, 7 = completely agree). On the basis of the 9-item scores, an average score for cultural intelligence has been calculated.

In the study, mindfulness is a mediating variable not a moderating variable. This distinction between the two types of variables is that “mediation is an attempt to establish *mechanism* by which one variable may be affecting another, whereas moderation is looking for differences in the relationship between group assignment and outcomes based on *pre-existing* variables” (Shapiro et al., 2006, p. 384). The Mindful Attention Awareness Scale (MAAS), a psychometrically sound instrument (Brown, & Ryan 2003) has been used for measuring mindfulness. The reason for choosing this scale was that it is the most widely used of the measures currently in use. MAAS has been validated in investigations in various types of populations (e.g., Carlson & Brown, 2005) and has established an acceptable level of reliability.

Results and Discussion

The effect of the yoga intervention is shown in Table 1 in a difference-in-differences format. The intervention group showed substantial differences in mindfulness, helping behaviour and CQ but the control group did not exhibit any meaningful changes over this time period. Within the intervention group the mean and variance increased after treatment.

Table 1: Scores at baseline and follow-up for intervention and control group.

		Control group	Intervention group	Difference
Mindfulness score	Initial	3.87 (0.75)	3.88 (0.70)	0.01
	Final	3.88 (0.75)	4.11 (0.85)	0.23***
	Change	0.02	0.31***	0.22***
Helping behaviour	Initial	2.89 (0.45)	2.88 (0.44)	-0.01
	Final	2.89 (0.44)	3.28 (0.53)	0.39***
	Change	0.00	0.40***	0.40***
Cultural intelligence	Initial	4.47(0.68)	4.48(0.64)	0.01
	Final	4.48(0.68)	4.72(0.70)	0.24***
	Change	0.01	0.24***	0.23***

***Significant 1% level.

Table 2 shows the means, standard deviations, correlations, and dependability statistics. The correlations are significant and positive, as predicted. Notably, Yoga is linked to Mindfulness; and Mindfulness is also positively linked to helping behaviour and cultural intelligence.

Table 2: Means, standard deviations, correlations, and reliabilities.

	M	SD	1	2	3
1 Yoga	0.96	0.25			
2 Mindfulness	4.19	0.85	0.35**	(0.87)	
3 Helping behaviour	3.28	0.53	0.34**	0.43***	(0.90)
4 Cultural intelligence	4.72	0.70	0.33**	0.39***	0.28* (0.91)

N = 105; Reliabilities (Cronbach alphas) are in parentheses on the diagonal.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

The next step was to examine whether mindfulness (enhanced through yoga) plays a mediating role or is it merely a side benefit. For this purpose, the PROCESS macro for regression, as described by Andrew Hayes (2022) was used. Table 3 shows the regression findings of the mediation model. The results show partial mediation, which means significance of the mediation as also the direct effects.

Table 3: Regression results for mediation model.

	Mindfulness			Helping behaviour			Cultural intelligence		
	b	SE	t	b	SE	t	b	SE	t
Constant	3.38	0.57	6.81***	2.88	0.95	3.03***	4.48	1.27	3.52***
Yoga	0.24	0.07	3.43***	0.14	0.05	2.80**	0.03	0.01	3.00**
Mindfulness				0.64	0.22	2.86**	0.50	0.17	2.94**
Indirect effect				0.27	0.13	2.08**	0.22	0.10	2.20**
(Confidence Interval)				(BCLB=0.02, BCUB=0.42)			(BCLB=0.02, BCUB=0.42)		
Direct effect				0.14	0.05	2.80**	0.03	0.01	3.00**
(Confidence Interval)				(BCLB=0.04, BCUB=0.24)			(BCLB=0.01, BCUB=0.05)		
Total effect				0.41	0.13	3.15**	0.25	0.10	2.50**
(Confidence Interval)				(BCLB=0.15, BCUB=0.67)			(BCLB=0.05, BCUB=0.45)		
F	9.97***			9.08***			9.19***		
R ²	0.32			0.44			0.43		

Unstandardised coefficients are reported. BCLB refers to lower limit of 95% confidence interval and BCUB refers to upper limit of the 95% bootstrapped confidence interval

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

The total effect of yoga on helping behaviour is significant ($b=0.41$, $p<0.01$; bias corrected lower bound, BCLB=0.15; bias corrected upper bound, BCUB=0.67), which supports the

hypothesis 1. Hypothesis 2 predicts that yoga would be linked to a higher level of cultural intelligence. The total effect of mindfulness for cultural intelligence is significant ($b=0.25$, $p<0.01$; $BCLB=0.05$; $BCUB=0.47$), which supports the hypothesis. The association between yoga and mindfulness is positive and significant ($b=0.24$, $p<0.001$), which was predicted by Hypothesis 3.

The indirect effect of yoga (through mindfulness) on helping behaviour was also significant ($b=0.27$, $p<0.01$; $BCLB=0.02$, $BCUB=0.42$), in accord with the mediation Hypothesis 4. Yoga had a substantial direct influence on helping behaviour ($b=0.14$, $p<0.01$; $BCLB=0.04$, $BCUB=0.24$). The indirect effect of yoga (through mindfulness) on cultural intelligence is shown to be significant ($b=0.22$, $p<0.01$; $BCLB=0.02$, $BCUB=0.42$) when the mediation Hypothesis 5 was examined. Yoga also has a small direct influence on cultural intelligence ($b=0.03$, $p<0.01$; $BCLB=0.01$, $BCUB=0.05$). Thus, yoga had a direct and indirect effect on the participants' helping behaviour as well as their cultural intelligence.

Hypothesis 1 predicts that yoga would be linked to improved helpful behaviour. The total effect of yoga for helpful behaviour is significant and positive which supports the hypothesis. Hypothesis 2 predicts that yoga would be linked to cultural intelligence. The total effect of yoga on cultural intelligence is significant and positive which supports the hypothesis. Hypothesis 3 predicted that yoga would be positively linked to mindfulness. The effect of yoga on mindfulness is significant which supports the hypothesis 3. This is in line with previous studies free market countries (Shelov et al., 2009; Epe et al., 2021; Erkin & Şenuzun Aykar, 2021).

The indirect effect of yoga (through mindfulness) on helping behaviour is shown to be significant when the mediation hypothesis 4 was examined. Yoga also has a significant direct influence on helping behaviour. Thus, yoga has a direct effect as also an indirect effect through enhanced mindfulness on helping behaviour. The indirect effect of yoga (through mindfulness) on cultural intelligence is shown to be significant when the mediation hypothesis 4 was examined. This is in line with previous research by Cray, McKay and Mittelman (2018) wherein they found positive effect of mindfulness on cultural intelligence. Yoga also has a significant direct influence on cultural intelligence. Thus, yoga has a direct effect as also an indirect effect through enhanced mindfulness on cultural intelligence.

This research, for the first time estimates that the effect of yoga on skills required for business executives in transitional economies – helping behaviour and cultural intelligence. It finds partial mediation by mindfulness. In case of helping behaviour, the effect of yoga through

mindfulness is 66 per cent of the total effect whereas the remaining 34 percent comes directly from yoga. In case of cultural intelligence, the effect of yoga through mindfulness is 88 per cent of the total effect whereas the remaining smaller but still significant 12 per cent comes directly from yoga.

Despite the increasing uptake within diverse organisations and endorsement by companies operating in emerging markets the pressure of time within MBA curriculum is such that introduction of yoga in a meaningful manner is difficult (Sanyal & Rigg, 2021). It will be fair to say that few individuals join an expensive EMBA program to cultivate their helping behaviour and cultural intelligence (Boyatzis & Cavanagh, 2018). Rather, they enter an MBA program for career advancement, and to prepare themselves for managerial responsibilities.

Directions for future research

A bit of caution is advised in application of conclusions from this study to other situations. Utmost care has been taken to check internal validity but in most randomised experiments external validity is a concern. Due to cultural factors, the applicability of average results (obtained in an Orthodox Christian country) to other transition countries may be hampered. Further research may be required to confirm the results in other transition economies.

In Europe, yoga's rich intellectual history is not widely known. In the gymnasiums, often yoga is confined to a physical practice for stretching. According to the yoga guru Iyengar (1966) who is widely credited as the person who brought yoga to the West, postures without being preceded by *yama* and *niyama* are just acrobatics. Western academics prefer to subtract spirituality from yoga and mindfulness. Accordingly, in this research a secular approach to yoga and mindfulness has been taken. However, some academics consider such an approach a Eurocentric parochial prejudice. These scholars believe that the world is now in a post-secular age and argue that in order to get the full educational benefits of Eastern contemplative practices, These practices must be connected to their spiritual roots. Disregard of religious traditions that go beyond narrow practical ideas negate the benefits and a denaturalised practice detached from its soteriological setting is of no consequence (Lewin, 2017). Future research could look into these concerns.

Substantial further research may be able to move us beyond the crucial but insufficient organisational wellbeing models of yoga and mindfulness. Using sophisticated statistical analysis techniques in this and subsequent studies may not result in a complete knowledge of yoga-based practices. Yoga is not a stress ball for executives to play with that can be perfected through

theoretical and empirical research. Ongoing research in helping behaviour and cultural intelligence includes a deeper conceptualisation of their dimensions, complementary measures of and a richer nomological network. There could be modes of mind the working of which may only be accessible through far more advanced research capacities yet to be developed.

Conclusion

Moldova was a constituent republic of USSR before the latter was dissolved. Moldovan executives are not lacking hard skills which continue to remain important for management both in public sector. Now that the monopolistic public sector is facing global competition, the businesses realise the need for behavioural change. Our results show that yoga can significantly improve helping behaviour and cultural intelligence of business executive. In case of helping behaviour, the effect of yoga through mindfulness is 66 per cent of the total effect whereas the remaining 34 percent comes directly from yoga. When it comes to cultural intelligence, yoga's mindfulness-based impact accounts for 88% of the total effect, with yoga contributing a smaller but still significant 12% directly. The most recent neuroscience research demonstrates that training can improve skills. While non-cognitive skills are flexible until later in life, IQ is likely to become fixed at puberty (Kautz et al., 2014). Executives in emerging economies can cultivate helpful behaviour and cultural intelligence at any age. This study demonstrates that yoga is a useful tool for this endeavour.

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Privatisation of water: New perspectives and future challenges

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Abstract

The global water market is attractive for private companies for reasons of reliability and opportunity. Due to its crucial nature, the demand for water remains steady despite variations in the economy. Governments around the world are looking towards private sector to deploy its management and financial capacities to this sector. Despite its prominence in recent debates and policies in the water sector, increasing private sector participation has achieved neither the scale nor the benefits anticipated. Recognition of water as a human right has given a new dimension to this sector. Public scrutiny of corrupt practices in the water sector is increasing. The potential market is huge but the challenges are complex. While water business is consolidating and growing, water companies seem to be unprepared for new challenges.

KEYWORDS: Water, business, privatisation

Introduction

Water supply utilities are now the centre of attention. Escalating drinking water and environmental standards and increasing public vigilance and financial problems are leading to decreasing confidence in their competence and sustainability. Yet water industry is a large and growing business whose true economic significance is only beginning to be realised. While the growth in various sectors of water industry varies, the industry seems to be consolidating and coalescing into more of a unified industry. The number of persons that private water providers supply is estimated differently by different sources. Recent data are not available. In England and Wales, the entire population of is served by private companies. In Chile, the Czech Republic, Armenia, Côte d'Ivoire, Gabon and Senegal, private companies provide water services to the entire urban populations. On the other extreme, private water corporations do not exist in many nations,

including Egypt, Pakistan, Japan, Canada, and Scandinavia. Uruguay, the Netherlands, and Nicaragua have even enacted legislation outlawing the privatisation of water. A statute in Italy that supported water privatisation was overturned in a referendum held in June 2011 by a resounding majority of Italian voters.

In the United States which many like to consider the bastion of capitalism and free enterprise, resistance to private water systems continues since the 19th century. As of now, the percentage of population served by the private organisations (including publicly owned systems operated by the private sector) is less than fifteen per cent. In 2019, the City of Baltimore, Maryland became the first big city in the United States to ban water privatisation. Misfortunes of high visibility privatisation projects are often dubbed as people's victory by the popular press and the early predictions of rapid privatisation are no longer valid. Acceptance of private water projects is wider in Europe. Thatcherite privatisation in UK generated considerable opposition at the time, but by this time 45% of population in Europe is being served by private operators. Rapid growth is visible in Mediterranean and North African regions. Overall, privatisation escalated all over the world in the 1990's but stumbled thereafter due to opposition from the civil society groups, especially in developing countries leading to what came to be known as 'water wars'.

The term "water wars" referred originally to the famous protests in Cochabamba, Bolivia, in 2000, when the government handed over the control of water supply of that city to consortium headed by the US construction company Bechtel. The politicians who organised the people against the government have reaped rich benefits in terms of popularity, with many of them now occupying high political offices including the presidency of the republic. There have been similar street battles in other countries with tragic loss of life. Inevitably the battles have been reflected in acrimonious debates among policy analysts. Some of the literature has been academic while much of the populist and polemical debate has taken place on the web.

The question of universal coverage

Safe drinking water was formally recognised as a basic need in the 1970's (ILO, 1976). In November 1980, the UN declared that the next ten years would bring safe water and sanitation for all. The then UN's Secretary-General, Kurt Waldheim, announced at the time that the goal was 'eminently achievable'. Faster construction of water supply and sanitation systems all over the developing world was the declared aim of the International Drinking Water Supply and Sanitation

Decade and the World Health Organisation estimated that services were laid out as twice the rate of the 1970s, and yet universal access was nowhere on the horizon when at the end of the Decade, Global consultations were held in Delhi, India in September, 1990. The Delhi Declaration called for 'water for all by with the slogan of 'some for all, rather than more for some'. The declaration was adopted by the United Nations General Assembly as 'strategy for the nineties'. In retrospect, it seems surprising that such an egalitarian declaration achieved a broad consensus considering that neo-classical economics was in ascendance at the time. Inevitably, when the policy initiatives emerged out of this declaration, World Bank and donor countries found 'welfare state connotations' of Delhi Declaration disconcerting. Within two years, the influence of neoliberal ideas became evident and the 1992 Dublin Principles illustrated their perspective in the fourth principle by stating that "Water has an economic value in all its competing uses and should be recognised as an economic good" (WMO,1992). Neoliberal diagnosis was stated clearly: "Past failure to recognise the economic value of water has led to wasteful and environmentally damaging uses of the resource. The increased role of the markets was recommended for managing water as an economic good. International aid agencies adopted Dublin Principles and actively promoted the role of the private sector in provision of drinking water. It has been alleged, however, that this change of course, especially in case of bilateral aid agencies, was not as much out of concern for universal coverage as for promotion of business of their water companies (Budds and McGranahan, 2003).

Meanwhile those opposing privatisation were campaigning to get drinking water declared as a human right. Since Human rights have no hierarchy, it was expected that water as a human right would be deemed to be as important as other rights mentioned in the Universal Declaration of Human Rights (UDHR) of 1948. This move was not without controversy. At the UN Commission on Human Rights in 2002, Canada voted against the Right to Drinking Water insisting that international law should not recognize the existence of a right to water as this is a domestic issue for each country. Consequent to heavy lobbying from the governments of the Global South and Northern NGO's, the UN Committee on Economic, Social and Cultural Rights developed a General Comment, which confirms that the right to water is implicitly contained in the International Covenant on Economic, Social and Cultural Rights. This Comment (No. 15) adopted by the UN Committee on Economic, Social and Cultural Rights at its twenty-ninth session in November 2002 affirmed that 'the human right to water entitles everyone to sufficient, safe,

acceptable, physically accessible and affordable water for personal and domestic uses'. A General Comment is only an interpretive tool and does not, in itself, constitute legally binding 'hard law'. Even so, the General Comment gained wide acceptance amongst many States and intergovernmental organisations, including the World Bank. On July 28, 2010 the United National General Assembly voted (with 41 abstentions) on a non-binding resolution recognising the right to water and acknowledged that clean drinking water are integral to the realisation of all human rights. On 30 September 2010 the Human Rights Council, responsible for mainstreaming human rights within the UN system, adopted by consensus a resolution affirming drinking water as a human right. Canada, the United States and more than two-thirds of the European Union are opposed to international action in this regard and therefore do not recognise human right to water.

A related unresolved issue relates to the role of business with respect to human rights. The United Nations has not acceded to the demands of the human rights advocacy groups that the same range of human rights duties be imposed on private business that the States have accepted for themselves under treaties the latter have ratified. Norms drafted to this effect by a committee appointed by the UN were opposed by the business groups and were finally rejected by the concerned UN body in 2005. After several years of deliberation, in June 2011, the UN Human Rights Council endorsed the "Guiding Principles on Business and Human Rights: Implementing the United Nations 'Protect, Respect and Remedy' Framework" proposed by UN Special Representative John Ruggie. These guiding principles mainly relate to rights at work and rights mentioned in the UDHR. Case law relating to water as human right has not yet developed. There is little shared knowledge across different stakeholder groups in the water business and human rights domain. Since most developing countries recognise water as a human right, those in water business need to plan ahead before they receive nasty surprises. Normally, the quantity of water supplied in terms of litres per capita per day would not cause a problem as the drinking water supplied by the private sector is more than that considered adequate for personal use, but affordable price could be cause for controversy. Also, while the right to water does not mean free water, a water utility would still need to evolve a policy as to how and when to deny water supply to a consumer for non-payment of bill if no alternative supply of drinking water is available to the consumer. A trickier area could be enhanced coverage. The governments usually sell privatisation on the grounds that it would lead to coverage of uncovered areas; but quite often the coverage does not increase to the extent promised (Clarke et al., 2009).

The water business enterprise will need embed their responsibility to respect the right to water by expressing their commitment to meet this responsibility through a statement of policy that is informed by relevant expertise and is approved at the highest level in the company. The statement needs to stipulate expectations from personnel and partners directly linked to the operation of drinking water supply, communicate the same to all stakeholders, be publicly available and reflected in operational procedures. With the help of rights groups, the enterprise would need to set up a non-judicial grievance redressal mechanism. In addition, the enterprise will also need to carry out a human rights due diligence which could be an ongoing process as the operating context evolves.

Water Business and Corruption

Water business has an old unsavoury reputation both in developed and developing countries. Grand Rapids, Michigan Water Scandal of 1900 in which a bribe of \$100,000 was passed on was a typical case of municipal corruption in those days which the people found “as fascinating as a dime novel” (McGerr, 2003). Recent spectacles of corruption include prosecution against officers and agents of Lyonnaise des Eaux in France, Vivendi (now Veolia) in France and Italy and Siemens, Pirelli, BICC, Marubeni and Tomen in Singapore, not to mention the grand larceny in developing countries. The water sector is particularly vulnerable to corruption because the technical complexity required to design and construct water infrastructure projects leaves less room for public transparency and leads to information asymmetry. Water sector is also complex in the sense that it involves a multitude of actors. This leaves water governance dispersed across political boundaries and several agencies which makes effective regulation and oversight difficult. The atmosphere of discretionary action opens up for many loopholes especially when high demand for water services reinforces the power position of suppliers. High capital intensity combined with a high frequency of interaction with suppliers and procurers makes procurement and contract implementation easy to manipulate. Kiltgaard’s (1988) equation *Corruption = Monopoly + Discretion – Accountability* is useful for understanding why corruption in water sector is ubiquitous at every point along the water delivery chain, including policy design, budget allocation and operation. According to Global Corruption report 2008, in wealthier countries corruption is concentrated in awarding of contracts for building and operating municipal water structure. The report notes that the stakes are high as this market is worth an estimated US\$ 210 billion annually in Western Europe, North America and Japan alone (Transparency International, 2008). Further,

corrupt practices have caused water shortages in some countries like Spain. In respect of the developing countries, according to this report, corruption inflates the overall cost for achievement of Millennium Development Goal (MGD) in respect of drinking water by US\$ 48 billion. Sub-Saharan Africa seems to be worst placed region in this respect. In the successive yearly corruption perception indices compiled by Transparency International nearly half of the twenty countries that perform worst in the index come from the region. At the same time, this region is not moving with adequate speed towards achievement of MGD in respect of drinking water.

Worldwide, privatisation of water supplies has progressed on economic grounds while losing the political wars with the public perception that privatisation deals were corrupt. This perception has been the primary determinant of the political outcome. Numerous water privatisation efforts have failed in Latin America, Africa, Asia and the United States, following opposition from public interest groups. These groups have claimed with some justification that the deals were not transparent because of which the water rates rose unreasonably and the promised service improvements were not carried out. The most high-profile reversal came in 2000 in Cochabamba, Bolivia, mentioned earlier where negotiations were carried out with only one firm. Transparency is essential for privatisation to be viewed as politically legitimate. From the point of view of the government, an effective way to combat corruption in privatisation is by increasing the flow of information to the public - on transactions, on the financial and operational performance of state-owned firms prior to sale and on expectations after privatisation. At the same time the businesses cannot shirk their responsibility. There was a time when bribing the officials of the third world countries was not only legitimate, in many developed countries it was tax deductible. In the US, Foreign Corrupt Practices Act (FCPA) had been on the statute book since 1977 but not many people were even aware of its existence. Due to pressure from the civil society groups, toughening is noticeable on the part of Western governments. Recent years have seen a spurt in crafting anti-bribery laws as also enforcement of existing laws. A new British anti-bribery law, passed in 2010, even makes small “facilitation payments” to speed up routine business punishable. OECD’s bribery convention requires members to change their legal system and open law-enforcement systems to intense external scrutiny and the members are subject to public naming and shaming when they breach them. Enforcement of FCPA has gone up steadily from 5 actions in 2004 to 74 in 2010. It is no longer possible for any CEO to claim with a sophisticated shrug that doing deals in Africa always means paying kickbacks.

If businesses in the water sector are serious about combating corruption, instead of forming a cartel, the industry groups could form an ethics committee. Stung by allegations of unjustified overpricing, companies accounting for almost all of supply for water pipes in Columbia - American Pipe and Construction, PVC Gerfor, Titán Manufacturas de Cemento, Tubotec, Celta, Colombiana de Extrusión-Exrucol and Flowtite Andercol – formed an ethics committee which includes outside experts. The committee has been successful in pointing out specific cases of irregularities in procurement forcing the Government authorities to make amends.

Efficiency and Cost

The water business in private sector was likely to be more efficient than public utilities which are often overstaffed, technologically challenged and corrupt (Segerfeldt, 2005; World Bank, 2006). However, this would not automatically result in lower prices for the consumers. The main argument against private business entering water sector was that it increases prices, making water unaffordable for millions of poor people. It was argued that as a natural monopolist, the business finds it easier to increase prices rather than increasing returns to scale by increasing coverage. This could be controlled by having private sector compete for the right to sell water to the market and to award this right to the company offering to sell this water at the lowest price. Even so, the cost to the consumer is likely to increase as public subsidies to the water utility would be discontinued or drastically reduced. In developing countries, these subsidies amount to 45 billion dollars per year and on average the average are as high as 70 per cent of the costs (Segerfeldt, 2005). Ideally, the reform including raising prices should precede privatisation. This was the case in Gabon where it required ten years of ground work to bring the tariffs to the level reflecting cost (Tremolet and Neale, 2002). In the event Vivendi won a concession contract based on a 17.25 per cent price cut. Revenue recovery could also be more efficient under private sector management. For example, in Buenos Aires, the private company found that 11 per cent of properties classified as residential were actually non-residential and another six per cent had under-reported their size. Reclassification resulted in increased fee from 425,000 customers. In most cases, tariffs go up when private business takes over water utilities and quite often prices increase in a haphazard manner. When the private operator took control of the Buenos Aires water supply, average tariffs were cut by 27 per cent. Next year, the prices were increased by 13 per cent and three years later by another 27 per cent and increases continued till 2002 before the currency crisis

hit the country. In early 2002, prices were about 93% higher in real terms than they were at the time of privatisation (Delfino et al., 2007).

The focus of studies on price increases has been on the customers who are already connected to the piped water supply systems. Those who are not connected usually purchase lower quality water from vendors paying on average 12 times more than for water from regular mains. Therefore, availability of a water connection at a double the existing price would give poor people substantial economic benefits (Segerfeldt, 2005). These people, however, are trapped in poverty and have no voice. A coalition of potential beneficiaries does not exist. On the other hand, those already connected to the system have a vested interest in subsidised water available from a public utility and get support from public utility employees as also from anti-business NGO's in their bid to retain the status quo.

Ferment and the Future

In the recent years, more national and regional level companies have been getting contracts as compared to global players. Another notable feature is the increasing tendency for national companies of developing countries to gain these contracts, which until 1995 were regarded as being almost exclusively the domain of companies from developed countries. Big contracts (for example, Buenos Aires in 1993 and Jakarta in 1997) created controversies preparing ground for water wars of the next decade. Inevitably, there was a move away from mega-contracts to smaller and possibly less contentious contracts. The average contract size has diminished since the 1990s. However, this trend may not continue as evident from an IPO issued in 2010 for a mega contract for water supply in Chongqing, China.

Water sector is in ferment and the businesses seem to be slow to respond to new challenges. While economic challenges are daunting, political considerations need to be given priority. Businesspersons should not consider it strange that large number of people consider the idea of profit being made out of water abhorrent. After all, the number of for-profit institutions in the public education sector is quite small as compared to public and non-profit institutions. Blaming the occasional distress of water companies on vested interests and anti-business groups is counterproductive. Given the experience of water wars, the degree of privatisation in future is likely to be decided primarily by politics. The business opportunities for private businesses will accelerate but neither in the United States nor in developing countries, will there be divestiture of the type that occurred in England and Wales. Many developing countries are trying Private-Public-

Community Partnership; but these experiments are only on a small scale. In bigger projects, developing countries are trying to sell the idea of Private-Public Partnership (PPP) for Private Sector Participation (PSP), because the objectives of the two ‘partners’ are quite different. The type of participation being tried out is given in Table 1.

Table 1. Business responsibility in PSP

	Service/ Management Contract	Affermage/ Lease	Concession	BOT	BOO	Divestiture
Ownership	No	No	No	No	Yes	Yes
Investment	No	No	No	Yes	Yes	Yes
Risk	No	Shared	Yes	Yes	Yes	Yes
O&M	Yes	Yes	Yes	Yes	Yes	Yes
Duration	Short	Medium	Medium	Long	Long	Indefinite
Increasing public opposition				→		

Source: Adapted from Stottman (2000).

In countries where the idea of privatisation leads to of fierce resistance and social strife, only service contracts and management contracts are possible. This could be the initial approach in South Asia and some countries of Latin America like Bolivia and Perú. Later, the business could move on to Affermage and Lease. When going in for concessions, the business will need to look at the foreign exchange risk. Devaluation of Peso in Argentina in 2002 caused such a problem that the net worth of the water utility became negative. There is tendency to underbid for contracts as the bidders are confident that the contract can be renegotiated. This tendency has been widespread in Latin America where three fourths of the contracts signed in the 1990’s were renegotiated within an average period of 19 months after signing the contract (Gausch, 2004). In view of public criticism, this option may not be available in future and the business will have to assess the realistic costs and hedge their bets. As compared to the rest of infrastructure businesses, where often technology is the main issue, the water business is likely to get more and more complex.

The story of privatised water in England is a potent and sobering one about the perils of water privatisation. In 1989, under the Thatcher administration, nine water systems were sold to

private companies (Hall & Lobina, 2012). Some of these new private companies joined the French transnational corporations Veolia and Suez in pushing for privatisation elsewhere, capturing markets in Central and Eastern Europe after the end of the Cold War as well as (backed up by the conditionality of the structural adjustment programmes of the International Monetary Fund and the World Bank) in Latin America and Africa (Bieler & Moore, 2023). In England, £7.6 billion was received by the government from the sale. But in addition, the government assumed £4.9 billion of the businesses' previous debt and gave them £1.5 billion in initial working capital. Therefore, there were rarely any net profits to UK taxpayers at the time, but ever since, English water users have suffered greatly as a result of this disastrous experiment in private delivery. The English water companies have distributed nearly £20 billion in dividends to their owners since going public, which is nearly all of the profit the companies have declared. Though privatisation has increased investments, due to out-of-control cash outlays, capital expenditures have to be funded almost entirely by increased debt and new borrowing. The effect on debt service costs is amplified because private owners pay higher interest rates than the government does. Network pressure has improved substantially, supply interruptions have become less frequent, the responsiveness to complaints has improved and leakage has been reduced. However, tariff has gone up much faster than inflation, making it unaffordable for poorer households as the regulators have given the companies permission to charge their water customers more for debt by raising rates. Health violations (such as the venting of untreated sewage), excessive CEO compensation (private water CEO salaries soar to over £2 million annually, despite the low-risk, regulated nature of this business), and deteriorated working conditions and safety standards are some other issues with private water delivery in England. In 2021, the environmental performance of England's 9 water and sewerage companies was the worst ever (EPA, 2022). In Scotland, water was not privatised. The public utility has invested more in better water infrastructure there than it has in England, despite the fact that customers there pay less than in England.

Conclusion

In contemporary civilisation, one of the most important components of public infrastructure is the provision of clean drinking water and sewage services. Reliable water services are essential for communities to prosper. Yet, water privatisation has grown to be a major component of the World Bank's neoliberal agenda since the mid-1990s. It has maintained that the private sector is the appropriate and necessary channel for supplying the impoverished with clean

water (Naziz, 2020). The Asian Development Bank has assumed a leading role in the reform of the water sector throughout the Asia-Pacific area, encompassing China, Nepal, Sri Lanka, and many Indian states. Critics claim that these external influences are problematic and argue that influencing water privatisation is part of a broader movement of Western powers imposing neoliberalism on countries in the Global South (Greiner, 2020) with no concern for equity (Correa=Parra et al., 2020).

Any local or regional government's primary function is to provide those services. There is general agreement that public utilities have been too slow in extending access to services and that they can be inefficient and corrupt. At the same time, increasing private sector involvement to address these problems remains controversial. Most of the research in water business is in the form of case studies. There is need for more of econometric research based on natural experiments. The water business brings fresh capital for investment in infrastructure. However, usually the loans are in dollars but the tariff is denominated in local currency. The business needs to hedge the currency risk in a professional manner instead of trying to re-negotiate the contract by bribing the politicians. The water business is being wrong footed both by human rights groups and anti-corruption activists. Individual water companies need to clean up their act and business groups need to do more by taking effective measures like forming ethics committees. The water business needs to go beyond technocratic solutions to problems and involve stakeholders in formulating innovative solutions. Considering that incomes in developing countries are rising and that one billion people are without safe water and perhaps several times that number do not have tap water on demand, the potential market is huge. This market can be profitably tapped only when water business eschews short-termism and rises to the new challenges.

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Using Machine Learning to improve the performance of Public Enterprises

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Abstract

Governments all over the world are aiming to improve the performance of their public enterprises. The goal of this method is to help public enterprise CEOs transition from a bureaucrat mentality to a leader mentality. Profitable operation of public sector enterprises through cutting edge technology is included in this effort. Machine learning is a subset of Artificial Intelligence using mathematics and statistics to learn from data and, sometimes, make predictions. is able to analyse massive quantities of data, and identify patterns in that data. In doing so, it provides new sources of inspiration and innovation. Machine learning opens new possibilities to drive positive change; helping computers learn from data to create models humans would not be able to build otherwise. The challenge is to maintain trust and deliver real benefits for everyone. To be useful, the applications of machine learning will, require close interaction between IT professionals and public enterprise executives.

KEYWORDS: Machine learning, Public enterprise, Artificial intelligence

Introduction

Can machines think? The question has baffled the philosophers and laymen alike for a long time (Mays, 1952). At the dawn of the computer age, British mathematician Alan Turing, the designer of programmable computing device, began a classic article titled ‘Computing Machinery and Intelligence’ with this question (Turing, 1950). He did not answer the question and discarded it as too meaningless to deserve discussion. Turing was not committing himself to the view that to think means thinking like a human (Dennet, 2008). However, in a prescient section entitled ‘Learning Machines’, Turing (1950) had anticipated machine learning (Harnad, 2018).

Machine learning (ML), a branch of artificial intelligence, relates to the construction of systems that can learn from data thus giving computers the ability to learn without being explicitly programmed. ML lies at the intersection of computer science, engineering, statistics and often appears in other disciplines, especially business. ML techniques can be applied to many problems that need to interpret and act on data. Arthur Samuel, whose papers in the 1950's on the subject are still worth studying, defined ML as a field of study that gives computers the ability to learn without being explicitly programmed. Samuels (1959) wrote a checkers playing program, had the program play over ten thousand games against itself and work out which board positions were good and bad depending on wins and losses. Forty years later, this definition was formalised as: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E" (Mitchell, 1997, p. 2). In the case of the checkers learning problem, task T is playing games, performance measure P is proportion of games won and experience E is playing practice games. Thus, searching for definitions in cognitive terms favoured by philosophers, e.g., "Can Machines think?" has given way to formulating definitions in operational terms, i.e., "Can it do what we, the thinking entities, can do?"

ML and data mining have so much overlap that it is not easy to distinguish between the two disciplines. ML is more focused on prediction, based on known properties learned from the training data. Data mining focuses on the discovery of (previously) unknown properties in the data. But, ML also employs methods like "unsupervised learning" where there is no training data and data mining uses many ML methods, albeit sometimes with a slightly different goal in mind. In ML, performance is usually evaluated with respect to the ability to reproduce known knowledge, while in Data mining, the key task is the discovery of previously unknown knowledge. The research in the two fields is converging. The best known conferences in the two fields, the European Conference on Machine Learning (ECML) and European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD), were co-located in 2001. In 2008 the conferences were merged into one conference and the division into traditional ML topics and traditional data mining topics has been removed. In the 1980's the field of ML was largely empirical and ad hoc. Over a period of quarter of century, a series of models have been developed that combine technical depth and broad applicability, thus giving the field theoretical adequacy as also effective applications.

Applying Machine Learning

Last 15 years have seen spectacular applications of ML. Siri in iPhones predicts the meanings of human voices and tries to provide the desired answers. Photo album in Facebook recognises faces to be tagged in photos. LinkedIn predicts who the users want to connect with. Since 2013, the Excel program of MS Office can comb very large amounts of data to find meaningful patterns. For example, with bi-directional access to live X (formerly Twitter), it can scan millions of Twitter posts and create charts to show which product is getting the most buzz. A new version of MS Outlook employs ML to review the e-mail habits of users to see whether a user wants to read each message that comes in. Casinos are able to use face recognition to bar entry to card counters. Driverless cars are allowed in several cities in the US. Less glamorous but equally useful applications are found in the field of operations and logistics like supply chain demand forecasting. For example, forecasting the manufacturer's demand under information asymmetry – the bullwhip effect – can be tackled through advanced ML techniques (Carbonneau et al., 2008).

Big business have been placing big bets on ML applications. IBM, seeing an opportunity in data-hunting services, created a Business Analytics and Optimization Services group in April 2009. Microsoft has designed ML software that can trawl internal corporate computer systems with a view to predict which software applications are most likely to fail when seemingly unrelated programs are tweaked. It has combined even more ML with its cloud computing system, called Azure, to rent out data sets and algorithms so that businesses can build their own prediction engines. Drug companies are using ML to understand spread of diseases. The ML approach is being found useful for finding business partners and building reciprocal relationships (Mori et al., 2012). There is hardly any area of business which is untouched by ML. It is viewed as the foundation of a better and smarter future. In the academic world of computer science, enthusiasm for ML has been growing at all levels for the last quarter of a century. In 2010, the Turing Award, recognised as the Nobel Prize of Computing, went to Leslie Valiant, an innovator in this field for his transformative contributions to the theory of computation, including the theory of probably approximately correct (PAC) learning. Next year, at Udacity (a start-up launched by Stanford University) an online course on ML, taught by Peter Norvig, Google's director of research, attracted a record 160,000 students.

ML programmes may not be able to answer questions relating to meaning of life but are getting better at answering queries relating to enterprises. The programmes, however, are yet to

understand nuances of languages and machine translation is improving at a very slow pace. Even so, confidence in the capabilities of ML is growing. The idea of algorithms sucking up and sorting through the otherwise useless garbage of data is appealing and it is easy to be attracted to the mystique of ML. It seems like a new world where thinking need not be constrained by what may or may not be possible. ML seems to be becoming like motherhood and apple pie. Nobody is opposed to it. The reality, however, is a bit more complex. There is a huge unmet demand for applications whereas much of the output is either not being used or is unusable. Netflix paid out the prize money but never used the winning algorithm because extraneous factors came into play. Like any breakthrough technology, ML involves some forethought and discipline before being let loose in the enterprise, especially when it affects public welfare. This article looks at the cutting edge applications of ML in the public sector. The key questions to ask are: “What kinds of business problems do we want to solve?” “What questions do we want to be able to answer?” and finally, “How much would they be worth if we could answer them?”

Transforming the public sector

Machine Learning has emerged as a transformative technology in the public sector, revolutionizing the way public enterprises operate. Its applications span a wide range of domains, bringing about greater efficiency, improved decision-making, and enhanced public services. There are two interconnected areas where ML is making a significant impact in the public sector viz. predictive analytics for improved decision-making and improved public services.

Predictive analytics involves using historical and real-time data to anticipate future trends, needs, and potential issues. For example, in the realm of healthcare, ML models analyse patient records and medical data to forecast disease outbreaks, enabling health authorities to mobilise resources, disseminate preventive measures, and allocate medical staff more effectively. This not only improves response times but also saves lives and resources.

In the context of management of urban areas, ML has contributed to creation of smart cities where, among other activities, it predicts traffic congestion and public transportation demand, allowing city authorities to optimise routes, schedules, and infrastructure investments. ML is used in urban planning to optimise traffic flow, manage public transportation systems, and plan sustainable cities. This can lead to reduced congestion, lower emissions, and more liveable urban environments.

ML improves public transportation systems by predicting ridership, optimising routes, and scheduling services more efficiently. This ensures that public transit resources are allocated in a way that meets passenger demand while minimising costs. Predictive analytics in this field has improved the efficiency of public transport systems and reduced congestion, making citizens' daily commutes less inconvenient.

ML is employed in financial sectors for risk assessment and fraud detection. Algorithms can analyse financial transaction data to identify patterns associated with fraudulent activities or unusual financial behaviour. More importantly, ML algorithms can protect citizens from identity theft.

By harnessing the power of predictive analysis, public organizations can allocate resources more efficiently, enhance public services, and ultimately better serve the needs of their constituents. ML can greatly assist public sector agencies in providing better services to citizens by enhancing efficiency, improving user experiences, and optimizing resource allocation.

ML-powered chatbots and virtual assistants are increasingly being used in government websites and platforms. These AI-driven systems can answer common citizen queries, provide information, and guide users through various processes, such as applying for permits or accessing public services. They operate 24/7, improving accessibility and responsiveness.

ML analyses citizen data to offer personalized recommendations and services. This personalisation enhances the user experience and increases citizen engagement. For instance, in healthcare, ML can help agencies provide tailored health information and treatment plans. In education, it can offer personalized learning paths for students, tailor learning experiences for individual students and personalising curricula to meet their unique needs and abilities. It also assists in administrative tasks, such as student enrolment and assessment scoring.

Typically, public enterprises serve a large number of people, especially in developing countries. ML automates routine administrative tasks, such as data entry, document processing, and form filling. This reduces the administrative burden on government employees, allowing them to focus on more complex and value-added tasks. It also speeds up service delivery and reduces errors. ML processes and analyses large datasets to provide insights that inform decision-making. Public agencies can use ML to forecast demand for services, allocate resources more efficiently, and identify areas that require additional attention or investment. This leads to better planning and resource management.

Public enterprises lay great emphasis on non-discrimination and affirmative action. ML improves accessibility for citizens with disabilities. For example, Natural Language Processing (NLP) and speech recognition can help translate spoken or written text into accessible formats, making information and services available to a wider range of users.

Public enterprises have to remain cognizant of public sentiments. ML can analyse citizen feedback and sentiment from various sources, such as social media, surveys, and public comments. This helps agencies understand public sentiment and concerns, allowing them to adapt and improve services accordingly. Responding to emergencies is another function of public enterprises. ML aids in forecasting and responding to emergencies more effectively. It can predict natural disasters, manage resources during crises, and analyse social media data to identify incidents in real-time, helping first responders react promptly. ML can improve healthcare delivery by assisting in diagnostics, patient monitoring, and predictive analytics. Public health agencies can use ML to predict disease outbreaks and allocate resources accordingly, ensuring better healthcare services to the population (Woo, 2013).

ML can significantly enhance efficiency of resource allocation in the public enterprises by leveraging data-driven insights and predictive analytics to ensure that resources are distributed more efficiently and effectively. ML models can analyse historical data and patterns to predict future demand for public services or resources. For instance, in healthcare, ML can forecast patient admissions, helping hospitals staff appropriately and allocate resources like beds and medical equipment based on expected demand. ML can optimise healthcare resource allocation by predicting patient needs and disease outbreaks. This allows hospitals to allocate staff, beds, and medical supplies more effectively, improving patient care. ML is transforming patient care through predictive diagnostics, personalized treatment plans, and improved public hospital management.

Increasingly, public enterprises are using ML to analyse budget data and historical spending to make data-informed decisions about how to allocate resources across various programs and departments. This helps in ensuring that funds are distributed to areas that need them most and are likely to have the greatest impact.

ML can be a valuable tool in emergency response and disaster management. It cannot predict natural disasters but can assess the potential impact, allowing agencies to pre-position resources and personnel in high-risk areas to respond more rapidly and effectively. ML can be used to monitor and manage environmental resources, such as water and energy. Predictive models

can forecast usage patterns and identify areas where conservation efforts are needed (De Lucia et al., 2020).

An illustrative list of popular applications and the ML techniques therein currently in use by public enterprises are given in table 1.

Table 1: Examples of common ML applications in Public Enterprises. (Techniques most commonly used in bold)

ML Problem	Applications		
	Public Finance	Public services	Other
Classification: identify the maximally distinguishing attributes using training data set	Risk classification (RI – Rule Induction)	Market segmentation (RI – Rule Induction)	Churn management (CBR – Case Based Reasoning)
Prediction: Finding probable future values or distributions of attributes	Forecasting default (RI – Rule Induction)	Customer reaction to promotions (GA – Genetic Algorithms)	Network behaviour (NN – Neural Networks)
Detection: Identifying causes of irregular patterns	Suspicious transactions (NN – Neural Networks)		Cost estimation (NN – Neural Networks)
Association: identifying rules governing relationships		Market basket Analysis (VS – Visualisation)	Similarity assessment (ILP – Inductive Logic Programming)

Unlearning and Relearning

Concepts in ML are better defined than in other branches of Artificial Intelligence, e.g., reasoning, expert systems, planning, natural language, robotics and vision (Hoffman, 2011). But, it does not seem to be headed for continued evolutionary progress in the standard mode. It is full of uncertainty and excitement. Some of the excitement has been due to the recent explosion of digital data from new realms – sensor signals, surveillance tapes, social network chatter, opening of public records and so on. Data overload which is seen as a problem in some disciplines is considered a boon by scholars in the field of ML as they hunt for meaningful patterns in these troves.

ML papers mostly describe a new algorithm and the research relies heavily on repositories - collections of databases, domain theories, and data generators for empirical analysis of ML algorithms. The new algorithm's behaviour is illustrated on synthetic data sets and then the paper reports results on a collection of standard data sets available in an archive. The most commonly used archive is UCI maintained by University of California, Irvine. This repository focuses on tasks like classification and regression and has made cross-domain studies in this area straightforward and commonplace leading to more than a thousand papers citing this repository. At the same time, it has had a harmful effect in the long term as the researchers are neglecting complex tasks like reasoning, problem solving and language understanding (Langley, 2011). There is no consensus within the ML community about what role UCI data set serves other than helping scholars churn out research papers. They are less useful than synthetic data, since the researchers do not control the process through which data are generated and they cannot be called real world data as they are not associated with real world users, experts or operational systems. Worse, they have depreciated the value of formulating problems and defining features. This has been a major concern for public enterprises.

Most public enterprises do not know how best to use accumulated data for improving decision-making. With the exponential growth of technology, public enterprises not only need better tools to understand the data they currently have, but also to prepare themselves for the data they will have. Data has piled up for a long period of time and public enterprise executives are afraid to get rid of it. They know that much of the data is useless but have no idea what use could be made of it in the future. Apart from normal decision making, the data could also be used in litigation and government investigation. This has led to information governance-related paralysis in the public enterprises. The cost of data storage is significant if one includes the cost of all the overheads of managing the different systems and the clogging of the networks as data moves back and forth. ML combined with an iterative workflow that leverages a small amount of human input to identify relevant information can be used to address data hoarding. On the legal side, some software applications have come in the market using which public enterprises can quickly find information that is safe for deletion and feel confident that they have made the right decision. As data accumulation continues to accelerate, more research is required in this direction. Some kind of data-management scheme has to be applied as data arrives so that wasteful volumes of data do not start accumulating and useful data do not fall through the cracks.

Experimental evaluation revolves around performance metrics. The race to improve performance metrics, however abstract, has meant that there is little interest in research on knowledge-generating mechanisms in the public enterprises. At the same time availability of large data sets meant lack of interest in using background knowledge to improve learning rate, marginalising research on learning faster from fewer experiences. A researcher claims victory when her algorithm makes an improvement in say accuracy in classification across certain datasets. The methodologies of showing improvement are open to question. What the meaning of that improvement is in a real world situation is rarely examined in the public enterprises. Moreover, mindless competition among the algorithms reveals little about the sources of power or the effects of domain characteristics. Public enterprises need to use ML diagnostically (what data to use) and if need be opportunistically (finding new data sources). Public enterprises operating in federal countries need to be careful about aggregate data from different states, because laws in different states could be different.

Pitfalls for public enterprises

The need to explicitly programme devices limits our capacity for innovation. ML allows us to build models that, after being trained with large data sets, can help predict real-world outcomes and uncover fresh insights at speed and at scale. Since the term ‘machine learning’ was coined in 1959, the technique has been used to build models that lie at the core of daily applications. However, the topic is not without controversy.

Many public enterprises use terms such as ‘predictive analytics’ or ‘behavioural insights’ instead of ML. This could be because of technophobia or because of the fear that when fraught with bias (the ‘dark side’), ML can be dangerous. One reason is simply that probability is a factor in the algorithms. There is always a potential that they will be off, therefore because they make so many forecasts, it is possible that some of them will be inaccurate. The amount and quality of the data used to train the algorithms, the particular ML technique selected, and whether the system uses only explainable algorithms (i.e., algorithms that allow humans to explain how they arrived at their decisions) may all affect the likelihood of errors, which may prevent the system from achieving maximum accuracy.

Another reason is concept drift. The relationship between the inputs the system uses and its outputs is not stable over time or may be misspecified. When a data is trained in normal times, it would give faulty predictions in covid times creating chaos at a time when the performance of

public enterprises needs to be most efficient. Concept drift is more frequent in countries with a diverse population. When the training data comes from one set of population, it may give faulty results when used on another set.

Even if the patterns the algorithm learned are stable and there is no concept drift, covariate shift can occur. For example, a certain policy or procedure may be designed using data from large urban area. With samples from certain sociodemographic groups who have underlying characteristics not commonly seen in rural areas. Such disparities may be discovered only when more errors are made while in actual use than it did during testing. Given the diversity of applications and the pace at which they are changing, it is becoming increasingly difficult to foresee what will happen in the environment that systems operate in, and no amount of data can capture all the nuances that occur in the real world.

Yet another reason ML can make inaccurate decisions has to do with the complexity of the overall systems it is embedded in. Often the data are of images. The quality of any analysis depends on how clear the images provided are, the specific algorithm used, the data that algorithm was trained with, whether the person inputting the images received appropriate instruction, and so on. With so many parameters, it is difficult to assess whether and why a mistake was made, let alone be certain about its behaviour.

While all enterprises are expected to act in accordance with law, public enterprises are also obliged to act in accordance with public policy which evolves with time. The governments as also the public views the senior management as the final decision-maker and do not apply liability to the software makers. As more black-box or autonomous systems make recommendations with much weaker involvement by the managers, this would cause serious problem in determining the liability.

Ethics is an important part of management of public enterprises. Products and services that make decisions autonomously will also need to resolve ethical dilemmas — a requirement that raises additional risks and regulatory and product development challenges. Scholars have now begun to frame these challenges as problems of responsible algorithm design (Babic et al., 2021). They include the puzzle of how to automate moral reasoning. Such designs are important for public enterprises.

Application of ML in public enterprises cannot follow the pattern of the private sector. Public enterprises lay emphasis on affirmative action. Relying on past data, ML can make a guess

that certain categories of people are not reliable employees or borrowers; whereas these categories of people need to be helped as a matter of public policy. Done right, ML can improve efficiency, help prioritise resources, and gain valuable insights we might have never known. But public enterprises need to be aware of pitfalls. The problem is compounded by the multiple and possibly mutually incompatible ways to define fairness and encode it in algorithms.

Conclusion

ML algorithms have gained an aura of objectivity and infallibility. The use of these tools, however, introduces a new level of risk and complexity in policy (Osoba & Welser IV, 2017). Human-like semantic biases result from the application of standard ML to ordinary language — the same sort of language humans are exposed to every day (Caliskan et al., 2017).

ML should not be viewed as a lifeless technology by public enterprises, but rather as a living organism. The success of these systems in the real world cannot be predicted by laboratory testing alone. The use of these platforms and how users will respond to decisions made by executives should be thoroughly evaluated. Public enterprises should subject their new ML-based applications to randomized controlled trials to ensure their safety and fairness prior to rollout. They need to analyse products' decisions in the actual situations, where there are various types of users, to see whether the quality of decisions differs across them. They should consider testing them in limited situations to get a better idea of their accuracy and behaviour when various factors are at play — for instance, when users do not have equal expertise, the data from sources varies, or the environment changes. Failures in real-world settings signal the need to improve or retire algorithms.

As ML-based products and services and the environments they operate in evolve, public enterprises may find that their technologies do not perform as initially intended. It is therefore important that they set up ways to check that these technologies behave within appropriate limits. There is a significant communication gap between various branches of research on public enterprises. For example, in case of consumer choice, insights from market science are yet to be fully integrated in the management of public enterprises. It is important to note that effective resource allocation through ML requires high-quality data, well-designed algorithms, and responsible governance to ensure fairness and transparency. Additionally, the adoption of ML should be aligned with the goals and priorities of the public sector organisation to maximize its impact on resource optimization. While ML offers numerous benefits in the public sector, it also

raises important ethical and privacy concerns, such as data security, bias in algorithms, and transparency. Striking a balance between reaping the advantages of ML and addressing these challenges is crucial for responsible and effective adoption in the public sector. Moreover, collaboration between the public enterprises, the academia and the civil society are essential to harness the full potential of ML in the public interest.

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Using Natural Experiments in Public Enterprise Management

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Abstract

Research in public enterprise management is becoming increasingly quantitative and scholars are aspiring to achieve the same standards of academic excellence that hard disciplines demand. Researchers in the domains of Public Economics, Public Finance, Human Resource, Marketing and Industrial Organisation, among others, are trying to mimic the principles of Physics by building complex mathematical models and conducting experiments. Since the scope for field experiments management is limited, scholars of these disciplines are increasingly employing natural experiments for research that aims to explore causal relationships in observational studies. Natural experiments are means to overcome some of the obstacles that researchers face while making causal inferences. To compare the actual with counterfactual, the difference-in difference methodology has seen many advances in recent years. However, mimicking research in Physics comes at a cost. Public enterprises due to their social responsibility deal with situations that have significantly more uncertainty than what Physics addresses. With some care, natural experiments can enhance research in management of public enterprises as also inform public policy.

KEYWORDS: Natural Experiment, Difference-in-Difference, Mathematisation, Internal validity, External validity

Introduction

Quantitative research in management is a new phenomenon. Not long ago PhD in management was non-existent and management research would have been considered an oxymoron. Till the 1960's, teaching management comprised of educating the ignoramus and producing "ideal managers" which was sought to be achieved by emulating other good managers. Top-tier universities did not accord management education the status they accorded to law,

engineering or medical education. MIT conveniently utilised the services of the manager of the nearby General Motors assembly plant for teaching (Bennis, & O'Toole, 2005). There were few full time teachers and research was, of course, irrelevant in a setting that hardly provided a comprehensive and professional education. It was not realised that in the decades ahead managers would need a higher order of analytical ability, a more sophisticated command of analytical tools, a greater degree of organisational skill, a greater capacity to deal with the external environment and an enhanced ability to cope with rapid changes. While no one doubted that for most people a strong vocational training, which equips the person to do a first job situation with modest intellectual demand, is essential it was becoming clear to many academics that this was not the job of the management school (Nelson, 1961). This issue also attracted the attention of general purpose philanthropic foundations in the United States where former academics and staff members with strong academic credentials constituted a major contingent in foundation leadership. The result was the publication of the Ford Foundation (Gordon & Howell, 1959) and the Carnegie Foundation (Pierson, 1959) reports. Both reports criticised management courses as being overly descriptive and lacking in serious analysis. Lack of theoretical research, non-intellectual curriculum and teachers with unclear mission were major criticisms in both of these influential "Foundation reports". The US press, especially the *New York Times*, provided extensive coverage to these reports forcing management schools to have serious look at the existing educational system.

Since most content in these reports was based on studies conducted by the management schools themselves, it was impossible for these institutions to ignore the reports or respond to the accusations without appearing to be self-serving and defensive. In the event, the management schools decided to transform themselves into academic institutions of substance. Management came to be seen not merely as a profession but as an important academic discipline as well all over the world. Good management schools now profess a dual mission: to educate practitioners; and, to create knowledge through research. The emphasis is on the latter because the frontiers of research are expanding and increasingly grounded in academic rigour. Few, if any of today's top-ranked management schools, would hire a tenure-track professor whose primary qualification is managing an enterprise with distinction or is reputed to teach well. Nor would they hire a person who has not demonstrated the potential to publish in top academic journals. These publications are usually not directly relevant in the classroom or workplace (Babin et al., 2021). However, accumulation of tiny facts through ongoing research accrete to a larger and more general scientific

understanding of organisational behaviour and the environment in which the enterprises function. Management research impacts the pace of advancement of knowledge in management which in turn impacts innovation and the competitiveness of enterprises (AACSB International, 2012). Adoption of this “scientific model” or “research based model” as it has come to be known, has raised the standing of the management schools within the university vis-à-vis other schools. Instead of merely offering high quality teaching, top management schools offer high level of scholarship through research supported learning process and their mission statements aspire to create ideas that deepen and advance our understanding of management.

Intergovernmental organisations promoting enterprises, like ICPE not only train public sector managers, they seek to facilitate societal advance by supporting research that pushes back the boundaries of knowledge. One consequence of this rigorous scholarship is the increasing importance accorded to the quantitative side of management research. It then follows that not only has Economics become more mathematically oriented but the study of other disciplines has been transformed as well. For example in the field of marketing, intuition and judgement are increasingly being replaced by the probability theory and operations research models. Globally, the emergence of rigorous empirical management research has led to welcome changes in the attitudes and practices of working managers (Williams, 2010). The management scholars now aspire to achieve the same standards of academic excellence that hard disciplines demand.

Some scholars feel that the management schools in their quest for legitimacy and identity have gone too far (Schermerhorn Jr et al., 2020). Top management schools have a number of professors whose only practical experience of management is managing their own research budget and assistants. The trustees and deans of these schools have begun to question the relevance of the costly and lengthy research being conducted and the utility of hiring of costly and unproductive faculty members seeking tenure (Krugman, 1995). Another effort towards mimicking Physics is the quest for experimentation. Undergraduate students present themselves as an unlimited supply of guinea pigs. Management researchers, especially in the fields of Economics and Finance build models of financial markets and other economic systems that are as predictive as models of physical sciences, thus creating a false sense of mathematical precision. While experimental economics and experimental finance have not been able to gain much respect or popularity, scholars in Economics as also other social sciences are increasingly turning towards what have

come to be called natural experiments which are observational studies that can help determine causality.

Mathematisation

Under the hierarchical system, while the quest for Physics in Biology distorts so much of the philosophical thinking about biology (Dennet, 1995), the economists not only try to model their discipline on Physics but try to mimic epidemiology as well by borrowing medical terms like contagion, Dutch disease and liquidity injection to lend their work an air of scientific rigour (Debrue, 1991). There is a yearning to be like Physics which appears to be precise, self-contained, logical, and mathematical. For management scholars, it is the place to be in.

Theoretical Physics is the inaccessible ideal towards which economic theory strives and this striving is a powerful stimulus in the mathematisation of economic theory. While explaining the general principle of comparative static analysis, Paul Samuelson (1947) pointed out that this is essentially the method of thermodynamics. Samuelson (1998) went on to explain that Economics and Physics could share the same formal mathematical theorems, viz., Euler's theorem on homogeneous functions, Weierstrass's theorems on constrained maxima, Jacobi determinant identities underlying Le Chatelier reactions and so on. Mathematisation of Economics led to a series of breakthroughs. The emergence of Econometrics ensured that theory continued to guide empirical research as it does in physical sciences. Option pricing formula used in Financial Management is also the solution to the heat equation (Osu & Egbe, 2016).

Quest for experimentation

Experimentation has been most widely used in the natural sciences leading to spectacular advances in knowledge. An experiment is the deliberate intervention by an investigator in a situation so as to be able to draw inferences about the relationships under study. Experimentation has been found to be much less successful in the social sciences. The main reason for relative sterility of experiments in the area of social research is the unbridgeable gap between the behaviour of elements of nature like electrons and that of human beings. As the Physicist Richard Feynman was fond of saying: "Imagine how much harder Physics would be if electrons had feelings". It is very difficult to persuade human subjects that they are not part of an experiment. The particles of Physics do not choose to behave as they do whereas human behaviour has volition (Heilbroner, 1999). Field experiments also lend themselves to criticism because some people or areas may get

a favourable treatment for no valid reason and also because that people dislike their lives being used as a laboratory.

Social scientists are now turning towards natural experiments. In these experiments (sometimes called quasi-experiments) randomisation is done not by the researcher but occurs through an unanticipated natural event. This method can be traced back to the work of John Snow (1855) in Public Health. According to the miasmatic theory of cholera prevalent the time, it was believed that cholera was caused by bad air and methods such as digging up and removing carcasses of horses were tried to control cholera. To prove that cholera is caused by bad water rather than bad air, Snow compared the changes in cholera mortality rates in the districts served by two water utilities which in 1849 sourced their water supply from the river Thames in central London. In 1852, one of the companies moved its water works upriver to an area relatively free of sewage. Cholera mortality reduced in both areas in 1853 but much more so in the areas supplied by the utility whose water works had moved upriver. With the exception of some occasional published and unpublished articles, natural experiments did not attract much attention in the management literature until the 1990s. Since then, a large number of studies have come out in diverse disciplines and researchers have used this approach to improve causal inference in a wide variety of fields, including Accounting and Corporate Law (Venkataraman et al., 2004), Corporate Social Responsibility (Wang et al., 2011), Entrepreneurship (Rostam-Afschar, 2010), Human Resources (Meyer et al., 1995), Innovation (Lin, 1995) and Strategy (Younge et al., 2015). By now, the methodology has been more or less standardised though finer points continue to be debated.

Through a natural experiment researchers attempt to find a naturally occurring comparison group that can mimic the properties of a control group in a physical experiment. A natural experiment is analysed through Difference-in-Difference (DD) method to reveal the average change caused by the ‘treatment’. DD estimates are derived by using Ordinary Least Squares (OLS) in panel data for several periods of time before and after an intervention. Let Y_{ist} be the outcome of interest for individual i in group s by time t and I_{ist} be a dummy for whether the intervention has affected the group s by time t . The following regression is estimated:

$$Y_{ist} = A_s + B_t + cX_{ist} + \beta I_{ist} + \varepsilon_{ist} \quad (1)$$

where A_s and B_t are fixed effects for groups and time periods respectively, X_{ist} are relevant

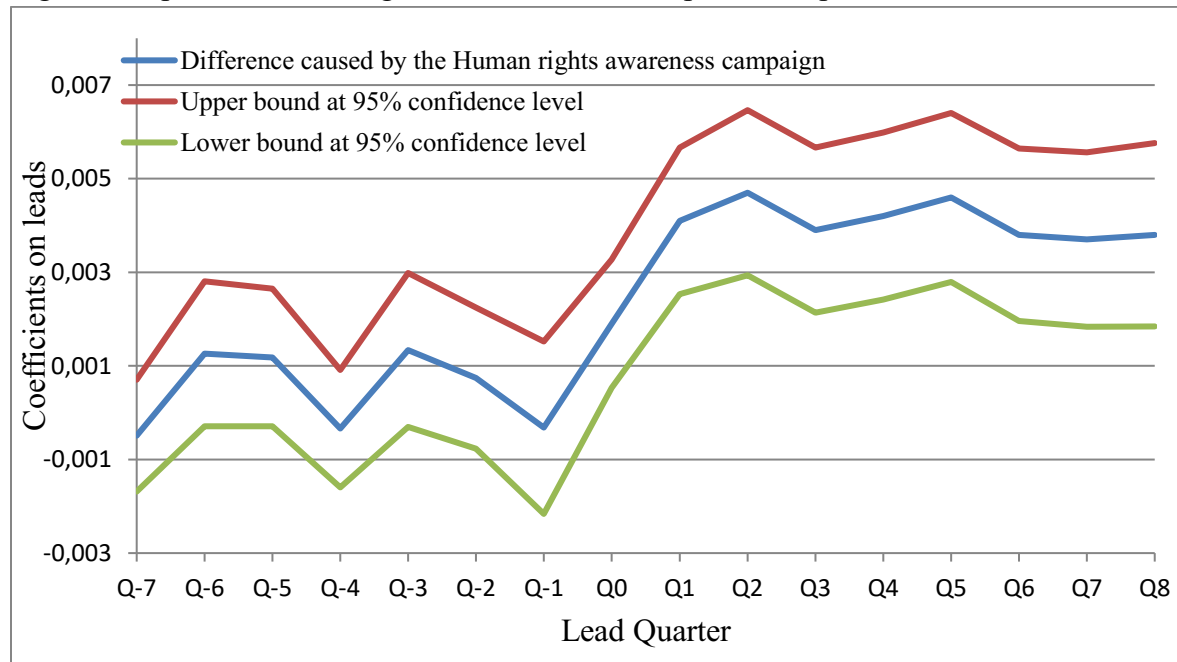
individual controls and ε_{ist} is an error term. The estimated impact of the intervention is then the OLS estimate of β .

DD can not only estimate the average effect of the intervention but also reveal whether the effects persist over time. To assess impact of human rights awareness on entrepreneurship, Figure 1 plots the coefficients of the following regression:

$$Y_{ist} = A_s + B_t + \sum \delta_l Q_{li} + \varepsilon_{ist} \quad (2)$$

where Q_l is a set of dummy variables for lag and lead quarters relative to the time of implementation in a given district. The plot reveals that the awareness of human rights promotes entrepreneurship and the effect of human rights awareness campaign are not temporary blips but last over a period of time.

Figure1. Impact of Human rights awareness on entrepreneurship over time.



DD design has several extensions including DDD which can, for example assess the impact on, say, two different types of potential entrepreneurs. A ‘discontinuity design’ is an extension of natural experiment that exploits situations where probability of enrolment into treatment changes discontinuously with some continuous variable (Blundell & Costa Dias, 2009).

Natural, experiment or neither?

Natural experiments exploit an event that happens to affect some subjects and not others. The researcher assumes that the naturally occurring intervention was assigned as if it was random (Dunning, 2008). There is a continuum of plausibility for natural experiments, defined by the

extent to which ‘treatment’ assignment is ‘as if’ random. This raises major concerns relating to internal validity. First there is the issue of the possibility of endogeneity of the interventions (Besley & Case, 2000). Some authors go to great lengths to prove exogeneity but in many papers the issue is dealt with cursorily. There are concerns about the appropriateness of the control group and linearity assumption in DD estimation. Ongoing research in Econometrics is identifying problems as also solving some of the same. For example, methods are now available to minimise the problem of serial correlation (Bertrand et al., 2004) which was not tackled in older studies showing the findings statistically significant when actually they were not. No natural experiment can claim the internal validity of a Physics laboratory experiment. When management research was in its infancy, it was criticised for not being as rigorous as research in physical sciences (Lorie & Roberts, 1950). Now, researchers in management using fancy mathematics are criticised for assuming certainty and predictability of Physics. In the field of Industrial Organisation, models are sensitive to simplifying assumptions about consumer preferences, asymmetric information and the ability of firms to make strategic commitments. Nobel laureate econometrician James Heckman (2000) doubts whether DD estimator can ever isolate a specific behavioural parameter.

External validity concerns inferences about the extent to which a causal relationship holds over variations in persons, settings, treatments, and outcomes. For a Natural Experiment to produce “useful knowledge” beyond its local context, it must illustrate some general tendency, some effect that is the result of mechanism that is likely to apply more broadly. Unfortunately, results cannot automatically be extrapolated outside the context in which they were obtained. It is well known that there are significant differences between human resource management practices of private and public sectors. Several studies are available from the point of view of private sector management, but scarcely any from the perspective of public sector. There is also the problem of scaling up which does not usually occur in physical sciences. In case of public enterprises, what is observed in small groups may not be relevant in large groups. Yet, many studies that tightly monitor internal validity employ much looser arguments to defend the transplantation of the experimental results to policy. The obvious answer to this problem is replication studies. Apart from the cost, replication studies have the problem of respectability. No academic journal of repute is likely to publish a replication study and therefore in a ‘publish or perish’ no prudent academic will be enthused to take on replication studies which cumulatively can claim external validity. While the use of natural experiments for establishing causality is becoming more sophisticated and probably more reliable,

the problems of internal validity and external validity still remain (Leamer, 2010). Public enterprises need to finance replication studies.

Conclusion

Management of public enterprises is different from private sector management for a variety of reasons (Boye, 2022). Public enterprises face a variety of stakeholders, each of whom places demands and constraints on managers, e.g., taxpayers and service recipients, consumer groups and producer groups (Metcalf, 1993). Public organisations are “open systems” that are easily influenced by external events. It is the responsibility of public managers to protect and promote this permeability of organisational boundaries in order to ensure that services are responsive to public needs. By contrast, private sector executives can and do ignore most constituents’ demands for direct input to the policy design and operations (Ring and Perry, 1985). Political constraints result in frequent changes in policy, the imposition of short time-horizons and risk aversion on public managers (Bozeman & Kingsley, 1987). Public agencies typically have few rivals for the provision of their services. Even when competition is present, public managers frequently enjoy a dominant position in the market, for example in education and health (Stewart and Ranson, 1988). It also argues that ‘public sector organizations often are expected to collaborate with other organizations offering similar services and not compete for customers’ (Nutt and Backoff (1993)).

Modelling Public Economics after Physics has yielded spectacular advances including Game theory, General equilibrium theory, Economics of uncertainty, long-term economic growth, portfolio theory, rational expectations and option-pricing theory, to name a few. The same does not hold for Macroeconomics as revealed by the recent financial crisis which was essentially a macroeconomic and policy related issue. In the field of Industrial Organisation, empirical research provides little guidance to the regulators in respect of mergers. In most of management research, operationally meaningful equations are rare to find. Conservation laws, symmetry, and the isotropic nature of space are some of the most influential ideas in Physics that simply do not have exact counterparts in other disciplines and management literature abounds with false generalisations. Elegance of solutions should not take priority over importance and usefulness of the questions that need to be asked.

Recently, natural experiments have yielded valuable insights in the field of public health (e.g., Albers et al., 2023). Because of the vulnerabilities revealed by the 2008 financial crisis, mathematisation of public economics could become more practical though less elegant. Demand

for quantitative literacy in management education will continue to increase. Much of mathematisation occurred when tools were developed to address the issue of paucity of data. Now there is abundance of data in the public domain and researchers are focussing on choosing the right tools and how best to employ them for analysis. Theory will clarify rather than complicate understanding and beyond identifying the causal effect there is likely to be more emphasis on understanding the mechanism at work. There is cause for optimism on both theoretical and empirical fronts. While physicists are inspired by mathematical elegance and driven by pure logic, forthcoming research in management of public enterprises is likely to take into account the harsh empirical realities.

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Enhancing food security through Public Enterprise

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Abstract

Public enterprises contribute significantly to food security by investing in agricultural infrastructure, ensuring affordability and accessibility of food, and responding effectively to emergencies that may threaten the availability of food supplies. Their interventions play a vital role in safeguarding the well-being and stability of a nation's food system. However, evidence shows that due to problems of targeting the poor and due to endemic corruption in public enterprises, adequate amount of food is not reaching the poor. While the public distribution of food through public enterprises has avoided famines, malnutrition persists especially in small remote villages.

KEYWORDS: Food Security, public enterprise, public distribution

Introduction

The prevalence of hunger in the modern world is a moral burden and a significant intellectual challenge to the development community and policy makers. Experience demonstrates that the availability of means of subsistence and increased earning potential do not inevitably result in the eradication of hunger or improvement of nutritional status. The majority of countries that have attained high standards of nutrition and health have done so by purposefully concentrating on food and nutrition interventions (Pettigrew et al., 2023). An effective system for supplying food grains to the impoverished in rural areas can prevent famine and lessen hunger in developing countries. Experience shows that food and nutrition interventions cannot be left to the private sector and public enterprises across the world are providing food to the poor at an affordable price.

Absence of public enterprise has led to tragedies in the past, the most studied of which is the anthropogenic Bengal famine of 1943 in British India resulting in three million deaths (Mallik, 2023). The 1943 crop yield was actually sufficient to feed the people of Bengal; the famine was

the result of an entitlement failure (Tauger, 2003). According to Nobel Laureate Amartya Sen (1981), the distribution of the food supply throughout Bengali society was hindered primarily by economic factors that affected the ability of certain groups of people to purchase food. The colonial government did not organise a Public Distribution System (PDS). The anxiety about shortages caused hoarding, speculation, and consequent price inflation that put even a basic subsistence diet beyond the means of most poor Bengalis. Today, famine is a rarity except in war ravaged countries and public enterprises across the world are providing food to the poor at an affordable price.

This article is an attempt to understand the policies and practices that determine the availability of subsidised food in rural areas and access to food by the vulnerable sections. It seeks to analyse the factors that lead to a situation in which starvation deaths are very rare, but hunger and malnutrition persist. It looks at the determinants of access to food - including geographical and household characteristics - in rural areas served by public enterprises.

The quest for food security

Food security has been an important item on the agenda for both the academic community and development practitioners for a long time. Definitions of food security and its indicators have been proliferating for the last half century (Maxwell, 1996). According to some estimates approximately 200 definitions and 450 indicators of food security exist (Zoungrana, 2022). Many economists doubt whether it has a precise meaning at all (Timmer, 2015). The most commonly cited definition of food security is that of the Rome Declaration of the Food and Agriculture Organization (1996): “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs for food preferences for an active and healthy life”. This definition is an ideal that no country can possibly achieve. For practical purposes, however, any definition that is intuitively plausible should suffice.

It has been argued that the set of food insecure is larger than the set of poor in developing countries (Wight et al., 2014). Therefore, any safety net targeting the latter would penalise those who are not poor but are food insecure. On the other hand, much of the empirical research shows that the aggregate estimates of poverty and food insecurity broadly tally even at regional levels (Díaz et al., 2002). Leaving out the non-poor leaves out only those sections of food insecure whose consumption patterns have changed by choice, necessitating nutrition education rather than income transfer (Suryanarayana & Silva, 2007). Even so, the changes in consumption pattern and whether they are due to distress or to the choice continues to be a matter of debate (Patnaik, 2007). Since

non-poor households also suffer from undernourishment, there are calls for a reassessment of the current policy of targeting the Public Distribution System PDS almost exclusively at poor households (Ray, 2007). The targeting often works against the policy objective of reaching the poor, as a significant proportion of the poor and food insecure suffer from severe malnutrition and calorific deprivation. Mane (2006) argues that the targeting has worked against the policy objective of reaching the poor, as a significant proportion of the poor and food insecure suffer from severe malnutrition and calorific deprivation. To avoid exclusion errors, a broad targeting or near-universal PDS is often recommended (Swaminathan, 2000). Kochar (2005) examined the case for targeting by assessing the responsiveness of caloric intake to the amount of the food grain subsidy. A low elasticity suggested that improvements in nutrition may require large subsidies and, hence, a targeted programme. However, she also found that targeting reduces the probability of participation by poor households, relative to a universal programme. As a substantial assault on poverty requires targeting scarce resources toward the poor, it is unlikely that targeting will be dispensed with. To avoid exclusion errors, a broad targeting or near-universal PDS is often recommended.

Public enterprise and PDS

Public enterprise is a term that refers to the involvement of the state or public sector in the ownership, management, or provision of goods and services. Public enterprise can have various forms and objectives, such as ensuring public welfare, promoting social justice, regulating markets, or fostering economic development. Public enterprise can also play a role in ensuring food security, which is the condition in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Food security is influenced by four main dimensions: availability, access, utilization, and stability (HLC, 2002). Public enterprise can contribute to improving food security at different levels and through different pathways, depending on the context and the needs of the population. Some examples of how public enterprise can support food security are:

- At the global level, public enterprise can facilitate international cooperation and coordination on food-related issues, such as trade, aid, research, and governance. For instance, the Food and Agriculture Organization (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger, improve nutrition and food

security, and ensure sustainable agriculture. The FAO provides technical assistance, policy guidance, data and information, and emergency response to its member countries and partners.

- At the national level, public enterprise can implement policies and programs that enhance the resilience and sustainability of food systems. For example, public enterprises can invest in infrastructure, market regulation, social protection and food safety. Public enterprises play a significant role in ensuring food security within a nation. Through various mechanisms and initiatives, these entities contribute to stabilising food supplies, managing distribution networks, and addressing challenges in agricultural production. One key aspect is their ability to invest in and support agricultural infrastructure, such as storage facilities, and transportation networks. These investments help enhance productivity, reduce wastage, and ensure a more efficient supply chain from farms to consumers. Mainly, public enterprises are tasked with improving food security by providing subsidised food grains to low-income households through a network of fair price shops.
- At the local level, public enterprise can support small-scale farmers, cooperatives, and community-based organizations that are involved in food production, processing, marketing, and consumption. In Brazil public enterprises have improved food security by linking family farmers to institutional markets, such as schools and hospitals, through the Food Acquisition Program (Flexor et al., 2023). During times of crisis, such as natural disasters or global supply chain disruptions, public enterprises often play a crucial role in maintaining food reserves and implementing emergency measures to ensure continuous access to food supplies. These entities can swiftly mobilise resources and coordinate efforts to mitigate the impact of such crises on food security.

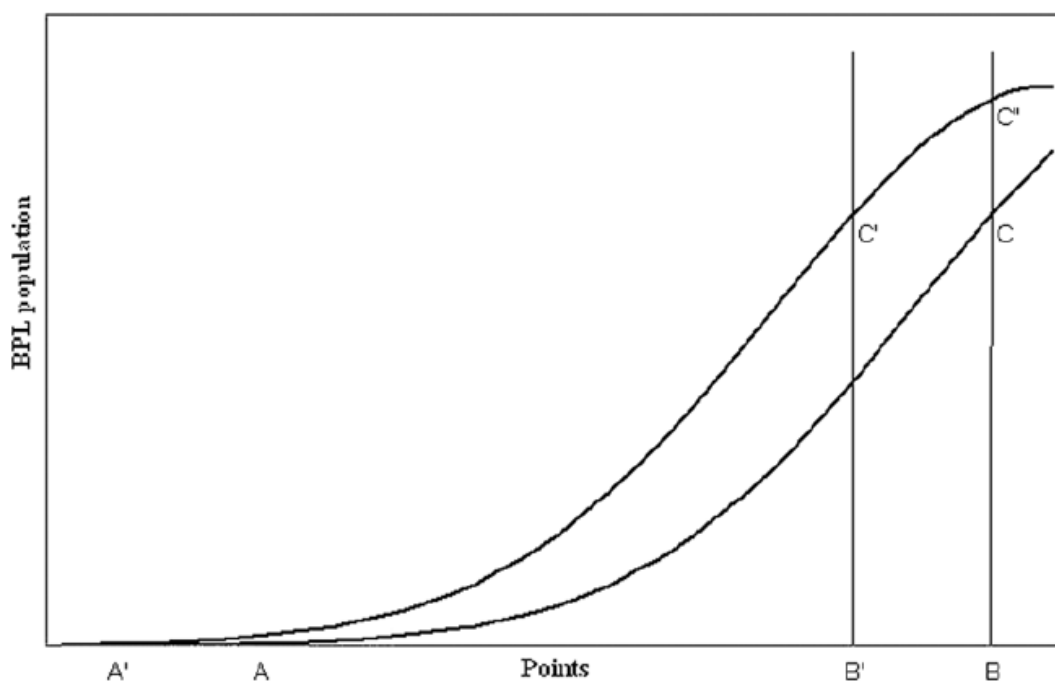
While public enterprises can be an important tool for improving food security at different levels and through different pathways, depending on the context and the needs of the populations, they may also face challenges and limitations, such as inefficiency, corruption, politicisation, or crowding out of private sector. Therefore, a public enterprise should be designed and implemented in a participatory, transparent, accountable, and evidence-based manner, and in coordination with other actors and sectors involved in food security.

The problem of targeting

The identification of the poor is a contentious issue. The federal government, which bears nearly the whole of the burden of food subsidy, relies on the poverty figures based on calorific norms specified by a central agency for each region (Hirway, 2003). The data do not reveal the extent of poverty within regions (Sundaram, 2003). Household schedules are confidential to protect the anonymity of respondents, with a view to getting correct data. The regional governments are told the number of estimated poor in urban areas and rural areas separately, but disaggregated data are not made available. The federal government insists that it is up to the regional governments to decide which households are poor, but the number should be limited to that assessed by the central agency. These poor households are entitled to food grains at a subsidised rate. The delivery is the responsibility of the regional and local governments.

Whether a household is above or below the poverty line is adjudged through a proxy means test on the basis of points awarded, as per the household survey. As an illustration, Figure 1 gives the population below the poverty line against the points awarded to households. In this figure, the curve on the right gives the actual poverty distribution in a state, as per periodic national surveys. As per the instructions of the federal government, point B would be the cut-off point, if area ABC is approximately equal to the assessed number of poor households in the state.

Figure 1. BPL (below poverty line) population distribution



In the identification exercise carried out by the local government officials who live and work in the same district, a large number of households receive fewer points than they deserve. The distribution curve on the left in Figure 1 gives the distribution as per the survey. If the reduction in points was the same for all households, it would not matter at all because the cut-off point would shift from B to B' in such a way that $\Delta ABC = \Delta A'B'C'$. But some households would have been assessed correctly between B and B'; and to avoid exclusion errors, the regional government concerned would prefer to retain B as the cut-off point. Since the allocation of subsidised food grains from the federal government is based on ΔABC and not $\Delta A'BC''$, the beneficiaries identified by the regional or local government agencies will get less than prescribed amount of subsidised food grains, even if a perfect supply chain were to exist. This explains as to why distribution through public enterprises wards off famines, chronic malnutrition persists in poor countries.

The problem of corruption

In the corruption perception index of Transparency International (2023), poor countries tend to do worse than rich ones, partly because poverty makes corruption worse and partly because corruption makes poverty worse (Vinayagathan & Ramesh, 2022). Considering that a lot of money goes into food subsidies in these countries, it is not surprising that public enterprises handling PDS are beset by corruption. From time to time, the mid-level officials of these agencies are prosecuted, either in specific cases or for owning assets beyond their known sources of income. This kind of corruption is a cause of concern for the tax payer but it does not directly affect the access to food of the poor. What affects the rural poor is the outright theft and subsequent sale of PDS articles on the open market and the diversion of food grains to those wrongly classified as poor. As a government doctor in a dispensary informed the surveyors:

When malnutrition cases come to us, we give them tablets; but we know that what these people need is food. Our superiors talk about vitamin, iron and iodine deficiencies, but the real problem is the lack of food. Even the poorest households can afford subsidised price of food; but for the last three months, no food grains have arrived at the ration shop. The person running the shop is getting rich.

When contacted, the person running the ration shop responded:

I have to take care of some people here [local politicians and officials]. I have to take care of people at the supply depot, otherwise no supplies would be forthcoming.

Some non-governmental organisations (NGOs) have organised public hearings, and the evidence reveals that politicians (elected and unelected) are on the take. It has been noted that ministers of the regional governments have taken over the role of personnel managers, and the transfer and postings of functionaries at all levels is within their power.

Two decades back, it was estimated that only a quarter of allocation reaches the intended beneficiaries, while the rest is eaten up by administrative costs, inadequate targeting and corruption (ORG, 2005; PEO, 2005). Recent emphasis is on the use of technology to achieve transparency. The allocations to the fair price shops are published on a website, and the movements of trucks carrying food grains for public distribution are monitored through the Geographical Positioning System. There are proposals for electronic ration cards. There are indications that these measures on reducing corruption.

Data and Methodology

This study covers the rural areas of central-India. Rural areas as those which have a population smaller than 5,000, have a population density less than 1,000 per square mile and have at least 25 per cent of the population engaged in the agricultural profession.

A stratified two-stage random sampling method was used. The first-stage units (FSUs) were the villages. The second-stage units (SSUs) were the households. The sampling frame was the 2001 census list of villages, from which 150 villages were selected; probability was proportional to the population. The eight-digit census code was adopted as identification number for the FSUs. In respect of the FSUs, the following data were easily available from official records:

- population;
- distance from the nearest town;
- mid-day meal available in schools;
- the number of inspections made by government officials; and
- the number of meetings of the shop-level vigilance committee.

Having recorded the data for the FSUs and determined the units to be surveyed, attention turned to the selection of the SSUs. The investigators listed the houses using the order used in the census. Where such listings were not available, listings were started from the north-western corner of the settlement. Thereafter, from each FSU, 30 households were selected using a circular system with equal probability and a random start. A ten-digit SSU identification number was arrived at by adding the two-digit household number to the eight-digit FSU identification number.

Details were obtained for the 4,500 selected households. Data from the government survey were accessed. Household characteristics, such as the educational attainments of the head of the household, were also available in the official records. Through a simple questionnaire, points were calculated using the method adopted by the government surveyors, after making it clear to the respondents that this was purely an academic exercise.

After looking at the ration card and after a personal interview, the receipt of food grains from the shop was recorded. The average of the last six months as recalled by the household was taken as a reliable figure. The pattern that emerged from the inspection of data and preliminary analysis was as follows.

- While the shop is supposed to receive supplies every month, in some months no supply was received. This is not compensated for in subsequent months.
- The amount available for poor families depends on the supplies received by the shop, but is not the same for all households.
- Rations are not given on a first-come-first-served basis, or on any fixed criteria. Some households get less because the stock available is insufficient, and some households do not get any because the FPS has run out of stock

Variables

In order to examine access to food by below poverty line (BPL) households, the dependent variable is a log of the availability of food grains in the household over a month. Since the monthly availability has been averaged over six months, there is no problem of zero observations. The independent variable education is the number of years of education of the head of the household. The test proposed by Bera and Jarque (1982) was used to confirm the validity of a general model requiring the estimates of the restricted model. MDW test (McKinnon et al., 1983) found that the natural logarithm of distance as compared to distance in kilometres would be better as an

explanatory variable. The test was used for other variables also and log of population was included as independent variable.

The senior officers of the public enterprise as also government officers of the regional government are expected to inspect the shops. Inspection is an independent variable indicating the number of inspections by administrative officials during the preceding quarter. ‘Vigilance’ attempts to capture the impact of local political pressure on service providers. For each shop, there is a vigilance committee chaired by the head of the village council of the area in which the shop is located. If the shop covers villages of a neighbouring council, the head of that village council is also included in the committee. Other members are unelected political appointees. Due to the lack of a consensus within the ruling party at the field level, many of the posts on the vigilance committees remain vacant and a large number of these committees are non-functional. Thus ‘Vigilance’ is a dummy variable taking the value of 1 if the committee is functioning and 0 if it is not.

Determinants of access

Table 1 reports ordinary least square (OLS) regression results in respect of access to food by the BPL households. While education is not a significant variable, the independent variable measuring remoteness is significant at 1 per cent level. The independent variable representing the size of the village is significant at 5 per cent level. The variable indicating inspections is significant at 1 per cent level, while the dummy variable representing the vigilance committee is significant at 10 per cent level.

Table 1: Access to subsidised food grains by BPL households: OLS regression results
Dependent variable: log of availability of food grains in kilograms.

	Coefficient (Standard error)
Constant	2.177*** (0.598)
Log of distance	-0.083***(0.017)
Log of population	0.111**(0.0511)
Mid day meal	-0.002(0.007)
Education	0.003(0.007)
Inspections	0.112***(0.043)
Vigilance committees	0.142*(0.077)
Adjusted R square	0.57

To examine the robustness of the estimated model, several methods were tried:

- (i) altering the sample size by randomly excluding some households from the sample;
- (ii) regressing in linear and log-log functional forms by taking log of some variables and using others in the original form;
- (iii) replacing some of the independent variables by related variables, e.g., continuous variable ‘education’ by dummy variable ‘literacy’; and
- (v) including additional independent variables, such as the income of the household.

However, none of the estimated alternative specifications change the observed empirical relationship between the indicator for the BPL household’s access to food and the variables found significant in Table 1. Hence, these are not reported.

Given that the remoteness is anecdotally associated with supply chain problems and a lack of supervision, one would expect that, all else being equal, the longer the distance between the village and the nearest town, the greater the problem of access. The coefficient for the variable representing remoteness has the expected sign. It predicts that a 10 per cent increase in distance will be associated with a 0.8 per cent decrease in availability. The size of the village is no less important a determinant. The regression predicts that, controlling for other factors, accessibility to food in larger villages is better than that in smaller ones. An increase of 10 per cent in the size of the population will be associated with a 1.1 per cent increase in availability.

It is expected that each shop will be inspected by the officers of the public enterprise frequently as also by the government officers every two months. These inspections are irregular and often ineffective or collusive. Nevertheless, the coefficient of this variable was found to be positive and statistically significant. Further, a functioning vigilance committee also results in a significant increase in availability.

It was found that the population of the village is positively related to access to food, the distance from the nearest town is negatively related. Availability of mid-day-meals to the school children was not found to be a significant variable. Educational level of the head of the household was not found to be a significant variable. While education creates awareness, it does not seem to

directly affect the availability of subsidised food. On the other hand, inspections by the officers of the public enterprise and the government seem to have increased availability of food significantly. The analysis shows that the small remote villages are being inadequately served by public enterprises. To a large extent, control over inefficiency and corruption through administrative measures can address the problem of malnutrition.

Conclusion

The nutritional levels of the rural populations in most developing countries are lower than that of the urban populations (Nabdi et al., 2022). The UN World Food Programme (2022) suggests that the volume of food produced is more than one and a half times what is needed to provide every person on earth with a nutritious diet. However, the interaction of the food sector with the institutional fabric of social relations determines access to an adequate supply of food to the poor. NGOs can play a role in improving food security in the countries where such organisations are active (Hyder & Husain, 1999). Public enterprises should not view NGOs' criticism of their working as interference. Instead, they should encourage NGOs in exposing inefficiency and corruption.

In a functioning democracy, it is often the case that different social groups lobby hard to get a larger share of the developmental pie. Poor people in small villages and remote areas are unable to make their voices heard. The warning issued by Jean Dreze and Amartya Sen (1989) is valid even after years of rapid economic growth in some developing countries:

Starvation deaths and extreme deprivation are newsworthy in a way that the quiet persistence of regular hunger and non-extreme deprivation are not. Endemic hunger may increase the morbidity rate and add to the mortality rate, but that is primarily a statistical picture rather than being immediately palpable and - no less importantly - being 'big' news.

The current policy of focusing on the most vulnerable population avoids deaths due to starvation. Careless targeting, a lack of supervision and corruption in the delivery system, however, mean that malnutrition will continue to haunt certain sections of the rural population. Public enterprises in the field of providing food security need reforms if their objective is to be broadened from avoiding famines to combating malnutrition.

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