BUSINESS REVIEW

Annual Peer Reviewed Journal

ISSN : 0973-9076

Vol - 18 No. 1 December 2024

SJIM

St Joseph's Institute of Management (SJIM)

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ISSN 0973-9076
Printed & Published by: Director, St. Joseph's Institute of Management, Bangalore, Karnataka, India

BUSINESS REVIEW

(A Journal of St. Joseph's Institute of Management)

Volume 18, No. 1 **December 2024**

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Editor's Note

Dear Readers,

I am pleased to announce a release of December 2024 issue of the Journal 'Business Review', published by St. Joseph's Institute of Management Bangalore (SJIM) Bangalore. The six carefully selected papers aim to communicate the findings of contemporary research going in the area of economics and business management.

The article titled 'Modifying the Inflation Target When Food Remains Too Expensive' by Mr. Vivek Moorthy examines the recent divergence between food and non-food inflation in India. It discusses how the food inflation has remained high and non-food inflation has been below the RBI's target. This has led to a debate on the effectiveness of the current inflation targeting framework. To address this issue, the paper proposes a modified Taylor rule that specifically targets food inflation while also considering overall economic conditions. This approach aims to balance price stability and economic growth in the face of food price shocks.

A study on 'The Effect of Dividend Announcement on Share Prices Evidence from Colombo Stock Exchange' by A M D S Kumari & G R M Gamlath investigates the impact of dividend announcements on share prices of companies listed on the Colombo Stock Exchange. Using a sample of 95 dividend-announcing companies, the research examines daily share price changes five days before and after dividend announcements. The findings suggest that, contrary to expectations, dividend announcements do not significantly influence share price movements on the Colombo Stock Exchange implying that investors may not react swiftly to such announcements.

The research paper entitled 'Logistical Challenges of Chinese E-Commerce Platforms: An Empirical Evidence' by Dr. Bhaskar Basu & Dr. Ritesh Kumar Dubey examines the impact of last-mile logistics service quality (LMSQ) on customer satisfaction in

the e-commerce industry. Despite the growth of e-commerce, many businesses struggle to maintain high levels of customer satisfaction, particularly in the last-mile delivery stage. The study found that all dimensions of LMSQ, including delivery time, packaging quality, ease of tracking, and return policies, are statistically significant in influencing customer satisfaction and together, these factors explain 76% of the overall satisfaction.

The article entitled 'Digital Transformation in HR Tools – A Perspective from Engineering Institutions in Bangalore' by Dr. Rashmi Singh Roy & Mrs. Rajimol K P examines the impact of digital HR tools on the performance of engineering institutions in Bangalore. The study found that the adoption of these tools has led to improved employee productivity and a more positive work culture. By automating administrative tasks like employee database management, leave requests, attendance tracking, and payroll processing, these institutions have streamlined operations and reduced paperwork. The research highlights the significant benefits of digital transformation in the education sector, particularly in enhancing HR efficiency and employee satisfaction.

The study titled 'Restructuring Business Models in Food Industry for Sustainability- A Study at Mysore City by Dr. S P Sunitha examines the impact of digitalization on the food industry, specifically focusing on the rise of online food delivery apps. The research delves into the challenges and opportunities presented by this new business model, particularly for small and medium-sized food businesses in Mysore City. The study found that younger entrepreneurs, particularly from the millennial and Gen Y demographics, have embraced digitalization to adapt to the changing market landscape. While online food delivery apps have expanded customer reach and increased sales, they have also introduced operational challenges such as increased costs, logistical complexities, and competition.

The research paper titled ‘A.I. Driven Smart Healthcare Enhancing Society 5.0 by Healthcare Information Systems Adaptation and Healthcare 4.0 by Varun. R. Mirlay, Dr. Rajat Gera & Dr. Adrian Bradshaw explores the role of AI-driven smart healthcare in enhancing and optimizing healthcare services, particularly in the context of Society 5.0. The study highlights the increasing importance of digital transformation in the healthcare industry, driven by advancements in technology and the growing demand for efficient and accessible healthcare services. The paper emphasizes the need for healthcare information systems to adapt to these changes. By integrating AI and automation, healthcare organizations can improve efficiency, reduce costs, and enhance patient care. The study suggests that a balanced approach, combining technological advancements with effective change management, is crucial for successful implementation.

I extend my sincere gratitude to all the authors for their invaluable contributions. I trust that this edition of the Business Review will significantly enrich the knowledge and understanding of our readers. The research presented here has the potential to drive innovation and progress in business, economy, and society.

Dr. Deepika Joshi
Editor – Business Review
(ISSN: 0973-9076)

Modifying the Inflation Target When Food Remains Too Expensive

Vivek Moorthy[1]

Abstract

In recent months in India, food inflation has been persistently high and above the RBI's headline inflation target while nonfood or core inflation has been declining and below it. The academic members on the rate setting Monetary Policy Committee kept recommending lowering the repo rate while the RBI officials, in the majority, repeatedly voted to keep it unchanged. A debate has been underway in policy circles as to whether and how the RBI's current inflation target should be modified to cope with this situation. This paper uses an earlier, two period, two person (rich and poor) and two item (food and nonfood) model that shows how aggregate utility can fall, despite GDP rising and with inflation being on target. It proposes a quasi-Taylor type rule to make the policy rate respond to excessive food inflation, yet based on the headline inflation rate, and with scope to be also responsive to the GDP gap.

Keywords: Inflation Targeting, Food Inflation, Monetary Policy Committee, Taylor Rule, Reserve Bank of India, Federal Reserve, Price Level Targeting

1. Introduction

Due to divergent trends in inflation, this year 2024 has been eventful and disputatious for monetary policy in India. Since January 2023, there has been a steep decline in non-food inflation, from 6.0% down to 2.3% for three months in a row April to June 2024. For twelve months in a row ending September 2024, non-food inflation has been below the 4% headline inflation target of RBI. This decline motivated Professors Goyal and Varma, two of the academic members on the RBI's Monetary Policy Committee (MPC) to continue with their dissents, in favour of cutting the repo rate from 6.5% where it has been since February 2023. Their statements indicated they were in favour of easing since core inflation had fallen below target, and enough growth had already been sacrificed to bring headline inflation down to target. Their

[1] Distinguished Professor (Economics), St. Joseph's Institute of Management, Bengaluru. Research Assistance was provided by Vaibhav Raj.

dissents were prominently cited in the media (Srivastava, 2024). The full statements of all members are in the minutes of the MPC meetings posted on RBI's website.

In opposition to them, the RBI members on the MPC stuck to their stance of keeping the repo rate at 6.5%. To begin with, this paper argues that the stance of the RBI members was sound. First, the RBI's mandate is to target headline inflation, which was still at 4.8% for April and May 2024, as of the MPC dissents.[2] Further, food inflation was above 8% for eight months in a row as of June 2024 data, and more than double the headline target. Relevant data on headline, food and nonfood price levels and inflation are presented together in Appendix I, for easy reference and perusal.[3] The discussion in this paper is heavily based on this Appendix.

As it transpired, the data that came out for July painted a different picture. Food inflation fell sharply from 9.4% in June to 5.4%. That brought the headline inflation to 3.6%, below its mandated 4% target. That drop seemed to perhaps justify the dissenting dovish stance that food inflation was due to supply shocks and hence RBI must focus upon core inflation in deciding the repo rate, even though the target is headline. The August data were along the same lines with both core and headline inflation again below the target.

Subsequently, however, September's inflation came out high at 5.5%, and with core inflation rising from 2.4% to 3.1%, reversing a long fall, while food shot up back to 9.2% (see Appendix I). Keeping in mind that the macroeconomic situation can suddenly change, the RBI's hawkish stance seems to have been vindicated. The RBI Governor and members on the MPC should be commended for sticking to their guns! Specifically, the Deputy Governor has repeatedly pointed out in recent months that

[2] A grammatical clarification is called for. Inflation for a given month, say June, is reported in July. The statement in July that "inflation *for* June *or* during June or *as of* was x.x%" is correct. But the statement that "inflation *in* June was x.x%" is ambiguous, since only in July do we know what June's inflation was. While this paper will try to maintain chronological precision, it should be clear from the context as to which month's data is being reported or discussed.

[3] In evaluating voting records, complications arise since the data available *at the time* of the meeting can indicate quite a different situation than *later data* when the minutes of the meeting are released -- two weeks later by RBI. The earlier data get revised too. MPC members voting records and statements should be judged by the preliminary data at the time of the meeting, not always easily available. The mini Table at the bottom of Appendix Ib provides recent meeting dates, release dates of MPC minutes, and also CPI data release dates.

due to adverse climate change effects, food inflation is likely to be high and that the RBI alone has to shoulder the burden of keeping inflation in check Patra et al. (2024b).

In commenting on the dissents, I had argued in early July, drawing conceptually on Milton Friedman's December 1967 Address, that trying to target a real rate of 2% and accordingly cutting the repo rate was not warranted. (Moorthy, 2024a) In the MPC Meeting on 6th to 8th August, RBI Governor Shaktikanta Das stated in an interview that "the issue of equilibrium natural interest rate is premature…any justification for easing based on so called high real rates can be misleading." (2024)

From a broader perspective, much of the agonizing deliberations and vacillations of the Federal Reserve and other central banks result from frequent zigzags of the inflation rate. In my opinion, central bankers globally have mistakenly chosen to target inflation at frequencies that are too high. Globally, the lowest chosen frequency is annual (year over year) inflation, which India also has chosen. The highest chosen frequency is month on month inflation, seasonally adjusted at an annual rate, as in USA. Annualizing the monthly inflation rate amplifies the monthly shocks.

However, even at an annual frequency much of measured inflation is merely due to random shocks to the price level. The price level shocks also get reflected in its proportional first difference i.e. the inflation rate. Indeed this was the reason why Milton Friedman (1959) argued against price level targeting. From this viewpoint, inflation can only be controlled over multiyear horizons.

The de facto operating procedure of central banks at present involves what is called flexible inflation targeting and colloquially 'inflation targeting lite': ignore the inflation shock in the latest data. Look past it, and instead pursue the target over a longer muti-year horizon. But doing so entails losing credibility and will entail loss of inflation control if the rise persists.

There may be a far better way for central banks to deal with price shocks. Building on findings cited below, in a comment on the Urjit Patel et al. (2014) report I had recommended "it is far better to pursue a low frequency metric with a near target date than a high frequency metric with a far-off target date (Moorthy, 2014)." Based on examining the intra year range and other measures of inflation volatility, it can be argued that a three-year (moving) average of headline inflation is the best choice for

the inflation target under recent and current Indian conditions. Such a metric is free of the base effect.[4]

This vital issue of the frequency of the chosen metric of inflation (monthly inflation, seasonally adjusted at annual rate, or year over year, or a multi-year average) is relevant to most central banks at present. However this is outside our domain. Instead this article engages with a different but no less vital quandary that central bankers globally are dealing with now.

The quandary and associated ones, can be described as follows: Food prices are volatile but food is also the most essential item in the CPI. Let us ignore its volatility. Consider an economy where headline inflation is on target and continues to remain there i.e. a situation of long run equilibrium in some dimensions. Also suppose that food inflation is above trend and steady. Similarly, non-food inflation is below trend and steady. Thus essential items are getting more expensive while less essential items are getting cheaper. As a result, the standard of living of the public as a whole may be falling, although per capita consumption and GDP could be rising, and the economy can seem to most analysts to be in good shape. Should monetary policy ignore the squeeze on living standards and remain content that the headline inflation target is being met? Or should the central bank make some adjustments to the inflation target to alleviate the hardship from high inflation in necessities?

This paper conceptually engages with this quandary, drawing upon earlier work.[5] Section II examines in detail the evolution of inflation targeting globally and in India. Its reference point for discussing India is the Urjit Patel et al. (2014) Committee Report. Section III outlines the conceptual microeconomic foundations of inflation targeting, highlighting the utility loss from steady inflation. Section IV draws upon a 2011 model simulation to outline how inflation can be on target with GDP rising and yet utility can be declining. Section V provides some tentative suggestions as to how

[4] Evidence on the suitability of the three-year average of inflation for setting *deposit* rates is provided in Moorthy (2001). A three-year metric, again used in Moorthy and Kolhar (2007) pointed to overheating of the Indian economy during the BRICS boom of that decade. Detailed justification for basing policy on a three-year average of inflation is in the doctoral thesis of Kolhar (2013).

[5] The need to deal with differential food and non-food prices even when the price level is stable was called a dilemma in Moorthy and Kolhar (2011). The broader term quandary, or quandaries, is more appropriate.

to modify the inflation target to deal with the present situation now prevalent in both emerging and developed economies, with inflation targets often being met but the public struggling with the high cost of living of necessities.

2. Evolution of Inflation Targeting Globally and in India

As a broad strategy -- as distinct from precise tactics -- inflation targeting is here to stay globally. As of end 2003, about 25 countries had formally adopted inflation targeting as a strategy. Ten years later that number had risen to 28. India joined the bandwagon and formally adopted Inflation Targeting in 2016 based on implementing the January 2014 Urjit Patel Report. Appendix II provides a list and chronological record of the adoption of inflation targeting.

This section discusses valid and invalid reasons for central banks choosing not to follow inflation targeting. The invalid reason, confidently asserted by many about a decade ago, is that inflation in India is driven by food supply shocks and cannot be controlled by the RBI. Many well-known academics and commentators espoused these views about India's inflation, including those chosen by RBI in various advisory roles.

The dominance of supply shocks upon inflation in monthly data is undoubtedly huge. The reason for this has been adumbrated in the previous section. In Indian discussion, supply shocks are still invoked, but not so often, less emphatically, and by fewer economists. For reasons of brevity, citations of those against inflation targeting on the grounds that India's inflation is driven by supply shocks and cannot be reduced by tight monetary policy, are eschewed here. Such citations have been provided by this author in earlier articles.6

However, over a longer period, evidence from decades of inflation targeting clearly indicates that tight monetary policies can definitely reduce inflation [Schmidt-Hebbel (2008)]. Compared to the Volcker disinflation, India's starting point for inflation targeting in 2016 was below prolonged double digit inflation. Hence its success so far

[6] Nevertheless, to get a sense as to how much opinion has shifted, it should be pointed out that about a decade ago the shift in the focus of RBI and policy makers from the Wholesale Price Index (WPI) to the Consumer Price Index was under way. At that time, an economist who was critical of the shift wrote an article titled "Republic of CPI" [Kohli (2014)]. My passing thought on that title was that luckily India is moving away from the banana republic of WPI!

has also been moderate. Further India has had to cope with the pandemic's disruption of global supply chains and then various repercussions of the Ukraine war on wheat and other prices. The RBI has weathered these storms rather well.

One valid reason for eschewing inflation targeting is that it is too reactive a policy and thereby risks destabilizing the economy. Indeed, the term Inflation Targeting is a huge misnomer and is misleading. According to this author, it is more accurate to call it Direct Inflation Targeting, with the acronym being DIT.[7]

Some of those opposed to Inflation Targeting, in particular Milton Friedman, strongly favoured the final goal of zero inflation. To achieve it, he advocated a constant growth rate rule for money supply as an intermediate target. However, the final goal of low inflation can be achieved via different approaches, of which a DIT rule is just one. Indeed the Federal Reserve Chairman Paul Volcker who conquered double digit inflation during the early 1980s often stressed that no rule can be counted upon to deal with a complex, rapidly changing economy. Hence the central bank should pursue the goal of price stability by using its discretion.[8]

As implied by the matrix below, being hawkish on inflation need not imply advocating that the central bank pursues an inflation target and vice versa. The German Bundesbank and the Swiss National Bank had a far better track record on inflation than the Federal Reserve without ever considering formally targeting it. Conversely many emerging economies that formally target inflation have an inflation target range that reaches upto 6% or higher, which implies acceptance of what can be considered moderate inflation.

From a preemptive standpoint, a strict inflation targeting rule is not enough. Even if inflation is at target and even below target, financial macro prudential measures may

[7] The term and associated acronym IT came into vogue after the pioneering paper by Bernanke and Mishkin (1997). Although it should be called Direct Inflation Targeting with the acronym DIT, based on prevailing dominant usage, one is compelled to use the term IT [Moorthy (2009)]. A minor, separate matter is that IT is a particularly confusing acronym in India since the term IT here became synonymous with the Information Technology sector, before its use by economists!

[8] In the gold standard era, price stability was the goal, which implied accepting long periods of deflation i.e. when the price level itself falls. Price stability has been redefined in the post Volcker era as 2% inflation and completely avoiding deflation. Volcker was for outright stable prices, not 2% inflation.

be needed to reduce potentially destabilizing activity. The main such measures are raising margin requirements on equity purchases and on financial derivatives, restricting mortgage borrowing by raising the minimum percentage down payment on a housing loan, lowering the maximum monthly EMI (Equated Monthly Installment) loan to income ratio to qualify for the loan. When credit is rising too rapidly in relation to nominal GDP, the interest rate may need to be raised, even if inflation is within range.

Table 1: Categorizing Monetary Policies

Strategy	Rules	Discretion
Pre-emptive	Milton Friedman's money growth rule: 1950s onwards	Fed chairman Martin (1951-1969) Fed chairman Volcker (1979-1987)
Reactive	Direct inflation targeting: Many central banks New Zealand 1990, Canada 1991, the UK 1992. Endorsed by Bernanke and Mishkin for the Fed in 1997	Greenspan (1987-2006) Discretionary pursuit of 2% (implicit) inflation target

Source: How Inflation Targeting Evolved, Moorthy (2009)

Federal Reserve Chairman Greenspan's failure to implement such macro prudential policies contributed to the dotcom bubble and then bust of 2001.[9] The same critique applies to his successor Bernanke. He did not make efforts to rein in the subprime loan based mortgage market, which completely collapsed after 2008. Overall Bernanke was not preemptive against financial over leveraging, indicating the failure of a mechanical inflation targeting policy as shown in the matrix above.

Discussion of the above issues can be subsumed under what can be called Minskyian macroeconomics. This whole subfield, incorporating both financial and banking regulation and behavioural finance matters, emerged after the September 2008 Lehman Brothers crash [Wray (2018)]. Most "Minskyians", vehemently

[9] The well-known BIS economists Borio and White (2004) were early critics of the Federal Reserve's laxity, based on their August 2003 paper at the annual central banker's conference. Even *prior to that*, in a coauthored article in January titled Sir Alan's Day of Judgement, I had pointed out that Greenspan could have used the Federal Reserve's power under Regulation T to tighten equity margin requirements during the dotcom boom (Moorthy & Pradeep, 2003).

recommended expansionary policy even when inflation was below the explicit or implicit target since the economy was collapsing badly. While emergency easing was certainly needed for some time after the September 2008 crisis, very few of its proponents in real time had called for preemptive rate hikes well before the crisis. A central bank that is preemptive during the expansion phase will not end up with having to deal with damaging deleveraging that calls for cutting rates so as to ensure negative real rates during the subsequent contraction phase.

Minskyian macroeconomics also implies that at times it will not even be logistically feasible to pursue an inflation target. If massive deleveraging is under way and credit demand has shrunk badly, the money market window of the central bank will be in surplus mode and money market rates would have dropped close to zero. Then the policy rate has to be lowered in tandem with the drop in market rates, whatever the inflation rate. For the purposes of our discussion we can ignore such extreme financial market conditions as prevailed in the aftermath of the 2008 global financial crisis.

The financial sector apart, another important neglected justification for preemptive tightening is due to the Keynesian phenomenon of short run quantity adjustment during the expansion phase i.e. sticky prices. Higher nominal demand initially shows up in higher growth without inflation, since firms are reluctant to raise prices initially to retain loyal customers. This phenomenon was well captured in Okun's illuminating phrase "the invisible handshake".

Due to such a strong short run quantity adjustment phenomenon, policy makers often conclude that potential GDP growth has risen, as many did in India and other BRIC countries during 2005 to 2007. Based on this conclusion, their central banks did not tighten when inflation remains low. But the excess demand slowly found its way into higher inflation with less growth during the subsequent stagflation phase.[10]

The above considerations pertain to a closed economy. These difficulties notwithstanding, in my opinion, the benefits of having a precise inflation target largely outweigh the costs. The global track record of inflation targeting indicates that it has

[10] A summary of Okun's (1981) invisible handshake arguments is provided in Chapter 3, Section 5 of Moorthy (2017). Evidence on the unrealistic projection of India's potential GDP growth and the subsequent stagflation, well after India's 9% growth hatrick during 2005 to 2007 ended, is provided in Moorthy (2017) in Chapter 7, Section 1.1 titled The Widespread Nine Percent Euphoria.

lowered inflation successfully [Mishkin (2000)]. If the RBI, or any other central bank, did not have a specific inflation rate target they could point to, in order to justify to the public and their critics as to why they are raising, or not lowering rates, it would be politically much more difficult for them to do so.

In a financially open economy it is much harder to implement inflation targeting, although the impossible trinity condition postulates that this is possible. When the Rajan Committee (2008) advocated greater financial openness, it was explicitly also stated that India should adopt a flexible exchange rate system, along with active futures market to enable hedging of currency risk. Under these conditions, inflation targeting is feasible. In principle this is a sound stance. But hard facts can intrude upon sound logic.

In practice, as central bankers know quite well, many of them have to raise or lower interest rates in tandem with the Federal Reserve to prevent undue depreciation or appreciation of their currency. The sole exception to this is China, whose sheer economic size and clout enable it to follow a fairly autonomous monetary policy. The impossible trinity can be fairly accurately described as a semi failed trinity. Nevertheless countries with large FX reserves in relation to their GDP, exports and imports, including India, can and do 'navigate' the trinity.

All things considered, the various drawbacks of inflation targeting are minor compared to the benefits accruing from anchoring expectations. Central banks can more easily raise interest rates by pointing to the inflation rate being above target, despite political and other pressures to do so. In my opinion, as the broad framework for macroeconomics and monetary policy, inflation targeting supplemented by discretionary macro prudential regulation is the best combination.

3. The Microfoundations of the Chosen Inflation Rate Target

There is a voluminous amount of literature and umpteen central bank publications on inflation targeting. Most of this literature fails to clearly provide the rationale for inflation targeting. Specifically, the Urjit Patel et. al. (2014) Committee presented a Table, drawing on RBI's previous econometric studies and its own research suggesting that India's "threshold" inflation rate varied between 4% to 6% (RBI 2014, pg. 78) This is the rate beyond which, implicitly, higher inflation would reduce growth.

Perhaps based on this table, 4% was chosen as the target rate with a + or minus 2% tolerable range, and mandated by Parliament in 2015.

While the Urjit Patel Report does not explicitly mention the term growth maximizing inflation rate, the various studies it has cited suggests that it has been influenced by this concept. This concept was implied in an influential paper by Sarel (1996). He estimated that the negative effect of growth on inflation above 8% was "extremely powerful". When inflation is below the 8% threshold, Sarel found that its effect on growth is positive but "very weak and statistically insignificant" (emphasis added). The sensible conclusion to have drawn would have been to ignore the estimated positive effect of inflation on growth in choosing an inflation rate target, since the effect is not significant.

Unfortunately many researchers began to estimate a threshold rate of inflation, as several RBI studies did, using Sarel type spline regression methodology (Appendix III). The conclusion from these studies was to pursue the estimated threshold rate as a target, ignoring the other costs of inflation discussed below.

The pioneering analysis of Friedman (1968) and Phelps (1968) pointed in the opposite direction from the threshold inflation rate, providing a clear rationale for a zero inflation target. They developed the natural rate of unemployment hypothesis and the associated expectations augmented Phillips curve concept from pure logic, and deduced that the Phillips curve would shift up, which it did in the 1970s.

The rationale for a zero inflation target is best explained by applying these two concepts (the natural rate hypothesis and expectations augmented Phillips curve) to an aggregate Macroeconomic Welfare Function, henceforth labelled MEW. The unemployment rate is denoted by URATE. A constant term is added for convenience:

Suppose,

$$MEW = Constant - \alpha\ URATE - \beta\ INFLATION \text{ (with } \alpha > 0 \text{ and } \beta > 0)$$

Since,

URATE in the long run is at the natural rate denoted U*, the MEW reduces to

$$MEW = Constant - \alpha\ U^* - \beta\ INFLATION$$ which in turn reduces to

$$MEW = k - \beta\ INFLATION, \text{ where } k = Constant - \alpha\ U^* \text{ and is also a constant.}$$

Hence in the long-run the lower the inflation rate, the higher is MEW.11

The negative impact of steady inflation, when U is at U*, on MEW stems from the menu costs of higher inflation, that lower utility. It does not result from a possible negative impact on growth above a threshold inflation rate. 12 Evidence for the menu costs that lower utility are provided in Okun (1981) and Levy et. al (1997) and other sources. These menu costs are independent of GDP growth or unemployment.13

A simple numerical example can further elucidate why the target inflation rate should be zero. Suppose Constant = 100, alpha = 10 and Beta = 1. The natural rate of unemployment U* is taken as 6%. Suppose in the starting long run equilibrium INFLATION is 7%. Then MEW = 100 – 10(6) – 7(1) = 33. Now suppose there is a disinflation policy that brings the steady rate of inflation down to 4%, then with the same URATE and growth rate,

MEW = 100 – 10(6) – 4(1) = 36.

Hence a three percentage point drop in inflation to 4% has raised MEW by 3 points. A further drop in steady state inflation to 1% raises the MEW to a value of 39. Thus, unless there is robust econometric or other evidence that inflation in some range raises growth, which Sarel (1996) and subsequent researchers did not find, zero inflation is optimal.

However, pushing the inflation rate to zero reduces MEW since deflation has huge costs. Some of these arise from the rigid money wage barrier that Keynes (1936)

11 In new classical models, as in Barro and Gordon (1983) the MEW is captured by a quadratic loss function based on the deviation of U from U*, or actual output from its potential based on the output gap. With such a new classical loss function, welfare declines due to workers being fooled even when U goes below U*. By contrast, the MEW used here is strictly Keynesian for which any decline in U Below U* raises welfare. However, declines below U* do not last Hence there is no long run benefit but only the inflation cost by reducing U Below U*, or its equivalent -- pushing GDP growth above its potential.

[12] Bruno (1995) based on a study covering over one hundred countries found no negative impact of growth on inflation until inflation rates of about 20% to 25%. This supports the argument here that the target inflation rate should be based on the costs of inflation, not on a growth-related threshold inflation.

[13] One neglected menu cost is the inconvenience to the public and the extra amount spent by the central bank on minting coins and printing notes as inflation rises, as discussed in Moorthy (2017) in Section 3.3.

highlighted. Since absolute wage cuts are very difficult to impose, the optimal inflation rate will be slightly higher than zero. An inflation rate of around 2% will facilitate worker reallocations across sectors to reduce unemployment by easily allowing for needed real wage declines upto 2%. At zero inflation this is not possible since for half the workers below the mean, whose real wages need to be reduced, the money wage barrier prevents such real wage declines.

The above argument is not just a Depression era hangover. Research for Canada in the early 1990s provided evidence of Keynes' money wage barrier. The histogram of money wage changes in Fortin (1996) shows a big cluster at zero. His findings led to the recommendation of Akerlof, Dickens and Perry (1996) redefining the deflation threshold as 2% instead of zero.14 Accordingly, advanced economy central banks mostly target 2% inflation. Emerging economy central banks target a bit higher.

However, a money wage cut barrier that justifies a 2% inflation target, does not imply a higher threshold inflation rate for emerging economies. The RBI has chosen a 4% target without logical justification or adequate evidence. Indeed, there are some strong financial system and other grounds for questioning even this 2% inflation target instead of zero, which we cannot go into here. Nevertheless, we will take 2% inflation as an acceptable target.

Delving into the micro foundations of the long run Phillips curve analysis of Friedman and Phelps was essential to critique the RBI's inflation target of 4% as being too high. But doing so using a Macroeconomic Welfare Function leads on to a far more important matter. It reorients the analysis from GDP to utility. Most analysis of inflation targeting is based on GDP. That is understandable since GDP is a concrete reported number. But bringing in the concept of utility provides the foundation for examining the welfare consequences of divergent trends in food and non-food inflation. This is done in the next Section.

4. A model with divergent price trends in essential and less essential items

Most analysis of food versus nonfood inflation, by the Federal Reserve and then other central banks, emphasizes the volatility of food and energy prices, compared to the

[14] A subsequent histogram for USA in Daly and Hobijn (2014) showed a similar large cluster at zero.

stability of the rest. For the USA, food and energy have weights of 13.4% and 6.8% respectively, summing to 20.2%. The rest come under core inflation with a weight of 79.8%, comprising the bulk of the CPI.15

For analytical convenience, for India we are dividing the CPI into food and non-food, which largely corresponds to the distinction between volatile and non-volatile items. It also largely corresponds to the distinction we are making between essential and non-essential items. This makes our analysis much easier. The weight of the Consumer Food Price Index (CFPI) as reported by MOSPI is 39.06%, and we will use this index. Details are in Appendix I.

Rental accommodation can also be considered an essential item. However its weight in India's CPI is about 10.1%. This low value is because in rural India most people dwell in their own residence, so housing is not part of the rural CPI. Urban India comprises 47.2% of the CPI and rural India now comprises 52.8% which is still bigger.16

The category of fuel and light comprises 6.8% of India's CPI at present. By a remarkable coincidence that is the same as in America right now, down to the first decimal! However, we are excluding the category 'fuel and light' inflation for India from volatile items, because it is not very volatile. The Government absorbs the global changes in imported crude by varying the excise duties so as to keep the retail price of petrol and diesel relatively stable. Thus, in India food corresponds to volatile items and non-food to core items.

[15] The Federal Reserve targets the core personal consumption expenditure deflator from the GDP accounts, which is fairly close to the core CPI. For our purposes, the difference between them is small enough to be ignored.

[16] By contrast in USA shelter, which is a part of core inflation comprises 36.5% of the CPI and the single biggest item. The bulk of this is the huge imputed sub item 'owner's equivalent rent of residences', amounting to 26.9% of the CPI while 'rent of primary residence' amounts to 7.7%. The monetary policy and welfare implications of the huge weight of owners' equivalent rent in USA, where there is no actual out-of-pocket expenditure for those without mortgage expenses, are outside the domain of this paper.

The distinction between core and non-core inflation is somewhat useful to deal with volatility. But from the perspective of consumers welfare and workers demand for wage hikes to offset inflation, the distinction can be quite misleading. We must always keep in mind that non-core inflation largely comprises the essential item of food. By contrast, core inflation mainly consists of less essential, or non-essential items.

Breaking down the CPI into essential and non-essential items provides a vastly different perspective for conducting monetary policy. Ignoring rental and medical expenses, central banks that target core inflation are effectively targeting non-essential inflation, while ignoring essential inflation! While this may be an extreme statement, it helps to provide an alternative, consumer based welfare perspective. As Patra, John and George (2024 a) put it in the title of one of their recent articles: Are Food Prices the True 'Core' of India's Inflation?

With this perspective as a backdrop, based on earlier work, this paper presents a simulation model that captures some critical features of many economies at present, including India. Suppose headline inflation is on target. It is a weighted average of inflation in essential items, which is above trend, and inflation in non-essential items, which is below trend. Both these inflation rates are assumed to be steady. We will assume that food is the only essential item, while all non-food items, lumped into one category, are non-essential. We can thus ignore volatility, and focus only on essential and non-essential i.e. food and non-food items.

To simplify the analysis rather than examine differential inflation rates, we will look at the change in the relative price of food and non-food, with the overall CPI remaining at its unchanged target. Consider a static, two persons (rich and poor) two good (food and non-food) economy. In this static, closed economy, assume that consumption = income for both rich and poor consumers. There is no saving.

To start with assume P food =1, P nonfood = 1. Both prices are conveniently taken as unity. We also assume that Nominal income Y(poor) = 20, Y(rich) = 80. With initial prices of both products being 1, the normalised CPI equals 100. It is assumed that demand for food is completely price inelastic, i.e. food is a necessity. A certain calorific input is required and no more is consumed. All extra disposable income is spent on non-food items. This corresponds to a form of the Stone-Geary demand function systems [Stone (1954)].

The novel feature of this model is two different CPIs respectively for poor and rich. The aggregate CPI is a (population weighted) average of the two. In official data, the CPI is not broken down by the income groups. But if we think of the rich and poor as residing in different regions, for which separate CPIs are now computed, then the formulation becomes more intuitive. Since the CPI is population weighted, weights for the rich and poor are equal.17

We now raise the relative price of food to non-food in Period 2 while keeping the price level constant, and work out the corresponding changes in income and utility. Keeping the price level constant implies a fall in the price of non-food to offset the rise in the price of food.

In this model, the exogenous variables in any given period are: Constant level of food consumption: QF for both poor and rich respectively.

Nominal income: Y(poor) and Y(rich) and Y Total) as specified. This may change or remain the same in next period. Here, we keep nominal income the same in period 2.

Price of food: This increases relative to non-food in Period 2 so as to keep the overall CPI at the chosen target level. This is chosen for convenience in Period One and Two also to be 100.

The endogenous variables in any period are:

Expenditures on food: P(food) × Q(food) for both rich and poor.

Expenditures on non-food = Y minus expenditure on food, for both rich and poor.

Quantity of non-food = Expenditure (non-food)/Price(non-food), calculated from CPI.

Real Income (y): Nominal Income divided by CPI for that individual.

Utility: Obtained from real income with the specified utility function

$$U = 100*(1- e^{-y/20}).$$

[17] However, in expenditure shares and GDP the rich will have a higher weight. Thus in the GDP deflator, unlike the CPI, the rich person has implicitly a higher weight than the poor person.

The economic process at work is as follows: When the price of food rises, with the same money income, both rich and poor spend more on food since they continue to consume the same quantity. So both have less money income to spend on non-food. However, the price of that has dropped.

For the poor person, the 10% rise in food prices outweighs the beneficial 5% drop in the price of non-food. So the quantity of non-food consumed falls. Based on the computed CPI (poor) so does the poor person's real income. Being at a low income level, based on diminishing marginal utility of income, there is a large drop in utility.

Table 2: Inflation, GDP and utility in a two person, two item economy

	Period 1			**Period 2**		
	Poor	Rich	Total	Poor	Rich	Total
Price of food	1	1	1	1.10	1.10	1.10
Quantity of food consumed	10	10	20	10	10	20
Price of non-food	1	1	1	0.95	0.95	0.95
Quantity of non-food consumed	10	70	80	9.43	72.29	81.71
Nominal income/or expenditure (denoted large Y)	20	80	100	20	80	100
Consumer price index	100	100	100	102.73	97.27	100
Real income (denoted small y)	20	80	100	19.47	82.24	101.71
Implicit deflator = nominal GDP/real GDP			100			98.32
Utility from income = $100*(1- e^{-y/20})$	63.21	98.17	161.38	62.22	98.36	160.59
Change in real income				-0.53	2.24	1.71
Change in utility				-0.99	0.19	-0.79

Source: Moorthy and Kolhar (2011)

For the rich person, the negative impact of the drop in discretionary income due to the rise in food price is much less than the positive impact of the drop in non-food prices, since a big amount of non-food (70 units) is initially consumed. Overall consumption of non-food goes up and so does real income by a relatively big amount. However, as the initial income level is high, the gain in utility is a small amount. The rich person is slightly better off.

The net aggregate impact is that total real income goes up while total utility falls. From a GDP centric perspective, the drop in non-food prices, which could be due to productivity gains in manufacturing and some services, raises GDP per capita. But if our focus is on utility, the rise in GDP per capita, at the same price level, does not imply higher total welfare.18

For computational simplicity, differential trends in food and non-food inflation are analyzed using changes in relative prices at the same price level. A more realistic example would build inflation into the model. If food prices rise at say 8 % and non-food at say 2% for that period, then inflation can be at the target rate of say 5%, with nominal income growing at 5% too. Such a model has been outlined in Section 7.6.1 of Moorthy (2017). There is steady food inflation due to a structural supply slowdown, not just a temporary shock. This model needs to be expanded to include utility and also to simulate various relevant scenarios at present.

The static model also elucidates another vital point usually ignored in most discussion of inflation targeting. Suppose the prices and nominal income in Period 2 continue into Period Three and beyond. Then both food and non-food inflation will be zero and so will the aggregate price level. Nevertheless, the price level of food is permanently higher with associated welfare loss. There is no 'error correction mechanism' to reverse its upward drift.

More generally, price level targeting is one way to ensure that upward jumps in the aggregate price level are then deliberately offset by downward moves. When the Bank of Canada was considering in 1990 moving to zero inflation targeting, the purists

[18] Macro theory in the new classical framework of Chicago and Minnesota and similar 'fresh water' universities was based on the Representative Agent, overlapping generations model. That was replaced by Representative Agent New Keynesian (RANK) Models with sticky prices. These were replaced by Heterogenous Agent New Keynesian (HANK) models, incorporating both sticky prices and unequal income distribution. Two authors Acharya and Dogra (2020) have recently come up with what they call a PRANK (pseudo representative Agent New Keynesian) model! Next there might be a CRANK model! By contrast, our model can be called a Classical Approach Simple Heterogenous model. It is based on changes in relative prices as in a classical model, not sticky prices. But it also is based on Heterogenous agents. The acronym CASH captures the assumption that all consumption which equals current income is implicitly based on a cash-in-advance constraint. And like cash, this model is simple to use!

argued that price level targeting was needed to prevent the price level from drifting upwards. This issue was discussed by Srour (2001) and many others.

The purist position taken above might seem to be archaic and unduly hawkish. But it is relevant to developments since last summer in India. The food price index jumped by over an abnormal 12 points in July 2023. Ever since the new CPI series was started in 2012, that is the only monthly change above 10 points. Even changes of above 5 points are few and far between. Over and above the 12-point jump in July 2023, the food price index again rose by over 5 points in both the months June and July 2024 (cf. Appendix I). Even if food inflation from now on remains within the range, these big jumps in the food price index of July 2023 and in June and July 2024 implied a big loss of real income to many consumers. 19

The relative price of food to non-food was relatively stable from April 2022 to June 2023 around unity. But in July 2023 it jumped to 1.07. One year later despite the big drop in July food inflation to 5.4%, this ratio had risen to 1.10. Economists engaged in sophisticated econometric analysis of just the inflation rate, including the RBI's research staff, tend to ignore the simple crucial fact that consumer purchases are made at the going price level, not at the going inflation rate.

5. Reorienting Inflation Targeting towards Consumer Welfare

Globally there is now a huge disconnect between what consumers and ordinary citizens feel about the cost of living and the perception of many central bankers and economists, based on growth and inflation. If inflation is on target and growth is at or close to its estimated potential, then the economists conclude that the economy is

[19] Due to the elevated July 2023 value of 186.3, the base effect does account for the huge drop in food inflation by 4 percentage points from 9.4% in June to 5.4% in July 2024. This is clearly evident from the data in (Appendix I). The RBI's MPC members should have stated during June and July 2024 (i.e. in real time) that upcoming food inflation for July, reported in mid-August, is likely to drop when the base effect kicks in, and hence should be ignored. They do not seem to have anticipated it. In the minutes of the early August 2024 meeting, released in late August, the base effect is discussed for quarterly data, but not for monthly data. Since it is the *monthly price level* data that is subject to sharp changes, the base effect should be discussed for monthly, not quarterly data, even though, smoothed out, some of it will carry over to the quarterly data.

performing well. But the simulation results reveal that judged by consumer welfare this need not be the case.

A few months back, the election results in India came as a surprise to many. While election outcomes reflect many social factors, economic factors matter. Judged by GDP growth the economy was doing well, but not by other criteria, in particular food inflation. Just after the general election results, the Times of India (2024) carried an article with the sentence "How can a Government running an economy that's growing at 8.2% suffer electoral reverses?" As of this writing, with voting under way for the 5th November Presidential election, a similar situation prevails in USA. 20. The disconnect indicates that we should seriously consider whether monetary policy needs to reorient inflation targeting to incorporate consumer welfare. It is not enough to target headline inflation, as the RBI has been doing so far.

Looking ahead, India and many other economies are likely to face the following scenario: due to rapid technical progress globally, non-food inflation is likely to be low. Rapid technical progress ensures falling unit labour costs and so low core inflation: assume it to be 1%. At the same time food inflation due to climatic crises etc. stays high: assume it to be 7%. If both have equal weights of 50%, headline inflation is 4%, exactly on target. Such a scenario was spelt out in section VIII of Moorthy and Kolhar (2011) as a likely future dilemma.21

Should the central bank ignore the high food inflation since headline inflation is on target. Standard inflation targeting policy implies yes.22 However it can be argued that

[20] There is deep voter discontent in USA about price gouging by grocery chains, and more so unaffordable rentals leading to many evictions and homelessness. Basically, essential items are too expensive while the Fed may be performing reasonably well with regard to its 2% core PCE deflator inflation measure. But over the four-year period the price level has risen a lot due to Covid related supply chain disruptions and the Russia-Ukraine war. The Economist magazine has carried an article with the title "America's economy is bigger and better than ever" (2024). That clearly indicates the disconnect between people and the 'economy' under the Democrats.

[21] In that article we assumed the share of food would fall to 20%. Food inflation, above 10% at that time, was assumed to be 15% while non-food inflation 3%. Thus overall inflation was 5.4%, quite acceptable then.

[22] The Economic Survey (2024) released in June suggested ignoring food inflation and instead targeting core inflation. For a critique of this, see Moorthy (2024b). Eichengreen and Gupta (2024) concede that headline inflation should be the target but that the weight in food inflation should be revised downwards

the time is long due to take a different approach. Lower growth entails more unemployment and thus hardship. Central banks do react to weak growth and/or job loss. Should not they not also react to high inflation in essential items (specifically food) since that entails hardship too? Once the need to alleviate the hardship from high food prices is accepted in principle, then the (headline) inflation target could be modified accordingly.

The RBI's inflation targeting at present is not formulaic. But the well-known Taylor Rule can be used to explain how the RBI can incorporate food inflation into setting the repo rate. The Taylor Rule is quite in sync with how central banks actually conduct policy – pursue the inflation target while also responding counter-cyclically to the state of the economy. In terms of the matrix in Section II, the Taylor rule can be classified as a half reactive and half preemptive rule.

The general formula for the Taylor (1993) rule can be written using our notation, as follows:

$$\widehat{R} = r* + \pi + \theta_{\pi}(\pi - \pi_{target}) + \theta_{y}(GDPgap) \text{ where,}$$

$\widehat{R}$ is the policy rate chosen based on the formula,

r* is the implicit natural real rate of interest,

π is the actual inflation rate and πtarget is the target inflation rate,

$\theta\pi > 0$ and $\theta y > 0$ are the weights on the inflation 'gap' and GDPgap respectively.

With y being actual output and y* potential output, our defined GDPgap = [(y-y*)/ y*] ×100. The GDPgap is often defined as [(y*-y)/ y*] ×100 in which the sign of θy would be negative.

since, based on a comparison with ASEAN countries, it is too high in relation to per capita income. This suggestion is sound, and the CPI should be updated, with a lower weight for food if warranted. Nevertheless, they do not discuss whether food inflation should get special consideration if it is too high.

In his seminal paper Taylor (1993) estimated a reaction function for the federal funds rate from 1987 to 1992 and based on that proposed the following specific formula for it:

$$\widehat{R} = 2 + \pi + 0.5(\pi - 2) + 0.5(\text{GDPgap})$$

In the above specification 2% is the implicit natural real rate of interest and by coincidence 2% is also the inflation target. This reduces to:

$$\widehat{R} = 1 + 1.5\pi + 0.5(\text{GDPgap})$$

However, both the implicit natural real rate and the target inflation rate will vary across countries. Typically, emerging economies have a much higher GDP potential growth rate and thus a higher natural real rate of interest. Suppose India's natural real rate of interest equals to 2.5%, although it could be much higher. Also the inflation target is 4%. Substituting these values into the general form of the Taylor Rule for India:

$$\widehat{R} = r* + \pi + \theta_{\pi}(\pi - \pi_{\text{target}}) + \theta_{y}(\text{GDPgap}) \text{ reduces to}$$

$$\widehat{R} = 2.5 + \pi + 0.5(\pi - 4) + 0.5(\text{GDPgap}).$$

If the economy is in long-run equilibrium with the GDPgap zero and inflation on target, the two adjustment terms for the inflation 'gap' and the GDPgap drop out, and so:

$\widehat{R} = 2.5 + 4 = 6.5\%$ should be the chosen value of the repo rate.

The formula can easily incorporate a specific response to food inflation. To recap, it is assumed that non-food inflation = 1%, food inflation = 7% and headline inflation = 4% which is on target. We propose a food inflation modified Taylor rule as follows:

$$\widehat{R} = r* + \pi + \theta_{\pi}(\pi - \pi_{\text{target}}) + \theta_{y}(\text{GDPgap}) + \theta_{f}[\pi(\text{food}) - \text{top of } \pi \text{ target range}].$$

$$\widehat{R} = r* + \pi + \theta_{\pi}(\pi - \pi_{\text{target}}) + \theta_{y}(\text{GDPgap}) \text{ when } \pi(\text{food}) \leq \text{top of } \pi \text{ target range.}$$

The food inflation terms kicks in only if π(food) > top of π target range i.e. 6% for India. It could be used symmetrically when food inflation falls below the bottom of the range (2% for India) but that is of limited relevance now.

We also assume for convenience a value of 0.5 for θf , the same value as of θ_π and θ_y in the standard Taylor rule. Applying our formula, specifically:

$$\triangle \widehat{R} = \theta_f [\pi (food) - \text{ top of } \pi \text{ target range}] = 0.5(7 - 6) = 50 \text{ basis points.}$$

As of this writing (October 2024) this implies raising the repo rate from 6.5% to 7%. While the RBI is unlikely to do this, there is no harm in suggesting it! Operational aspects of the formula need to be spelt out, notably the frequency at which inflation is measured. However, we have assumed steady inflation rates here and so the frequency of measurement does not matter. But in the actual situation this will rarely be the case. The year-on-year food inflation will be volatile and so a wider band for it in the formula, say 0% to 8%, may be warranted.

There are limitations of the Taylor Rule as a basis for setting the policy rate. Minskyian situations apart, it assumes an implicit value for the real rate of interest which, as Friedman (1967) pointed out, the central bank cannot know. In my opinion, a random-walk rule for the policy rate is preferable but that calls for separate elaboration and justification.

To summarize, monetary policy globally, despite the widespread adoption of inflation targeting, is too GDP centric. It is also perhaps too responsive to pressures from portfolio investors to cut interest rates. A central bank is a public institution. It should be people centric, not equity market or GDP centric. Accordingly, even when headline inflation is within the target range, making the policy rate respond to food inflation that is above the target range will lower food prices and thereby, other things equal, add to consumer welfare.

Postscript: Hopefully, in the short run, we are all fed. (VM, Overheating and Undereating, 2007).

Acknowledgement: The author wishes to thank Dr. John Paolo R. Rivera, Senior Research Fellow, Philippine Institute of Development Studies, Manila for fruitful discussions on this subject. The views expressed in this article are solely those of the author.

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Appendix Ia: Recent Data on Prices and Inflation and Related Variables

Month	Food Index **	Non Food Index	CPI Total Index	Food Inflation	Non-Food Inflation	Headline Inflation *	Relative Price of food to non-food	Repo Rate
2022Apr	169.4	170.5	170.1				0.99	4.00
2022May	172.1	171.4	171.7				1.00	4.40
2022Jun	173.8	171.8	172.6				1.01	4.90
2022Jul	173.8	173.1	173.4				1.00	4.90
2022Aug	175.1	173.8	174.3				1.01	5.40
2022Sep	176.7	174.4	175.3				1.01	5.90
2022Oct	178.6	175.5	176.7				1.02	5.90
2022Nov	177	176.2	176.5				1.00	5.90
2022Dec	174.1	176.7	175.7				0.99	6.25
2023Jan	174.8	177.6	176.5				0.98	6.25
2023Feb	174.4	178.3	176.8				0.98	6.50
2023Mar	174.9	178.7	177.2				0.98	6.50
2023Apr	175.9	179.5	178.1	3.8	5.3	4.7	0.98	6.50
2023May	177.2	180.3	179.1	3.0	5.2	4.3	0.98	6.50
2023Jun	181.7	180.6	181	4.6	5.1	4.9	1.01	6.50
2023Jul	193.8	181.5	186.3	11.5	4.8	7.4	1.07	6.50
2023Aug	192.5	182.2	186.2	9.9	4.8	6.8	1.06	6.50
2023Sep	188.4	181.3	184.1	6.6	4.0	5.0	1.04	6.50
2023Oct	190.4	182.0	185.3	6.6	3.8	4.9	1.05	6.50
2023Nov	192.4	182.4	186.3	8.7	3.5	5.6	1.05	6.50
2023Dec	190.7	182.5	185.7	9.5	3.2	5.7	1.04	6.50
2024Jan	189.3	183.1	185.5	8.3	3.0	5.1	1.03	6.50
2024Feb	189.5	183.4	185.8	8.7	2.8	5.1	1.03	6.50
2024Mar	189.8	183.2	185.8	8.5	2.5	4.9	1.04	6.50
2024Apr	191.2	183.8	186.7	8.7	2.3	4.8	1.04	6.50
2024May	192.6	184.6	187.7	8.7	2.3	4.8	1.04	6.50
2024Jun	198.7	184.8	190.2	9.4	2.3	5.1	1.08	6.50
2024Jul	204.3	185.8	193	5.4	2.4	3.6	1.10	6.50
2024Aug	203.4	186.3	193	5.7	2.4	3.7	1.09	6.50
2024Sept	205.8	186.8	194.2	9.2	3.1	5.5	1.10	6.50

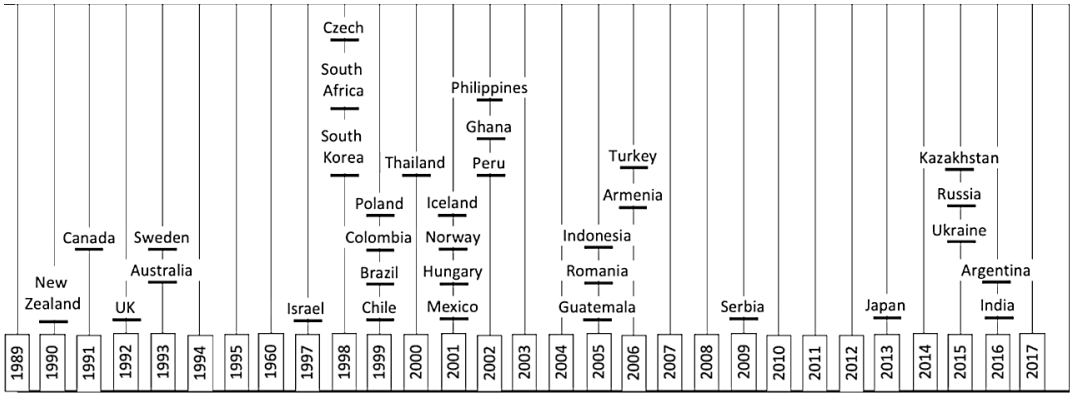
*Inflation is measured as percent change over 12 months ago.

**In the MOSPI's monthly data release on the Consumer Price Index (CPI), the subgroup Consumer Food Price Index (CFPI) reported at the bottom is what we have taken as the food component.

This has a weight of 39.06% and correspondingly our chosen non-food category has a weight of 60.94%. The MOSPI also reports a bigger category of food which comprises the CFPI plus non-alcoholic beverages (weight 1.26%) plus prepared meals and snacks, sweets etc. (weight 5.55%), for a total of 45.86%. Many researchers including the RBI use this broader category for food and correspondingly non-food category weight of 54.14%.

Appendix Ib: MPC Minutes and Inflation Data Released dates

Relevant and Latest MPC Meeting Dates	Latest Data available as of Meeting as per Press Release on CPI from MOSPI	Minutes Press Release Date
	2023	
August 8th-10th	For June 2023 on 12th July	24th August
No Meeting	For July 2023 on 14th August	NA
October 4th-6th	For August 2023 on 12th September	20th October
No Meeting	For September 2023 on 12th October	NA
December 6th-8th	For October 2023 on 13th November	22nd December
	2024	
June 5th-7th	For April 2024 on 13th May	21st June
No Meeting	For May on 12th June	NA
August 6th-8th	For June 2024 on 12th July	22nd August
No Meeting	For July on 12th August	NA
October 7th-9th	For August 2024 on 12th September	23rd October



Source - Dua (2020)

Appendix III: Estimates of Threshold Inflation Rates for India from Past Empirical Studies

Study	Period	Threshold Inflation Percent	Methodology
Chakravarty Committee Report (1985) #		4	
Rangarajan (1998)*		6	Macro Econometric Model
Kannan and Joshi (1998)	1981-96	6-7	
Vasudevan, Bhoi and Dhal (1998)	1961-98	5-7	Correlation/regression
Samantaraya and Prasad (2001)	1970-99	6.5	
Report on Currency and Finance (2001)	1970-2000	5	Sarel's Spline Method
Singh and Kalirajan (2003)	1971-98	No threshold	Spline regression
Bhanumurthy and Alex (2010)**	1975-2005	5-5.5	Spline regression
Singh, Prakash (2010)	1970-2009	6	Spline regression
RBI Annual Report 2010-11		4-6	Spline regression, non-linear least squares and Logistic Smooth Transition Regression (LSTR) model
Pattanaik and Nadhanael (2013)	1972-2011	6	Spline regression, non-linear approach, vector auto regression (VAR)
IMF (2012)	1996-2012	5-6	
Mohanty et al (2011)	1996-2011	4-5.5	Spline regression, non-linear least squares and Logistic

			Smooth Transition Regression (LSTR) model.
Subbarao (2013)	1996-2012	4.4-5.7	Spline regression, non-linear least squares and Logistic Smooth Transition Regression (LSTR) model.

cited as accepted rate of rise in prices

* Rangarajan (1998) observed that the objective of policy should be to keep inflation rate around 6 per cent.

**Using monthly data for January 2000 to April 2007, they suggested 4-4.5 per cent as the threshold.

Source – Patel, U. et. al. (2014) report, pp. 78

The Effect of Dividend Announcement on Share Prices Evidence from Colombo Stock Exchange

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Abstract

Dividend announcements by companies play a pivotal role in informing and influencing investor decisions. The extent to which such announcements impact investor behavior and subsequently affect changes in share prices is a subject of paramount importance. While extensive research in Western countries has shed light on the relationship between dividends and share prices, the Sri Lankan context presents a paucity of studies in this domain, with limited and varied conclusions regarding the extent of this impact. Hence, a comprehensive investigation into the true influence of dividend announcements on share prices is deemed essential. This research pursues two key objectives: first, to meticulously examine the impact of dividend announcements on share prices, and second, to assess the overall daily share price fluctuations within the listed companies on the Colombo Stock Exchange. Employing a quantitative approach, the study draws its population from the 290 listed companies on the Colombo Stock Exchange, with a sample of 95 final dividend-announcing companies selected via stratified sampling techniques. Daily share prices serve as the metric for gauging share price changes, with the dividend announcement date employed as the temporal marker for such announcements. Data for this study were sourced from the library of the Colombo Stock Exchange and the exchange's website, spanning the year 2022. Data analysis was conducted using the independent sample T-test methodology, investigating daily share price changes five days prior to and five days after the date of dividend announcements. The results of this study indicate that, within the tested period, dividend announcements have no discernible impact on share prices. Moreover, it is evident that share prices do not respond rapidly to dividend announcement information. These findings carry significant implications for investors, company management, and financial advisors, offering insights to inform their day-to-day decision-making.

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Keywords: Dividend announcement, Share price, Listed companies, Price fluctuations, Sri Lanka

1. Background of the Study

The real owners of the companies are shareholders who decide whether to hold the shares of the company or sell the shares on the basis of returns (Ireland, 2016, pp. 47-49) . The decision depends on the corporate action. Corporate action is an event. Dividends are an important component of corporate action and directly affect shareholder wealth. Maximization of shareholders wealth is primary objective of the company. When changing the corporate action of companies, it affects the operations of the companies. The company's operation change in positively can earn profit. When increase the profit of companies, they declared dividend. Dividends are the benefits of shareholders that are given by companies on behalf of shareholders investment. Shareholders wealth increased when companies pay out dividends (Arif Pasha & Nagendra, 2017).

Investors interested in buying shares primarily consider factors such as stock prices, risk, company dividends, Dividend announcement and profitability (Neetu & Shuchi 2010). Companies issue shares to investors to grow their business and meet their financial needs. Dividend announcements provide information regarding the liquidity and profitability of the company. Dividend announcement is a critical factor influencing investors decision make (Anwar, Singh, & Jain, 2015). When considering the dividend, the announcement date is most important. The day when the board of directors declares the upcoming dividend is known as the dividend announcement day. Ex- dividend date, final dividend announcement date, Interim dividend announcement and record dates are some of dividend announcement dates. In this study consider the final dividend announcement date. When considering above mention information, can identify the importance to determine the dividend policy of the company. It shows how managers decide on dividends and if they stick to the right rules that impact the company's future. This also gives hints to investors about the company's upcoming performance (Suwanna, 2012).

According to Felimban, Floros, and Nguyen (2018) numerous studies research that announcement of dividend policy changes bring information about company's future prospects. This research is attempted to investigates how impact dividend

announcement on share prices. Only a few researches can be found on dividend announcements and share prices in Sri Lanka. Menike (2014); Mallawa , Samarakoon, and Karunananda (2019) are some research analyzed the impact on dividend announcement on share prices according to the action of Colombo Stock Exchange. Much of the research on this topic is based on the western stock market. And also previous research has provided conflicting views on dividend and shares wealth. According to Lintner (1956) there is a relationship between dividend policy and shareholder wealth. This means that investors are reacting to dividend announcement. But according to the Miller and Modigliani (1961) there is no connection between dividend policy and shareholder wealth. It means investors will not react to dividend announcements. These two conclusions were used as the basis for most of research conducted on dividend announcements affect share prices.

Considering the prior researches done on dividend announcement and share prices, those findings presented both confirmative and contradictory evidences relating to the relationship between dividend announcement and share prices. Some researchers found that there is positive relationship between dividend announcement and share prices. When the dividend announcement meets investors' expectations, the market price of shares tends to rise. Conversely, if the dividend falls below expectations, the market usually responds by driving share prices down (Neetu & Shuchi 2010, p. 405). According to the Ngoc and Cuong (2016) positively effect of dividend announcement on share prices in the announcement date. Authors found that the share prices of the company increase at the dividend announcement date, because of the company dividend policy affect to the increase firm value.

However, other studies have suggested that there may not be a significant link between dividend announcements and share pricesTop of Form Bottom of Form. According to Ali and Chowdhury (2010) share price reactions and dividend announcements are not statistically reaction. According to the Gordon and Kwame (2010) there is no any impact between the dividend announcement and behavior of the share prices. Authors found that there are not any share prices changes reaction to the dividend announcement date. And also, some researchers stated that cannot investigate the impact of dividend announcement on share prices, because some other factors affect the changes on share prices. According to the Bajaj and Vijh (1990) that difficult to

investigate the price reaction in correctly when announcing the dividend, because the dividend yield impact on short term share prices.

Further only few numbers of researches have conducted in Sri Lanka regarding this in recent time. It is concluded when dividend announcement information is favorable investors react the positively and it becomes negative investors react negatively. When considering the recent time there is no sufficient research regarding the impact of dividend announcement and share prices. Therefore, it is important to identify whether the dividend announcement will affect the share prices for the purpose of fulfilling this time gap.

Hence, with this information in mind, the question arises: Do dividend announcements impact share prices, and if they do, what is the relationship between dividend announcements and share prices? Therefore, identify the reaction of investors when companies issue a dividend announcement correctly and to determine exactly what impact it will have on the share prices of companies are more important. Through this study focus to identify whether the dividend announcement affects share prices of listed companies in the stock market in Sri Lanka. It is support to fulfill this knowledge gap and this research tries to find out the solution for this research question "Does the dividend announcement affect to the share prices?" This study aims to analyze the daily fluctuations in share prices of listed companies on the Colombo Stock Exchange and explore how dividend announcements affect these share prices.

2. Review of Literature

Based on prior research examining the correlation between dividend announcements and share prices, divergent conclusions have emerged. Some scholars have posited a positive association between dividend announcements and share prices, while others have argued that no such connection exists. This disparity in findings underscores the absence of a universally accepted consensus on the relationship between dividend announcements and share prices. In this context, it is imperative to consider the array of pertinent empirical and theoretical factors expounded in earlier research studies concerning the impact of dividend announcements on share prices. Furthermore, it is essential to furnish insights into the relationship between dividend announcements and share prices based on previous research endeavors, incorporating details pertaining to the relevant variables involved.

2.1 Theoretical Review

Previous research has explored the relationship between dividend announcements and share prices. Modigliani and Miller's Dividend Irrelevance Theory (1958) suggests investors will indifference to dividend policies if they are too high. Lintner's Smoothing Theory (1956) suggests that shareholders prefer stable pay out rates and gradual dividend growth, leading firms to increase dividends when management believes earnings have personally increased. Both theories provide concrete insights into the relationship between dividend announcements and share prices.

The bird in the hand theory, also known as "Dividend Relevance," suggests that investors prefer dividends over potential capital gains due to the certainty of cash (Lintner, 1962). This theory suggests that share prices increase when firms announce positive dividends, while they decrease when negative dividends are made. The Dividend Signaling Theory, introduced by Ross (1977) and Bhattacharya (1979), aims to understand why companies pay dividends despite disadvantages. This theory suggests that financial markets analyze every action a company takes to determine its future cash flow and fixed value. Firms increase dividend announcements that positively impact share prices, while decreasing them leads to decreased share prices. This theory is best for understanding how dividend announcements influence share prices. - Top of Form - Bottom of Form.

From a management perspective, a firm's dividend policy serves as a reflection of its anticipated future profitability. As elucidated by Miller and Modigliani in 1961, they endeavored to reconcile the irrelevance proposition within their idealized framework with the intricacies of dividend policy. They introduced the concept of dividends as informational tools, particularly under conditions of uncertainty. Their proposition suggested that dividends convey valuable insights into managers' assessments of a company's future profitability prospects. Nevertheless, they were explicit in asserting that alterations in dividend policy are merely the "handle" for instigating changes in stock prices, not the root cause thereof. In this context, earnings figures and dividend announcements assume pivotal roles as mechanisms for deciphering managers' forthcoming plans. A plethora of research findings substantiates the notion that dividend announcements are laden with significant market-relevant information, especially when one scrutinizes shifts in dividend policies. Diverse studies spanning various stock markets have yielded multifaceted outcomes on this subject.

Within the framework of the Efficient Market Hypothesis (EMH), an efficient market is characterized by the full and immediate incorporation of all available information into asset prices. The EMH comprises three distinct facets: weak form, semi-strong form, and strong form efficiency. These delineations are rooted in the speed at which the stock market responds to public announcements, thereby gauging the efficiency of the market. Market efficiency, in essence, signifies the swiftness with which the stock market processes and reacts to publicly disclosed information. As illuminated by Fama in 1970, the concept of market efficiency encompasses the timing of the stock market's response to public information and establishes the foundation for these three tiers of efficiency. Weak-form efficiency underscores the notion that prices already encompass data inherent in historical prices and trading activity. Semi-strong form efficiency, on the other hand, posits that prices absorb all publicly available information. The apex is reached in strong-form efficiency, where prices assimilate all information, including non-public data. Notably, despite extensive research and documentation regarding the impact of dividend announcements on stock prices, no model has yet been formulated to predict stock prices with certainty. Consequently, the present study is conducted within the framework of the semi-strong form of capital market efficiency. When capital market is perfect there is no effect of dividend on stock prices (Masum, 2014). Moreover, Jensen and Johnson (1995) proposed that cutting dividends leads to a decrease in share prices. Interestingly, in perfectly efficient capital markets, dividends have no impact on share prices.

2.2 Empirical Review

Previous researches have been done regarding the dividend announcement and share prices. Those led to various conclusions regarding the relationship between dividend announcement and share prices. Some of those researches found there is positive relationship between these two variables and others founds there is no relationship or impact between dividend announcement and share prices. Those are mention in this part.

Subsequent investigations have shed light on the dynamics of the relationship between dividend announcements and share prices. Gordon (1959) and Stevens and Jose (1992) discerned a noteworthy positive correlation between dividend announcements and stock prices, signifying the influential impact of such disclosures on market valuations. Neetu and Shuchi (2010) further reinforced this perspective, asserting that an increase

in dividends results in more pronounced positive abnormal returns, thereby bolstering the foundations of the efficient market hypothesis. This observation underscores the pivotal role of dividend announcements in prompting investors to adjust their security positions, making investment decisions in the post-announcement period. Suwanna (2012) extended these findings, highlighting a conspicuous upward surge in stock prices subsequent to dividend declarations, affirming the positive connection between dividend announcements and share prices. Employing a market model, these studies have unveiled statistically significant Abnormal Returns (AR) and Cumulative Abnormal Returns (CAR), conclusively validating the pivotal role of dividend announcements in influencing stock prices. In pursuit of these insights, the authors conducted a comprehensive analysis of sixty Thai companies within the financial industry, listed on the Thailand stock exchanges, spanning the period from 2005 to 2010. Employing event study methods, this study meticulously scrutinized the ramifications of dividend announcements on share prices over a span of forty days.

Ngoc and Cuong (2016) found that dividend announcements positively impact a company's stock returns, with stock prices generally rising before the announcement date and then declining, aligning with the dividend relevance theory, highlighting the significant role dividends play in shaping investor sentiment and stock valuations. Ngoc and Cuong's 2016 study found that dividend announcements positively impact a company's stock returns, with stock prices generally rising before the announcement date and then declining, aligning with the dividend relevance theory, highlighting the significant role dividends play in shaping investor sentiment and stock valuations. Further, Aharony and Swary (1980) studied how dividend announcements affected share prices on the New York Stock Exchange. They analyzed 149 industrial firms, categorized into three subsets based on dividend activity: no change, increase, or decrease. The study found that companies that increased their dividends experienced positive abnormal returns, while those that reduced their dividends experienced negative abnormal returns. The findings highlight the market's sensitivity to dividend policy changes and their consequential impacts on share prices.Top of FormBottom of Form The study conducted by Capstaff, Audun, and Marshall (2004) on Oslo Stock Exchange dividend announcements found no significant disparities between the Naïve and Analyst models. They employed event study methodology to assess how dividend announcements affected share prices. They found that when dividend announcements

exceeded the previous year's figures, they sent a positive signal to investors, boosting share prices. Conversely, when dividend announcements decreased, they sent a negative signal, affecting share prices negatively.

In a complementary vein, Shlomo, Michaely, and Thaler (1997) conducted an insightful examination of how changes in dividend announcements could impact a company's future earnings. In their comprehensive study encompassing one thousand twenty-five firms, they postulated that heightened dividend announcements were significantly linked to subsequent earnings increases. These augmented earnings, in turn, reverberated as signals in the market. As predicted by the dividend signaling theory, this signification triggered a corresponding surge in share prices, thus conveying a compelling message about the future prospects of the companies in question.

Koch and Sun (2004) undertook a meticulous examination of the intricate interplay between changes in dividends and the recent earnings trajectory in the context of the US market. Their extensive study drew upon a sizable sample of six thousand three hundred and ninety-five firms, meticulously scrutinizing the reactions of one thousand six hundred and eighty-two of these firms. A central tenet of their research posited that the stock price response to dividend announcements is intrinsically tied to prior earnings, a proposition strongly supported by empirical findings. According to Koch and Sun, variations in dividend announcements possess a dual effect: they both influence and are influenced by changes in dividends. Remarkably, their research unveiled a noteworthy positive statistical association between dividend announcements and the subsequent modifications in dividend payments, thereby engendering a favorable market response. Their study culminated in the compelling conclusion that investors actively harness dividend announcements as valuable indicators to glean insights into impending dividend adjustments, underlining the pivotal role of this communication in shaping investor perceptions and market dynamics. Further, a segment of the research community posits that dividend announcements do not bear a substantial relationship to fluctuations in share prices. Miller and Modigliani (1961) notably contend that dividend policy holds no sway over shareholder wealth, asserting that investors remain impervious to the impact of dividend announcements. According to their perspective, the conventional financial model governing a company's dividend, investment, and financing decisions is

endogenously determined and remains uninfluenced by well-documented dividend announcements. Nevertheless, the findings of Ali and Chowdhury (2010) do not lend unequivocal support to the notion that stock prices exhibit significant reactions to dividend announcements. After examining how stock prices reacted to dividend announcements in 25 listed banks, the authors found that insider trading and other factors in the capital market overshadowed the information conveyed by dividend declarations.

However, the study by Arif Pasha and Nagendra (2017) found that dividend announcements do not have a significant impact on abnormal returns, and no consistent pattern is observed around the event date. While some companies experienced negative returns on the event day at various times, overall, dividend announcements did not lead to changes in stock prices. This finding contradicts Gordon and Kwame's (2010) assertion that there is a significant relationship between dividend announcements and share prices. Despite the announcements, certain companies exhibited abnormal returns, with some even offering higher dividend amounts than anticipated. However, the analysis of abnormal returns did not reflect this trend, and the hypothesis that dividend announcements have no effect on stock price behavior was confirmed. This indicates that dividend announcements do not influence share price behavior.

Research conducted in 2014 and 2019 identified a positive relationship between dividend announcements and share prices in the Sri Lankan stock market. Menike (2014) observed a positive average abnormal return, along with significant changes in share price behavior during dividend announcements. Similarly, Mallawa et al. (2019) confirmed that dividend announcements play a crucial role in share price performance, noting a significant impact on market responses before and after these announcements on the Colombo Stock Exchange. These findings underscore the importance of dividend announcements in shaping investor behavior and influencing stock prices in Sri Lanka.

This comprehensive theoretical and empirical review reveals a spectrum of viewpoints concerning the intricate interplay between dividend announcements and share prices. Some scholars contend that dividend announcements wield a noteworthy influence over foreign stock market valuations. In contrast, others assert that such

announcements leave stock prices unaffected. This divergence of perspectives holds profound implications for the broader economic landscape and the overall efficiency of financial markets. Notably, there is limited research in Sri Lanka that explores how dividend announcements relate to share prices. This paucity of studies leaves an ambiguity in our understanding of the precise dynamics governing the interplay between dividend announcements and share prices within this specific context. In essence, this chapter's literature synthesizes the diverse and occasionally contentious array of theories, prior research findings, and related scholarship, thereby setting the stage for the current study to contribute fresh insights to this nuanced discourse.

3. Research Methodology

This study aims to delve into the influence of dividend announcements by scrutinizing the response of share prices to such announcements, employing an event-based methodology. Event-based studies encompass an analytical approach that centers on the behavior of a firm's stock prices in the vicinity of pivotal corporate or economic events, with dividend announcements being a key focal point in this investigation. Notably, event-based studies have found application across a broad spectrum of firm-specific contexts and widespread events within the realms of accounting and finance. In these applications, the central concern typically revolves around discerning the impact of an event on the price dynamics of a specific class of firm shares. Such events encompass a diverse array, including earnings announcements, mergers and acquisitions, the issuance of new equity or debt, and, prominently, the focus of this paper, new announcements related to dividends. As elucidated by Brown and Warner (1985), an event study can be aptly described as an empirical financial research technique that empowers an analyst to gauge the repercussions of a specific event, such as a dividend announcement, on both stock prices and share values.

Furthermore, to investigate the impact of dividend announcements on share prices, a Stratified sampling technique was employed to establish the study's sample. The initial pool of 290 listed companies was stratified based on their dividend announcement status for the year 2022. Among these, 220 companies made dividend announcements during that year. Among the dividend-announcing companies, a further stratification was performed based on the type of dividend announcement date, leading to the selection of all companies that made final dividend announcements as the sample. In

total, 20 such final dividend announcement companies were chosen as the study's sample, spanning a one-year period from 2021 to 2022, with a focus on companies exhibiting price sensitivity in the vicinity of the dividend announcement dates. The event date in this context was defined as the date of the dividend announcement, with t=0 marking the time when the board of directors proposed the dividend proposal. The time window encompassed both the estimation and event periods, creating a fixed period in which the share prices of the firms were analyzed. The interest period spanned both before and after the event date, allowing for the capture of price effects stemming from announcements occurring after the stock market closed on the dividend announcement date, in line with the methodology outlined by Mackinlay in 1997. This study employed a time window of -5 to +5, and for the estimation of return parameters, a five-day estimation window was defined. The effect of dividend announcements on share prices was assessed using an independent sample t-test, with a 10-day analysis period (five days before and five days after the dividend announcement) serving as the basis for analysis. Additionally, the second objective of the study aimed to evaluate the overall daily share price fluctuations, for which Standard Deviation was employed as a measure. Standard Deviation is a straightforward method for gauging the level of volatility or price fluctuations. The conceptual framework for this research was methodically designed in alignment with the research theme aligned to the literature review. To identifying the effect of dividend announcement on share prices and to assess the overall fluctuation of daily share prices are the objectives of this study. Dividend announcement is independent variable and share price is dependent variable. Mainly dividend announcement can be seen in two types. Those are interim announcement and final announcement. For this study used final dividend announcement. Based theories used in previous studies, these independent and dependent variables can be conceptualized as follows.

Figure 1: Conceptual framework

(Source: by authors)

In this study, dividend announcements (independent variable) and share prices (dependent variable) are the key variables under examination. The dividend is announced according to the company's dividend policy, which significantly influences the timing and nature of the announcement. Dividend announcements are considered one of the most crucial events in the financial calendar, as they often trigger stock market reactions, reflecting the semi-strong form of the efficient market hypothesis (Neetu & Shuchi, 2010). These announcements are also meaningful indicators of a company's liquidity (Laabs & Laabs, 2013). The dividend announcement date is used as a measure to evaluate the impact of dividend announcements. Share price, defined as the cost of purchasing one share of a company, is determined when the decisions of investors align with the company's pricing. However, share prices are not stable; they fluctuate in response to market conditions. Daily Share Prices (DSP) are considered a key measure of share price in this context. Building on the identification of these key variables through the literature review, the following hypotheses have been developed to achieve the study's objectives.

H_0 – There is no significant impact in dividend announcement on share prices

H_1 – There is significant impact in dividend announcement on share prices.

Specially, a reasonable care has been taken in selecting the sample to avoid industrial factors affecting the share prices. And also, this study considers the companies who make public announcement related with the final dividend payment. Interim dividend announcements are not considered in this study. The name of the company that made the dividend announcements, the date of announcements, dividend per share, date of payments, ex dividend price and type of dividend (Interim/ Final) gathered regarding the dividend announcements. And also consider the values of the Daily Share Prices (DSP) by the Colombo Stock Exchange to measure stock price fluctuations or it measures the movements in the share prices of listed companies. Daily share prices data for the analysis period was obtained from the Colombo Stock Exchange websites for conducting this study. ASPI is the one of the main market indexes used in CSE to measure the fluctuations of Stock Prices or it measures the movements of share prices of listed companies. This is used to measure the overall market condition based on different criteria in every country that operate share market. In Sri Lankan context they used the all-voting securities to measure the market cap in CSE. ASPI data related with

analysis period are gathered from the marketing department of CSE to conduct this study.

Independent sample t- test analysis is the technique which is employed to analyze the data to examine the impact of dividend announcement on share price. This study aimed to compare share prices before and after the dividend announcement to determine if there are any differences between them. In this study has concerned before 5 days and after 5 days of announcement, totally 20 days as event window similarly to Ali and Chowdhury (2010). When considering the independent sample t- test it is comparing the mean differences between two unrelated groups in the dependent variable (share prices before and after the 5 days on dividend announcement) in same condition. When considering the independent sample t-test analyze it compare the mean difference between two unrelated groups in the dependent variable in same condition. There are several assumptions having in the independent sample t-test analysis. There are six assumptions in this analysis. Those are can mention as follows.

1. Dependent variable should be measured on a continuous scale. It means dependent variable measure at the interval or ratio level.
2. Independent variable should consist of two categorical independent groups. In this study independent variable is dividend announcement. In here tested two groups that those are share prices of pre dividend announcement and post dividend announcement.
3. There should have independence of observation. That means that there is no relationship between each group or between groups of themselves of observations. This is an important assumption of the independent sample t-test. When considering this study there are no relationship between the two groups (share prices of before and after the dividend announcement)
4. There should be no significant outliers. Outliers mean that there are simply single data points within collected data that do not follow usual patterns. When outliers are available in the collected data, those have negative effect on the independent t-test and reducing the validity of the results. When run the independent sample t-test using the SPSS statistics can easily detect the possible outliers in the collected data.
5. Dependent variable should be approximately normally distributed for each group of the independent variable. When considering independent sample t-test of

approximately normal data is most important requirement. Shapiro-wilk test can use for test the normality.

Table 1: Matrixes for data analysis calculations in this study

Matrix	Description of the calculation
Daily Share Returns (R_{it})	The daily share return is calculated by using collected closing price of each firm. This is the actual return on shares; the daily share return of individual firms was estimated according to the formula shown in below. **Rit = (Pit / Pit-1) / Pit-1** Rit - Actual Return on share i on day t Pit - Price of share i on day t (day of announcement) Pit-1 - Price of share i on day t-1(day prior to the announcement)
Market Returns (R_{mt})	To estimate the market return, the most popular market model is used. Market Return was calculated as the following formula. **Rmt = (ASPIt - ASPIt-1) / ASPIit-1** Rmt - Return on Market Portfolio ASPIt - ASPI (All Share Price Index) for day t ASPIit-1` - ASPI for day before t
Expected Returns $E(R_{it})$	**E(Rit) = α +β*Rmt** E(Rit) - Expected Return on share i on day t in the test period α - Estimated Regression Intercept of share i (Constant) β - Estimated Systematic Risk Rmt - Return on market portfolio When calculating Expected Return have to find the α and β parameters. Those two parameters are ascertained using the data of comparison period through Ordinary Least Square (OLS) Regression. For the purpose of calculation α and β parameters 25 observations of previous daily returns were used. There are mainly three ways to calculate expected return as; • Zero - one model • Mean - adjusted model

	.• Market model Here the alpha and beta parameters were ascertained using the market model. Therefore, the daily closing adjusted share prices and market index of ASPI are used to measure the liner relationship between expected return of five companies share price and market index.
Abnormal Returns (ARit)	Abnormal Return is the estimated impact of the event on the share prices. In this also the market modal was used to calculate the abnormal returns for eleven days surrounding dividend announcement date (Test Period). To calculate market return, following formula was used and it can be derived by subtracting the estimated return from the actual return. **ARit = Rit – E(Rit) + eit** ARit - Abnormal Return on share i on day t Rit - Actual Return on share i on day t E(Rit) - Expected Return on share i on day t eit - Standard Error Term This model has been probably the most popular benchmark employed in event studies. Also the abnormal return can be derived through the expanded formula of; **ARit = Rit –(α + βRmt) + eit**
Excess Return (ER_{it})	The excess return means the return difference between actual return/ daily share return and the market return. It is also examining the share market response to dividend announcement by examining the excess return earned by the shares during the test period. When calculating excess returns the study assume that the zero one model generates the excess return. In the zero one model it is assumed that the α equals to zero and β equals to1. (α = 0 and β =1). The formula for calculate the excess return can be derived as; **ERit = Rit - Rmt** ERit - Excess Return on share i on day t Rit - Actual Return on share i on day t Rmt - Return on market portfolio in day
Average Abnormal Return (AAR)	This study conducted by testing total sample of 25 events to get an overall view of share market response to dividend announcements. For this purpose, the average returns were calculated for twenty-five events through tested period. That means 25 events for the period from t -5 to t + 5 are averaged across firms. The average returns for a day for each event

	were summed up and averaged to obtain the average abnormal return for each simple sample as follows; **AARt = 1/N ∑ ARit** AARt - Average Abnormal Return for day t N - Number of events in the sample ARit - Abnormal Returns of the firm during the event period
Cumulative Average Abnormal Returns (CAAR)	After calculating the average abnormal return, the CAAR calculated for measure the market response to dividend announcements. For this purpose, five years AAR are sum up and Calculated the CAAR for test period of 11 days window including announcement date.
Standard Deviation	The standard deviation for each event was calculated by using Microsoft excels formula.
Significance Test	The t – statistics were calculated to examine the statistical significance of the Average Abnormal Return and t- statistics were calculated using excel. The t value is calculated as; **t – Value = Average Abnormal Return / Standard Error**

Source: Extracted from the literature

6. There needs to be homogeneity. Using Levine's test can check the homogeneity of variances.

In order to Calculate the Daily Share Returns and Daily Market returns for the purpose of analyzing and interpreting results to achieve the study objective, the stock return and the market returns are measured by using daily stock details. It can be calculated as discrete returns or logarithmic returns. This study uses discrete returns. The following table shows the formulas used for calculating the measurements for the analytical purposes.

4. Data Analysis and Findings

This section discusses the findings on how dividend announcements affect share prices for companies listed on the Colombo Stock Exchange and looks at the daily fluctuations in share prices. It describes the behavior of share prices throughout the

test period. The study utilized independent sample t-tests to determine the impact of dividend announcements on share prices. This chapter aligns with the study's objectives and hypotheses.

4.1 Nature of Dividend Announcement

Dividends policies are different from one company to another company. As a result, could be seen various type of dividend announcement throughout year of 2019. When considering the dividend announces there are 220 companies listed in Colombo stock exchange announce the dividend. As mentioned in above chapters the dividend policy of a firm is differ from each other. There are many types of dividends announce the companies. Final dividend announcement, Interim dividend announcement, Scrip dividend announcement, second interim announcement, First & Final dividend announcement, first interim announcement and third interim are the sum of dividend announcement could identify through the data collection. When study the dividend announcement could be understood some companies announce the dividend twice of a year. The companies have voting and none voting securities. Most of the time companies announce the dividends for voting securities. And also, the companies declared XD date, payment date and dividend per share when announce the dividend. Some companies announce the higher dividend per share. This study was conducted using 20 companies listed in CSE and all of these companies include in S&P 20 index which was introduced in 2012 and ASPI. When considering the dividend policy of those selected companies their nature of dividend policy is not similar to each other. Hence, this section aims to explore the dividend policies of the selected companies. Though there is Voting (Code N) and Non-Voting (X) Securities in some of above companies, considered only dividend announcements of voting securities due to avoid the lack of data for this study.

4.2 Share Price Reaction to Dividend Announcement

Theoretically in abnormal return examining, markets are supposed to be efficient markets when the share prices absorb all the information related to the market; historical, current and expected information hence at no point are investors expected to earn abnormal returns (Malkiel,2003). Daily share price indices of specific companies and the S&P price list were employed to compute abnormal returns (AR) and cumulative abnormal returns (CAR) during the event window. The study compared the actual returns of the company during the event window with the

expected returns to determine the abnormality of returns after the dividend announcement.

4.3 Analysis of AARs, CAARs and t Statistics to Release of Dividend Announcement

Table - 2 represents the what findings of AARs, t-statistic of AARs, CAARs and t-statistic of CAARs for 25 companies' dividend announcement for each of the 11 days' event window.

Table 2: Details results of AAR, CAAR and t statistics

Event Day	AAR	t(AAR)	CAAR	t(CAAR)
5	-0.0042102960	-0.4308553340	-0.0042103000	-0.1289690000
3	0.0075833450	0.7760321310	0.0033730490	0.1033226320
3	0.0257273320	2.6327743980	0.0291003820	0.8913975630
2	0.0116445310	1.1916285080	0.0407449120	1.2480906980
1	0.0028305270	0.2896584420	0.0435754390	1.3347948820
0	**0.0057736450**	**0.5908387500**	**0.0493490840**	**1.5116521200**
-1	-0.0049298780	-0.5044929220	0.0444192060	1.3606409940
-2	-0.0195703160	-2.0027038630	0.0248488900	0.7611666490
-3	0.0036582440	0.3746187100	0.0285071340	0.8732253220
-4	0.0029476870	0.3016478320	0.0314548210	0.9635183210
-5	0.0079315640	0.8116666740	0.0393863850	1.2064765320

Source: Researchers' data analysis

The findings presented in Table 2 indicate that the Average Abnormal Return was observed on day t-5 and the subsequent days., next 4 days prior to dividend announcement AAR has been increased systematically. When considering 5 days event window, it reported positive AAR. On the announcement date t=0 the AAR shows a significant positive value and after the announcement day t+1, it reported highest AAR throughout the period. The AAR after the announcement date has been obtained higher values compared to previous dates from t-5 to t-1. Figure 2 depicted those results and it can be clearly observed that AAR has been increased from starting day to last day.

The Cumulative Average Abnormal Return also reported positive values during the test period. It shows positive decreasing trend during the test period and reveal the continuous improvement of CAAR up to 2nd date after the announcement made. When

considering t values of 5 days of test period, it implies that there is good relationship between selected variables. According to results drawn from the event study AAR and CAAR, there has been some kind of market reaction to dividend announcement in the market.

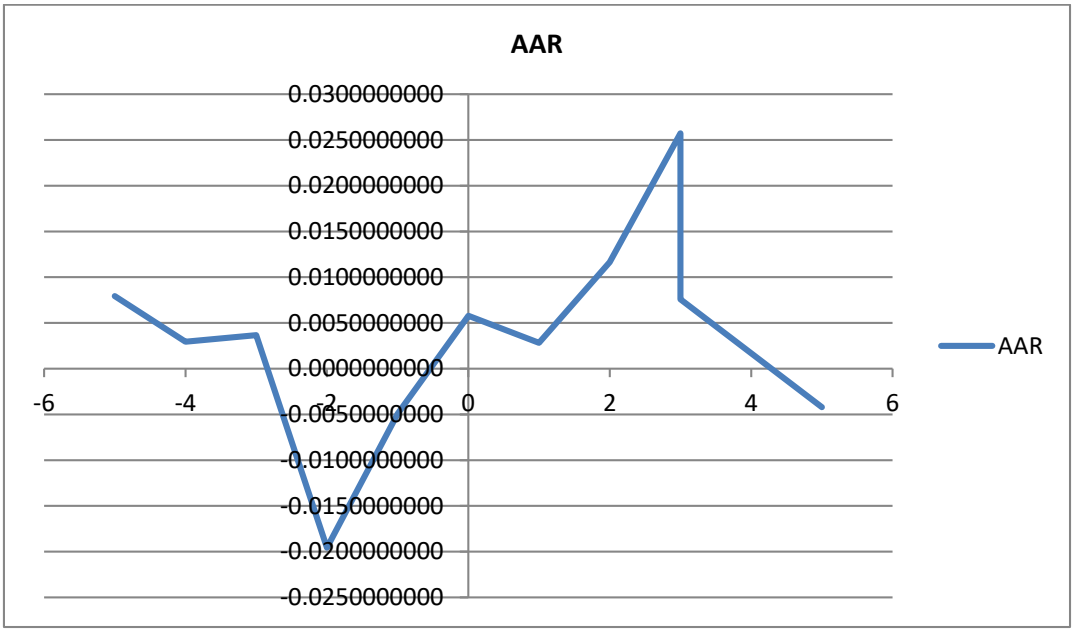
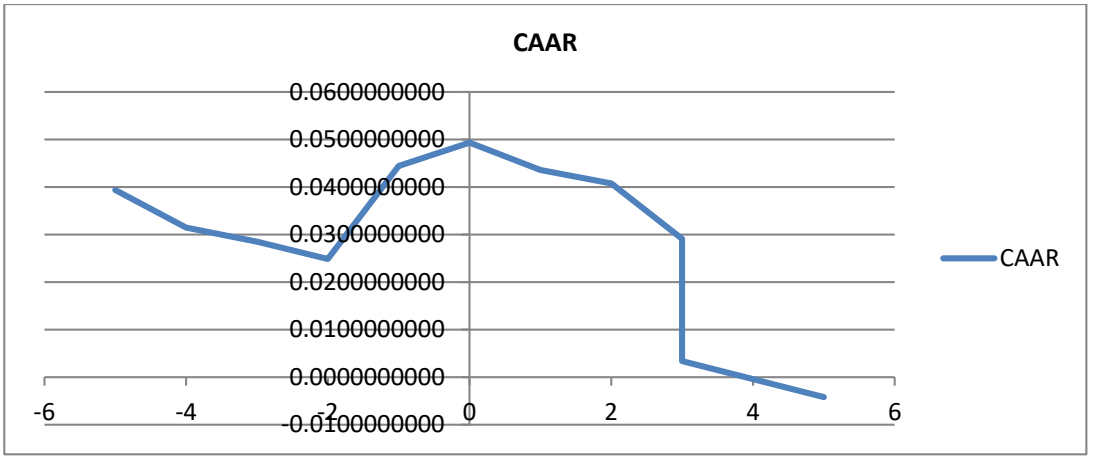


Figure 2: Average abnormal return for release of dividend announcement

Source: Researchers' data analysis

Further presentation has been done subsequently to confirm the results drawn from Table 2 and Figure 3. It consists of final results of Actual Return, Market Return, Expected Return, Excess Return and Abnormal Return for the test period. AARs Shows the fluctuation of AARs of the sample companies during the event window. AARs fluctuate negatively in the event day of -4, -3, 0 and +1, 2, 3, 4 It is again confirmed that investors perceive Dividend announcement as good and bad information to earn return from stock market.



Source: Researchers' data analysis

Figure 3:
Cumulative average abnormal return for release of dividend announcement

Figure 3 illustrates the Cumulative Average Abnormal Returns (CAAR) of the sampled listed companies. The trend shows that the cumulative abnormal returns (CARs) were predominantly negative throughout the pre-event window, with the exception of day -4. Following the dividend announcement, investors took time to assess the information, and the market reaction suggests that negative news outweighed positive news, leading to a negative impact on stock returns. This indicates a significant effect of the dividend announcement on stock returns, as clearly demonstrated by the CAAR trend. Consistent with findings by Ranjani, Sujeewa, and Rathnasiri (2009) and Edirisinghe (2017), the CAAR results reflect a downward trend in stock prices on the Colombo Stock Exchange (CSE).

4.4. Hypotheses Testing

Based on the abnormal return analysis, the researcher tested the hypotheses. As shown in Table 2 and Figures 2 and 3, which present detailed results of AAR, CAAR, and t-statistics, the researcher identified that the t-value of AAR is significant around the announcement date. Therefore, H1 is supported, and the null hypothesis is rejected. This chapter discusses the impact of dividend announcements on share prices. In summary, the research concludes that dividend announcements have a significant impact on share prices. Specifically, there is a positive impact on the share prices of

the selected companies, as evidenced by the positive abnormal returns observed around the announcement day.

5. Key Findings, Conclusion and Implications

5.1 Key Findings

This section presents the summarized results of this study, grounded in the methodology and research hypotheses. When examining stock market reactions to dividend announcements, the results indicate an increase in abnormal returns surrounding the announcement day. Shareholders of the sampled companies experienced positive abnormal returns and cumulative average abnormal returns (CAAR) on and after the dividend announcement day. These findings further confirm the existence of excess returns and cumulative excess returns, as positive returns were observed during the test period following the event date. Consequently, the null hypothesis is rejected, supporting the theory developed by Gordon and Lintner, which posits a direct relationship between a firm's dividend policy and its market value. Although there is an impact on share prices, it is relatively small and may not be considered significant. Nonetheless, the positive impact of dividend announcements on share prices is evident, as share prices tend to increase after the announcement compared to before. Therefore, it can be concluded that dividend announcements convey valuable information to investors.

5.2 Conclusion

The main objective of this study was investigating the impact of dividend announcement on share prices and it was study using listed companies in Colombo stock exchange. The study has based on 2019 one-year period and used 95 listed companies. After the analytical result of independent sample t-test can be clearly identified there is no clear-cut pattern of the daily share prices throughout the tested period (before and after the fifteen days of dividend announcement date). According to the result share prices are moved both upward and downward within 30days of tested period. prices. As a result of that cannot precise perfect idea regarding the dividend announcements influence the behavior of investors. This result is accordance with the Arif Pasha and Nagendra (2017, p. 8) and Gordon and Kwame (2010) conclusions. According to the both authors around the event date share prices are moved both upward and downward. And also, there is not express dividend announcement is impacting the share prices. The authors conclude the dividend

announcement is not impact the share prices. The results of the study contradictory with Neetu and Shuchi (2010) and Ngoc and Cuong (2016). According to the dividend relevance theory the dividend announcement effect positively on the stock return of the company around the announcement date is the concluded by those authors.

The second objective of this study is identifying the overall fluctuations of daily share prices around the tested period of before and after the fifteen days of dividend announcement. For achieve this objective collected 30 days share prices of 95 companies listed in Colombo stock exchange. Within tested period share prices not change quickly and share prices moved lower level. Averagely share prices moved between Rs.400 and Rs 580 of 95 companies. When considering the number of companies' fluctuation of share prices within tested period is lower level. Therefore, finally conclude that share prices are not sensitive to the dividend announcement information.

This research was conducted using a sample of 95 listed companies, with data collected over a one-year period. Additionally, the study focused exclusively on final dividend announcements. However, stronger evidence could be obtained by examining all types of dividend announcements (such as interim dividend announcements and cash dividend announcements) over a longer period. The study considered only listed companies on the Colombo Stock Exchange. It is important to note that not all listed companies issue dividend announcements, and for some companies, data relevant to the study were unavailable. Dividend announcements are not the sole factor influencing share prices; several other factors, such as bank rates, political factors, market players, and speculations, also affect share price fluctuations. This research was conducted under the assumption that other factors influencing share prices remained constant. To obtain more reliable results, future research should control for the impact of these other factors by using more sophisticated statistical techniques.

5.3 Implications

These findings are support to managers to take decisions regarding the day-to-day activities of the company, because dividend announcement is one of the corporate actions of the company. Using result of this study can decide at what time are most important to announce the dividend and can be identified earlier how react the market changes as a result of the fluctuations of share prices. And also, it is most important to

manage the stock risk. This result also helps to the investors to planning their investment and earning decisions for earn more capital gain through monitoring the stock market price reaction within the announcement period. And also output of the study can use to financial advisers to increase their earnings. Because financial advisers can take idea regarding the fluctuations of share prices and the impact of dividend announcement, then can give best advisers for their clients at what time buy or sell their shares maintain their portfolio.

However, there are few limitations that the researcher found as; the inherent limitations of secondary data and historical data, because of data sources are limited, when consider the selected tested time period (5 days), it is not sufficient to identify the impact and other factors can be affected to the changes in share prices. To lessen the impact on future research success, it's advised to study how dividend announcements affect the share volume of companies in the Colombo Stock Exchange. For that can use daily share volume. Therefore, daily overview could be an interesting study to identify the effects on company's dividend announcement on share volumes. And also, in future can be done research regarding the how dividend announcement impact on financial performance of the companies.

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Logistical Challenges of Chinese E-Commerce Platforms: An Empirical Evidence

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Abstract

The rising domination of E-commerce platforms in the various product/service categories is an overwhelming phenomenon across the globe. A customer browses a website, places the order for the product/service of his / her choice, and awaits the delivery. Although a lot of players enter the e-commerce market, not everyone survives in the long run. Existing literature focuses on the logistics and last-mile connectivity and theoretically underpins the arguments on customer satisfaction. Lately, last-mile delivery in e-commerce is an interesting area for further research among academicians worldwide. This study empirically evaluates the multiple dimensions of recently developed logistics service quality (LMSQ) and finds all the dimensions to be statistically significant for customer satisfaction. The last mile logistics service quality (LMSQ) factors explain 76% of the overall satisfaction of the customers. This study provides a measurement instrument for both researchers and practitioners interested in perspectives on the cross-section between E-commerce and Logistics.

Keywords: E-commerce, Logistics, Service Quality, LMSQ, China

1. Introduction

The Chinese market has witnessed the expansion of e-commerce platforms such as Alibaba's Tmall, JD.com, and Netease Koala. Alibaba dominates the China e-commerce market by garnishing a whopping 55.9% of retail e-commerce sales (Cheung, M.C. (2019). Panova et.al., (2019) observes e-commerce is witnessing strong global growth and China is the leading market in e-commerce. "The Chinese E-commerce platform Taobao.com has more than 800 million products on its platform with sales of nearly $170 billion, which is comparable to giants like Amazon and eBay" (Economist.com, 2013; Cao et al., 2021). Ingaldi and Ulewicz (2019) suggest that personalization, mobility, same-day delivery, and artificial intelligence will shape e-commerce in the near future. With bigger players in the market, it becomes difficult

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to compete on the grounds of resources. Also, to ascertain sustainability, the corporations (e-commerce platforms) need to be operationally efficient and agile to adjust to the dynamic business needs. Cross-border e-commerce heats the challenges for existing players.

Supply chain management plays a major role in the operational efficiency, customer satisfaction, and long-term sustainability of the businesses. Logistics performance has a much greater role to play in customer satisfaction in the e-commerce business segment (Ramanathan, 2010). In the e-commerce business, the customer visits the portal, orders the required service/product, and awaits delivery on or before the promised date. Once the order is placed, it is the responsibility of the customer service team to ensure that the delivery conditions are adhered to. The complexity in the supply chain is of no concern for the customer and the reliability and trust factors are at stake if the delivery is not made as promised. Esper et al. (2003) and Agatz, et al. (2008) suggest that the last mile distribution is of utmost concern for the end users/customers and it is regarded as a critical factor for judging the logistics performance of the e-commerce platform. Junyong and Limbo (2014) suggest that imperfect logistics directly affect the satisfaction and experience of the customers and hence, remain the bottleneck for e-commerce.

Bowersox et.al., (2012) from Michigan State University argue that supply chain management is focused on competitive advantage whereas logistics revolves around meeting customers' requirements, whereas logistics finds its roots in military origins, and at present logistics is an activity within the supply chain. Most of the existing literature on e-commerce revolves around logistics-related issues and challenges and the supply chain aspect of e-commerce is untouched.

In this study, we evaluate the challenges for e-commerce platforms in terms of examining the customer's perception of supply chain management and logistics and its relevance to them. Existing studies have often used the famous SERVQUAL model (Parasuraman, et. al., 1988) and Mentzer, et. al, (1999) Logistics Service Quality (LSQ) model for evaluating the perceptual

value of services being offered to the end customers. We use the "Last Mile Service Quality" (LMSQ) evaluation index system by Hong and Chen (2019) to understand

the stakeholder's understanding of SCM and Logistics challenges for e-commerce platforms.

2. Literature Review

2.1. E-commerce Supply Chain vs Traditional Supply Chain

The supply chain of an e-commerce platform differs significantly from the typical supply chain. In Figure 1, the typical supply chain management structure (Bowersox, et. al., 2012) is shown to have traditional compartments like procurement, manufacturing, and distribution before reaching the consumer. However, the ecommerce platform differs significantly from the traditional supply chain platform. In Figure 2, a simplified conceptual model representation of a typical supply chain management for an e-commerce platform is illustrated. It shows that an e-commerce platform is the integrating link between the buyers and sellers and the products and services to be offered to the buyers can be done through a seller's logistics, third-party logistics, or e-commerce platform-supported logistics. There might be the typical prevalent supply chain management in place for the sellers however, that is of no or least concern for the e-commerce platform. Therefore, through our model of e-commerce supply chain management, we observe that logistics and reverse logistics are an integral part of the supply chain. For an e-commerce platform to succeed in attracting consumers, it must focus on this last part of the supply chain also known as the last-mile delivery (Vakulenko et al., 2019).

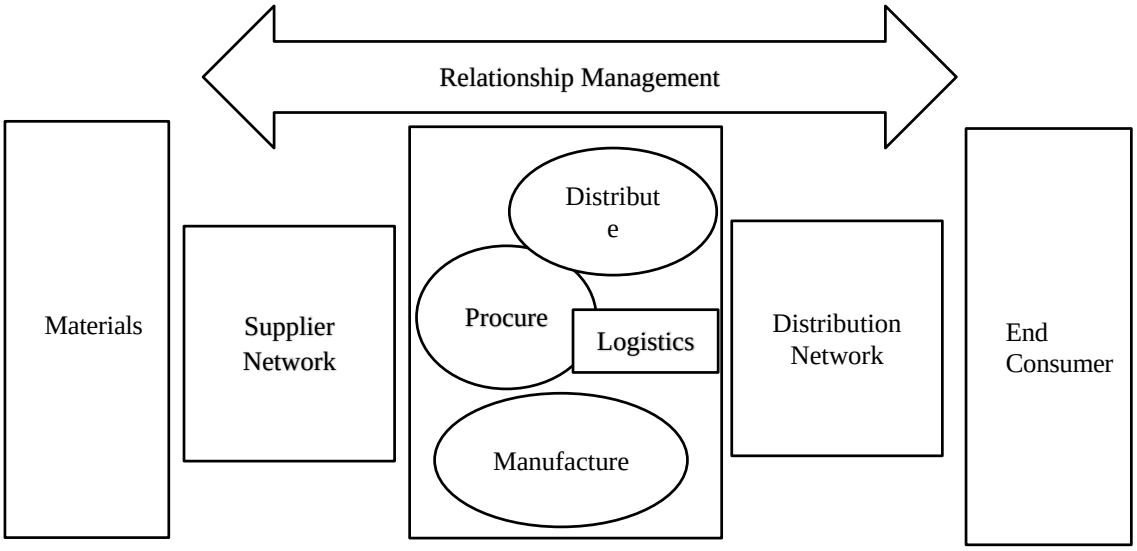

Figure 1: A Typical Supply Chain Management Structure

Source: Bowersox et al, 2012

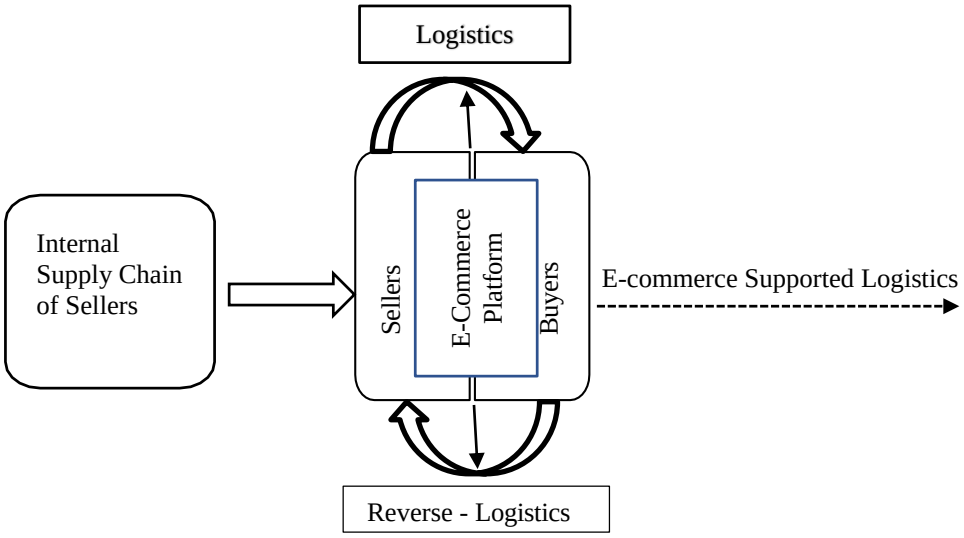

Figure 2: An E-commerce Supply Chain Management (E-SCM)

Source: Author's own contribution

2.2. E-Commerce Supply Chain Challenges

"One of the profound impacts of digitalization on supply chains is manifested through e-commerce" (Al Mashalah et al., 2022). E-commerce retailers are constantly competing to impress customers through order fulfillment, with delivery guarantee being a key competitive factor (Yang et al., 2023). For an e-commerce platform, the supply chain management challenge essentially boils down to the logistics. And as discussed by most of the authors and existing research for maintaining healthy customer loyalty, customer satisfaction and providing customer delight for promoting repeat purchases, the e-commerce platforms need to focus on this aspect (Esper et al., 2003; Agatz, et al., 2008; Junyong and Limbo, 2014; Ingaldi and Ulewicz, 2019; Ramanathan, 2010).

Clearly, the challenges for e-commerce platforms are multi-dimensional, but one needs to focus on the prime reason why the e-commerce platform was introduced in the first

place. With the changing modern lifestyle, the dominance of internet connectivity, and the paucity of time for customers, e-commerce platforms came up with the proposition to serve the needs of the customers/consumers with doorstep delivery of products and services. Convenience, product quality, timely delivery, availability of a wide variety of choices, and cheaper prices were the essential value propositions that e-commerce platforms offer. We bring back our focus to these basic value propositions and the challenges that e-commerce platforms face in modern times.

The biggest challenge for e-commerce platforms is ensuring that the right orders are delivered to the right customer at the right time. The last stretch of the "order fulfillment" aimed at delivering a product to the end-consumer ranks high among e-commerce retailers (Lim et al., 2018; Mangiaracina et al., 2019). Aspects of order responsiveness, order visibility, order condition, and order accuracy rank high in the minds of the consumer (Politis et al., 2014; Zailani et al., 2018; Chaisaengduean, 2019). This leads to our first hypothesis:

- *H_1: Order Quality has a positive impact on customer satisfaction*

An associated challenge is the expectation of the consumers for timely and reliable delivery (Ahn et al., 2004). Firms are on the lookout for innovative last-mile delivery solutions for the consumer at a minimal cost for maximum positive impact (Mangiaracina et al., 2019). For example, delivery speed is considered to be an effective performance indicator for evaluating last-mile service quality (Savelsbergh and Van Woensel, 2016; Mangiaracina et al., 2019). This leads to our second hypothesis:

- *H_2: Delivery Quality has a positive impact on customer satisfaction.*

Panova et.al, (2019) studied the locational aspect of e-commerce enterprise development and other factors which contribute to the advantage of e-commerce platforms. In the study, the authors examine the cases of two corporations and observe that reliability in supply chain management is one of the most important factors in deciding their location of operations. Along similar lines, Hameri and Hintsa (2009) examine the drivers of change and their implications on international supply chain management. The authors consider the security concerns and evolution of complex supply chain networks to assess future trends. This leads to our next hypothesis:

- *H_3: Reliability has a positive impact on customer satisfaction.*

The performance of different last-mile distribution strategies in diverse delivery environments, e.g., time-windows, customer densities is a challenge for the delivery personnel (Pahwa and Jaller, 2022). E-commerce retailers need to monitor touchpoints in service encounters across the supply chain, more so the service encounter at the customer end (Vakulenko et al, 2019). Hence our hypothesis:

- *H_4: Personnel Quality has a positive impact on customer satisfaction*

Another challenge that e-commerce platforms face is the fake products listed on their website and the damage to products (Agatz et al.,2008). The e-commerce platform by mandating stringent quality assurance, immediate refunds on reporting by customers, penalizing the seller, etc. can tackle some of these challenges. However, product returns or exchanges by the customer have a bearing on the relationship with the e-commerce vendor leading to the hypothesis:

- *H_5: Product Quality has a positive impact on customer satisfaction*

3. Research Methodology

Our model (Figure 2) signifies that logistics is the most important aspect of the e-commerce platforms and last-mile logistics forms the essential part of the supply chain management for the e-commerce platforms.

3.1. Research Objective

Once the customer places the order, his worry is only about the timely delivery as it is implicitly assumed that the quality of the product or service has been taken care of (beforehand) by the e-commerce platform. This leads us to the objective of this study:

RO: What is the perception of customers towards some of the prominent aspects of the logistics/supply chain management that the customer looks at in the current e-commerce setup?

3.2. Hypotheses

The following hypotheses are formulated based on the research objective:

H_{01}: There is no significant impact of Order Quality on customer satisfaction.

H_{02}: There is no significant impact of Delivery Quality on customer satisfaction.

H_{03}: There is no significant impact of Reliability on customer satisfaction.

H_{04}: There is no significant impact of Personnel Quality on customer satisfaction.

H_{05}: There is no significant impact of Product Quality on customer satisfaction.

3.3. Sampling Design

This study is motivated by the hypotheses proposed in the last section and the service quality dimension developed by Hong and Chen (2019) concerning the customer's perception of the last-mile connectivity of the logistics supply chain of e-commerce platforms.

Table **1: E-commerce Logistics Service Quality Evaluation Index**

Dimension	Sl. No.	Indicator
Order Quality	L1	Time for pick-up
	L2	Pre-notification of delivery time
	L3	Distribution business scope
	L4	Delivery turnaround time
	L5	Consignment rate
Delivery Quality	L6	Right time delivery
	L7	Delays due to special holiday
	L8	Delivery mode variety
	L9	Adhering to delivery promises
	L10	Delivery preciseness
Reliability	L11	Information Privacy
	L12	Damaged goods compensation
Personnel Quality	L13	Attitude of employees
	L14	Communication skills of employees
Product Quality	L15	Integrity of goods
	L16	Express packaging quality

Source: (Hong and Chen, 2019)

Since the scope of the study involved largely Chinese e-commerce platforms and Chinese consumers, the geographical spread of the consumers was largely confined to the eastern region of China, primarily from the developed areas of Beijing, Shanghai, and Guangdong Province. The assumption made is that the logistics services are comparatively better in these regions. Additionally, a representative age group of 20-50 is chosen as the targeted sample for the study. Table 1 shows the dimensions and indicators for E-commerce logistics, developed by Hong and Chen (2019) regarding the customer's perception of logistics service quality.

3.4. Sample Size and Demographic Profile

The LMSQ index was built upon the measurement method of consumer perception minus consumer expectation based on a 7-point Likert scale. We slightly altered the setup for our research and asked the customers/e-commerce platform users to rate their expectations by comparing the best e-commerce platform service that they have received vs the worst experience that they have had in the past. For example, for measuring the order quality, the customer assumes the best pick-up time that he had come across vs the worst pick-up time that he had come across from an e-commerce platform. Therefore, we had a few additional questions in our survey on demographics (gender, age, and tenure of usage of e-commerce platforms). We also checked if both the comparable experiences are from the same e-commerce platform or different ones. The participants were intercepted at malls, schools, transportation stations, outside work locations, and other public places. Table 2 depicts the demographic characteristics of the sample surveyed.

Table 2: Demographic Details of Respondents

Variable	Measure	Frequency	Percentage
Gender	Male	224	48.8
	Female	235	51.2
Age	20-30	169	36.8
	30-40	146	31.8
	40-50	144	31.4
Platform Experience	Same Platform	306	66.7
	Different Platform	153	33.3

E-commerce Customer Experience	1-4 years	138	30.1
	4-7 years	151	32.9
	7-10 years	88	19.2
	> 10 years	82	17.9

Source: From Survey

4. Data Analysis and Findings

A total of 500 responses to the questionnaires circulated were collected, out of which 459 were complete in all aspects and hence usable. Of all the usage responses, 49% (224) of the respondents were male and 51% (235) of the respondents were female. The majority of the respondents were aged less than 40 years of age and accounted for 69% of the total sample. 63% of the respondents had e-commerce platform usage of less than 7 years. About 67% of the respondents reported that their best and worst experiences were with the same e-commerce platform. If we categorize the Likert scale score of >=5 (out of 7) as satisfied and <5 (out of 7) as dissatisfied, then only 42% of the respondents are satisfied (overall) with their current e-commerce platform.

We investigate the relationship between self-reported satisfaction measures (dependent variable) with the LMSQ index measures (independent variable). We run a linear regression (OLS) to identify if each/any of the index measures are significant in the overall satisfaction of the customer. We use Age, Gender, Platform, and Tenure as control variables. We expect that the coefficients of the five dimensions of the service quality, should not be equal to zero and should be significant to reject all the above null hypotheses. The regression model used for testing the relationship is as below:

$$Satisfaction_i = \alpha + \beta_1 Age_i + \beta_2 Gender_i + \beta_3 Platform_i + \beta_4 Tenure_i + \beta_5 OrderQualityi + \beta_6 DeliveryQuality_i + \beta_7 Reliability_i + \beta_8 PersonnelQuality_i + \beta_9 ProductQuality_i + \varepsilon i \quad \ldots\ldots (1)$$

where i = 1 to 459 respondents. Age, Gender, Platform, and Tenure are dummy variables taking a value of 0 or 1. If the Age is <35 years then it takes a value of 1 meaning a millennial or younger generation, else 0. If Gender = 0 then female or else

male. If the comparable response is for the same e-commerce platform, then it takes a value of 0, or else it takes a value of 1. If the e-commerce platform usage of the customer is of less than 5 years then it takes a value of 0 or else 1. Rest of the variables are as per the LMSQ Model (Hong and Chen, 2019). Our results obtained from the OLS Regression technique are as below:

Table 3: Regression Statistics

Regression Statistics	
Multiple R	0.87
R Square	0.76
Adjusted R Square	0.76
Standard Error	0.28
Observations	459

Table 4: ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9	116.27	12.92	159.20	0.00
Residual	449	36.44	0.08		
Total	458	152.71			

Table 5: Regression Coefficients for various variables

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.61***	0.12	5.19	0.00
Age	0.01	0.03	0.38	0.71
Gender	-0.01	0.03	-0.50	0.62
Platform	0.03	0.03	0.99	0.32
Tenure	-0.01	0.03	-0.20	0.84
Order Quality	0.21***	0.01	14.06	0.00
Delivery Quality	0.19***	0.01	13.47	0.00

Reliability	0.18***	0.01	18.82	0.00
Personnel Quality	0.19***	0.01	20.70	0.00
Product Quality	0.20***	0.01	20.64	0.00

*** Significant at 1%, ** Significant at 5% and * Significant at 10%

5. Discussion

The analysis of the regression results leads to interesting findings. None of the control variables: Age, Gender, or Tenure of Usage of E-commerce Platforms were found to be significant. Even, the reported responses of the same e-commerce platform or different e-commerce platforms were not found to be significant. On the other hand, all five dimensions of the LMSQ model by Hong and Chen (2019) were found to be significant and positively impacting overall customer satisfaction (Table 5). Surprisingly, the strength of the coefficients for all the dimensions was close. From Table 4, it is evident that all the coefficients of the model are not equal to zero and hence there is some impact on the satisfaction of the customer for each of the variables. The overall model's explanatory power (Table 3) for satisfaction stood at (adjusted R-Square) 76%. Clearly, from a customer's viewpoint, all the dimensions of order quality, delivery quality, reliability, personnel quality, and product quality are equally important (Table 6). Deviation from any of the above quality measures may lead to dissatisfaction and poor customer experience. The LMSQ model holds good for estimating the overall satisfaction of the customer: 0.21ODQ+0.19DLQ+0.18REL+0.19PEQ+0.2PDQ+0.61

Theoretically, existing literature has focused on challenges in logistics in supply chain management of e-commerce platforms (Yu, et. al., 2016; Junyong and Limbo, 2014; Qin, et. al., 2019; Lamba et. al., 2019; Li and Suomi, 2006; Jingxuan, 2015; Shi, et. al., 2018) and emphasizes on the aspect of efficiency. A few have focussed on the role of e-commerce logistics on trust, satisfaction, and reliability for the customers as well (Rico, et. al., 2019; Clemons, et. al., 2013; Hao, et. al; 2018). With advancements in technology, availability of big data, the requirement for huge investments, increasing complexity of logistics and supply chain, rising security concerns, governance, and regulatory issues are some of the other challenges that e-commerce platforms face today (Farooq et. al., 2019; Fan, 2019; Lamba, et. al., 2019).

This study validates the e-commerce "last mile" logistics' service quality (LMSQ) evaluation index system and adds to the existing body of literature in identifying the various aspects of e-commerce supply chain management that the e-commerce platforms need to look into for retaining and attracting customers.

Table 6: Hypotheses Testing Summary

Hypothesis	Decision
H_{01}: There is no significant impact of Order Quality on customer satisfaction	Rejected
H_{02}: There is no significant impact of Delivery Quality on customer satisfaction.	Rejected
H_{03}: There is no significant impact of Reliability on customer satisfaction	Rejected
H_{04}: There is no significant impact of Personnel Quality on customer satisfaction	Rejected
H_{05}: There is no significant impact of Product Quality on customer satisfaction.	Rejected

With rising cross-border e-commerce trading, the level of complexities in the supply chain management of e-commerce platforms is bound to surge. However, if the basics of the last mile or terminal link with the customers are kept intact, the success of the e-commerce platforms is guaranteed. From the proposed model of supply chain management for e-commerce platforms (Figure 2), the practitioners must understand that once an e-commerce platform can attract the customer to the website, then the last contact through the delivery must be ensured on a positive note, or else repeat customer or customer retention would be a huge challenge. With so many opportunities at the fingertips, the loyalty of the customer is highly volatile. That's the prime reason why the government and the various e-commerce giants (Alibaba, Amazon, etc.) focus on creating a sustainable and agile logistics infrastructure to support customer delight. With rising innovations in the field of RFID usage, GPS technology, other enterprise management and integration systems, drones, and diverse logistics options, the complexity is bound to increase, but if optimized properly, the results would be amazing for e-commerce platforms.

6. Conclusion

The challenges for the e-commerce platforms are to tackle the ever-growing demand and competition simultaneously. And with government policy support, regulatory framework, and adaptability to the latest technology innovations, the challenges can be met by the e-commerce platforms. From the analysis, it is evident that managing logistics or supply chains for e-commerce platforms is a big challenge and one cannot ignore any of the dimensions of service quality: all are equally important. Especially in China, the challenges are humongous, as e-commerce plays a vital role in the absence of proper brick-and-mortar infrastructure. Jack Ma rightly pointed out, "E-commerce is like a dessert in the US, yet the main course in China"2.

Future research in the area of optimization of logistics and supply chain is required as each and individual component needs to be given their due importance. Focusing on one aspect and neglecting another will boomerang on the e-commerce platforms. Innovations to support the survival and competitiveness of the smaller players in the e-commerce markets need to be prioritized. With a focus on data, data science, artificial intelligence (AI), and machine learning (ML), block-chain some of the security concerns, investment in redundant activities, optimizing the best available resources, etc. can be achieved.

7. Practical Implications and Research Limitations

The study reinforces the operational challenges involving coordination and collaboration with stakeholders/third parties involved in the critical last-mile delivery performance of e-commerce providers and adds to the existing body of literature. Our study is based on the LMSQ Index applied to limited categories and may not be representative across all e-commerce segments, for example, grocery and electronic appliances may not necessarily have similar customer responses. Also, customer tastes and culture may vary across geographies. Hence, generalizability of the result may not be advisable beyond the shores of China.

Acknowledgment: The authors would like to acknowledge the role of Ms. Li Lydia, Coordinator, Academia Globe, Chengdu, China in data collection

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Digital Transformation in HR Tools – A Perspective from Engineering Institutions in Bangalore

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Abstract

Adapting to digital changes has become essential in order to keep a pace with this changing technological development. In this context, Automation initiatives in HR processes in Education Sector plays a vital role in embracing digital transformation and creating an opportunity for paperless administration. This paper mainly focuses on the impact of digital tools used by various engineering institutions across Bangalore for their employees. The administrative processes include Employee Database, handling Leave Request, recording Attendance, Processing Payroll and other employee benefits. Implementation of digital HR tools foster employee productivity and ensure a positive work culture. The present study employs a convenient sampling technique for data collection from various engineering institutions across Bangalore. Regression analysis was used to analyses the data and draw an inference. The outcome of the study shows that HR digital transformation has made a positive impact on overall performance by establishing conducive, flexible and transparent work culture.

Keywords: HR digital Transformation, HR Tools, Employee Productivity, Paperless Administration, Automated HR Processes

1. Introduction

Digital transformation involves devising new business models and capturing emerging market opportunities (Catlin et al., 2015). It requires substantial investment in building digital skills matched with corporate goals (Lorenzo, 2016). Over the last few years, HR as a function is undergoing profound changes in terms of digital transformation. By using digital tools to deliver various HR solutions, Institutes are facilitating an environment that enables and enhances productivity among the employees. In this context, various Engineering Colleges in Bangalore have automated routine

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administrative operations in HR processes like Employee Database, Handling Leave Request, Recording Attendance, Processing Payroll. However, to grasp the effects of this implementation, it is imperative to know if the employees possess the necessary skills /knowledge to use these tools to the maximum of their advantage. In order to answer this question, we embarked on a data-based study of various engineering institutes in Bangalore to ascertain both qualitative and quantitative impact of digitalization of HR processes on institutes and their employees. Various studies have shown that digitalization is a continuous process as opposed to a discrete set of activities and requires constant knowledge augmentation from the employer and employee in a cohesive manner to achieve desirable results. Mere introduction of digital systems has not shown remarkable success or has found resistance from various segments, thereby reducing its adoption and effectiveness. Junejo et al. (2021) found that e-HRM has created value and improved processes within the organization, shifting from labour-intensive to enhanced procedures. As market conditions and employee needs change, Human Resource departments must modernize administrative operations within the firm. A strategic approach to HRM that aligns with IT and business needs is also essential (Wirtky et al., 2016). Reducing turnover and retaining skilled workers can be achieved through the use of e-HRM (Al-Alawi, Al-Azri, & Mohammad, 2016; Johnson, Stone, & Lukaszewski, 2020). Therefore, adopting Digital Human Resource Management tool is vital for enhancing organizational performance.

We argue in this paper that in order to gain maximum utility from introduction of HR technologies, a holistic implementation as well as continuous training and knowledge dissemination is required so that the impact and adoption is seen to be equitable, just and user friendly.

2. Review of Literature

According to Kavanagh et al. (2012), HRM operations have been greatly facilitated by the evolution of information technology. Digital technology has been recognized as a crucial internal factor that assists firms in undergoing transition (Ismail et al., 2017). digital HRM entails overseeing all HRM operations through digital tools, applications and online platforms. The digitization of HRM activities also relies on innovations. The various review of literature on human resource digital transformation facilitates

comprehension of current knowledge across several disciplines rather than a specialized domain (Tarafdar & Davison, 2018). Murphy (2018) states that when HR personnel are relieved of low-level administrative duties, they are able to concentrate on more strategic roles that offer significant value. In their investigation, Fedorova et al. (2019) explored how the digitization of work influences employee motivation. The research findings indicate that the utilization of technological tools for monitoring employee work increases their motivation to strive for performance improvement, engage in novel project endeavors, and earn appreciation from their superiors. The process of human resource digital transformation has encompassed multiple stages, including the digitalization of internal and external organizational activities. However, it did not address the activities involved in value creation. Digital technologies are employed to digitize current corporate operations with the goal of achieving maximum cost savings (Pagani & Pardo, 2017). The utilization of digital technology in human resources is aimed at developing essential skills and overcoming challenges (Singh & Hess, 2017).

The utilization of human resource digital transformation in administrative duties enhances efficiency and plays a significant role in the organizational strategy (Silva & Lima, 2018). The adoption of digital transformation in human resources enhances opportunities and facilitates the development of employees' competencies and skills (Betchoo, 2016). This transformation refers to the adoption of techniques that utilize technology to streamline administrative tasks and minimize the workload of people in a business (Fenech, Baguant, & Ivanov, 2019). Implementing human resource digital transformation strategies, such as flexible work schedules can improve work-life balance and contribute to overall employee satisfaction (Sankar, 2018). Every firm must prioritize the implementation of work-family balance to foster personal relationships through the digital transformation of HRM. The goal of work-life balance is to meet employees physical well - being needs related to work and their mental well-being needs outside of work by leveraging information systems in human resource management (Alaradi & Sankar, 2019).

The emergence of technology and how businesses do their business have completely redesigned the process of HRM strategies. Technology has become crucial in facilitating digital transformation and enabling HR practices to persist during the pandemic (Gigauri, 2020). Organizations are increasingly turning to digital HR

systems in an effort to streamline the processes of collecting, restoring, and updating up-to-date information regarding their employees' KSAs (Hopkins & Markham, 2017). The usage of digitalized HRM supports the Recruiting and Selecting processes by expanding the candidate pool and streamlining it by lowering the amount of time and resources needed (Marchington & Wilkinson, 2005).

Performance evaluation and management systems rely on information technology to examine organizational and individual activities by providing workers with the necessary strategies, methods, information, and support systems (Benson et al., 2022). Reengineering HR tools by incorporating digital transformation. It explores how institutions can enhance their HR practices by adopting advanced digital tools to improve HR management and decision-making processes (C. Karthikeyan, 2020). S. Talamala, (2023) in their paper discusses the major digital tools used by both national and global organizations, highlighting how digital transformation has enhanced the talent management process in Indian institutions. P Chaudhary, KK Sharma (2021) explained in their paper that institutions frequently fall short in vision, their preparedness and the commitment necessary for effective implementation of technology. Wood, G., & Collings, D. G. (2021) offer a thorough examination of HRM procedures in industries with strict regulations, including banking.

In addition to outlining solutions for handling compliance-related difficulties, their article explores how HRM plays a key role in maintaining compliance with complicated regulatory frameworks. The significance of ongoing employee training and integrating compliance into the organizational ethos is underscored as a means of reducing risks and upholding regulatory compliance. Human resource management's changing position in the banking industry is examined by Garg and Singh (2020), who observe that it has evolved from a transactional to a strategic role. Their article discusses the main issues that HRM in this industry must deal with, such as satisfying the growing demand for improved employee abilities, managing talent in a highly regulated environment, and adjusting to technology improvements. The authors contend that in order for banks to successfully handle these changing issues, their HR practices must be modified.

3. Materials and Methods

Digital Transformation in HR Tools has significantly impacted engineering institutions in Bangalore, streamlining HR processes and enhancing operational efficiency. These institutions, known for producing top-tier engineering talent, are increasingly adopting advanced digital tools like HR Information Systems (HRIS), AI-powered recruitment platforms, and automated performance management systems. The shift towards digital HR tools enables real-time data analytics, improves decision-making, and fosters a more agile workforce management system. In Bangalore's competitive academic landscape, such tools are essential for managing large volumes of faculty and student data, automating routine HR tasks, and ensuring compliance with institutional policies. As engineering institutions continue to modernize, the integration of these tools not only enhances administrative efficiency but also aligns with the broader digital transformation efforts taking place across India's educational sector. This paper aims to gather the employee's viewpoint on the digital transformation of human resources. The aim of this study is to identify the benefits of HRM digital transformation in academic institutions and to evaluate its impact on organizational performance.

3.1. Research Objective

Based on the above grounds the following objectives of the Study have been designed:

- To study the significance of digital transformation within academic institutions.
- To evaluate the impact of digital HR tools on employee performance.

3.2. Research Methodology

The paper used a descriptive research methodology, which involves analyzing information gathered by describing it without making broad inferences or generalizations. The variables investigated in this current study comprised of two main variables: the digital HR tools (X) variable, serving as an independent variable, and the Employee Performance variable (Y), acting as the dependent variable. The aim of this study was to assess how this digital transformation (X) influences the improvement of Employee Performance Improvement (Y) in educational institutions.

3.3. Data Collection Methods

To gather data, a quantitative approach was adopted by distributing an online survey to employees at various engineering institutions in Bangalore who employed digital transformation in academic and administrative activities. To explore the connection between digital Human Resources tools and employee performance, this research employed both primary and secondary sources of information. A standardized questionnaire was used to collect the main data. Publications such as journals, articles, and websites provided the secondary data. Conclusions were drawn after examining, analyzing, and interpreting primary and secondary data. A simple random sampling method was employed to gather data for this study. A sum of 321 academicians based in Bengaluru participated in the study.

3.4. Tools for Data Analysis

The internal consistency and reliability of the questionnaire were evaluated using Cronbach's alpha, and the given responses were analysed with IBM SPSS Statistics. ANOVA, with a 5% level of significance was employed to test the Hypotheses. This investigation was done to identify whether the effect of digital transformations on employee performance was statistically significant.

3.5. Formulated Hypothesis:

A set of hypotheses are developed to achieve the goals of the paper. The aim is to evaluate the hypothesis that digital transformations significantly affect employee performance.

H_0: Digital HR tools do not have a significant impact on employee performance.

H_1: Digital HR tools have a significant impact on employee performance.

4. Results and Discussion

The study examines the relationship between digital HR tools, identified as the independent variables, and employee performance, the dependent variable. Cronbach's alpha was used to evaluate the internal consistency and reliability of the questionnaire. Following this, linear regression analysis was conducted on the data. The objective of the study was to determine the significance of digital HR tools on employee performance.

Table 1: Cronbach's Reliability test output

Cronbach's Alpha	N of Items
0.834	12

Table 1 of the output indicates 0.834 Cronbach's alpha. This number exceeds the benchmark value of 0.7, confirming the questionnaire's validity and internal coherence. The questions all correlated, proving that they all help define and measure digital HR tools.

The effect of digital HR practises on employee performance was examined after questionnaire validity and consistency checks. Linear regression was used to assess its influence. Implementation and usage of Digital HR tools were independent factors in this study, which examined organizational performance.

Table 2 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.507	0.257	0.064	2.084

a. Predictors: (Constant), Usage of digital HR tools
b. Dependent Variable: Employee Performance

The coefficient of determination (R2) test evaluates a model's ability to explain the variance of an independent variable with a value between 0 and 1 (Ghozali, 2017).

Table 3: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	43.987	4	10.997	38.384	0.000
Residual	90.817	317	0.286		
Total	134.803	321			

a. Dependent Variable: Employee Performance
b. Predictors: (Constant), Usage of digital HR tools

According to Table 2, the coefficient of determination for the variables studied in this study is 0.257, indicating that only 25.7% of employee performance increase is associated with usage of digital HR tools. Research suggests implementation of digital transformations in HR practices in academic institutions might positively impact

employee performance. These observations reveal a correlation between the two factors evaluated in this study.

Table 3 indicates that the given value of ρ is less than the α level (0.05), rejecting H0. This implies that digital transformations significantly improve employee performance.

Table 4: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	24.201	6.103		3.966	0.000
Usage of Digital HR tools	0.263	0.127	0.289	2.073	0.044

a. Dependent Variable: Employee Performance

On the basis of the results of the simple regression equation presented in table 4, it is evident that digital transformations have a significant impact on enhancing employee performance. If the variable X has value of zero, then the variable Y is equal to 24.201. Increasing variable X by 1 will result in corresponding rise of .263 in variable Y.

5. Conclusion

The study on digital transformation in HR tools within engineering institutions in Bangalore highlights a clear and positive correlation between employee performance and the impact of digital HR initiatives. By integrating digital transformation in various HR functions, these institutions have not only streamlined their processes but also significantly improved the overall employee experience. This enhanced experience, marked by greater efficiency and accessibility, directly contributes to increased employee productivity. The findings of the current study underscore that the successful implementation of digital Human Resource tools can lead to more engaged and productive employees, thereby supporting the broader goals of organizational growth and innovation. In this study, it was also found that many institutions view automation of HR merely as means towards cost reduction, and therefore completely miss the concomitant benefits it can have on increasing employee productivity, and turnaround time. Human resource digital transformation is positively affected by employee experience, according to this study. This study would be beneficial to those

stakeholders who believe that HR digitalization is extremely crucial amongst other digitalization activities as it functions as the mechanism to directly interface with employees and management, and transparency and accountability is cornerstone of this mechanism, any deviation from the said goals may lead to unrest, demotivation and high attrition, which can be eventually detrimental to the organization. According to the findings of the current study, the education sector must address the challenges encountered during the digital transformation of human resources to enhance employee competence and drive organisational success.

6. Limitation and Future Direction

The research on Digital Transformation in HR Tools within engineering institutions in Bangalore faces several limitations. The limited availability of specific case studies from Bangalore's engineering sector makes it challenging to draw broad conclusions. Additionally, the speedy evolution of digital HR technologies and the absence of longitudinal studies limit the understanding of long-term impacts. Many studies also focus more on theoretical frameworks than practical implementations. Future research should focus on collecting empirical data from multiple institutions, exploring the integration of advanced AI-driven HR tools, and assessing their impact on faculty and administrative staff. Cross-institutional studies and comparative analyses between different cities or regions would also offer a more in - depth insight into the digital transformation in Human Resources within the academic sector.

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Restructuring Business Models in Food Industry for Sustainability- A Study at MysoreCity

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Abstract

The 21st century is characterized by a tremendous advancement in IT, permeating every aspect of business and life welcoming the digital era. Technology and digitalization are driving global transformation. The intervention of digitalization in every industry has greatly contributed to success and sustainability. The food industry is no exception to this phenomenon. Digitalization has restructured the entire food industry, from conventional sector to fast-moving, mobile, interlinked with forward and backward Supply Chain Management strategies.

The purpose of this study is to understand the innovative and restructured Business model- Online food delivery apps. Further, the study analyzes the impact and challenges of digitalization on the services rendered by players of food delivery sector for their survival. The respondents are hoteliers, catering service providers, and food supply entrepreneurs in Mysore city and the sample size of the study is 59. Descriptive and exploratory research design is adopted to describe the new business models "online food delivery apps "adopted by the service providers and explored the value propositions contributed by this new business model. The collected data is analyzed using SPSS 21 and the analysis indicates that the entrepreneurs belonging to Millennial or Generation Y (age group of 30-45 years) have majorly adopted digitalized apps as their new business models for survival and sustainability. The study further reveals that though the customer base is constantly increasing yet, it includes huge hidden costs and challenges in the operational modalities.

Keywords: Business models, Digitalization, Food Industry, Innovative strategies, Sustainability

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1. Introduction

Emerging markets exhibit a strong presence of novel company models, innovative strategies, and compelling value propositions. It's no exception to India economic environment. The constant growing population, urbanization, infrastructural development, socio-cultural changes, diverse work force, impact of cultural diversity, information and technology adoption, integration adoption, integration with world economies, influence of westernization, expanding middle class population, workforce expansion, increased standard of living, and changing consumption patterns has provoked business operators to rethink and review their business operations for survival and existence. Thus Innovation, new business models, and the integration of technology and information are inevitable for every business or a firm for success and survival.

Comprehending Porter's Five Forces Model by a systematic industry analysis would enable a firm/business to construct appropriate and viable strategic decisions to meet the competitive environment. To do this, a business must identify the unfulfilled demands and preferences of the market and create models that work to draw in customers, hold their interest over time, beat off rivals, and turnout into profitable ventures. For this a suitable business model that validates a company's success in any market can be framed by a strategic decision made following a comprehensive SWOC analysis (Dsouza, Prima, Parappagoudar, Sachin, 2021). And adoption of information and technology is inevitable in the ICT era (Baabdullah, Alalwan, Rana, Patil, & Dwivedi, 2019). It is equally applicable to the food industry as well.

As global concerns about climate change, resource depletion, and food security intensify, the food industry stands at a critical juncture. Traditional business models, often characterized by linear supply chains and a focus on short-term profits, are increasingly being challenged by the need for sustainable practices that prioritize environmental stewardship, social responsibility, and economic viability. This shift towards sustainability is not merely a trend but a necessary evolution to ensure the longevity and resilience of the food sector. Optimal resource management and safety standards are vital in this sector

Emerging markets, shifting population demographics, economic forces, social and cultural diversity, and environmental consequences have all resulted in a swift

transformation of the food industry's operational procedures. Further in order to cut waste, lower carbon footprints, and support ethical sourcing, the food sector must reevaluate its manufacturing methods, distribution networks, and consumer behavior. This shift includes a range of creative tactics, like implementing the ideas of the circular economy, utilizing technology to increase productivity, and encouraging stakeholder participation. Food industry being customer centric, consumer tastes, preferences, personalization, customization, price sensitivity, service operations, distribution, logistics and food experience are vital for any business.

Customer interaction across many areas often leads to transparent collaboration that leverages online communities to promote creativity. By adopting these improvements, companies can support larger social objectives like better public health and fair access to food in addition to satisfying the growing demand from consumers for sustainable products. In addition to this, the advancements in technology and digital applications have revolutionized corporate operations. New technologies have brought forth new ideas, methods, raw materials, and business strategies. The use of digitization offers many advantages, including improved flexibility, skilled resource management, and increased operational efficiency. It is no exception to the food delivery industry (Berman, 2012). Both traditional and modern-oriented food industries have restructured and redesigned their processes and modes of operations to meet the competition and improve survival. The success of a service provider is determined by a number of critical aspects in the food sector, including quality, service, ambience, sanitary factors, pricing tactics, customer treatment, and food grade.

The advent of online food delivery platforms has not only redefined convenience but has also created a prosperous marketplace connecting consumers with an extensive network of restaurants, cafes, and eateries. This revolution has democratized access to diverse culinary offerings, empowering users to explore global cuisines from the comfort of their homes or workplaces. Moreover, it has offered a lifeline to countless restaurants and cafes enabling them to extend their reach beyond brick-and-mortar locations and tap into a broader customer base. Further catering businesses and home supplies are catching up in Mysore city providing traditional and home food culture especially to old age residents, bachelors and visitors. By adding value propositions

with different offerings, services, and benefits, the industry is highly paving the way for great success and sustenance.

Yet, as this industry continues to flourish, it has its own set of challenges such as hidden costs involved in the operational process, fair business practices, changing customer preferences and expectations, competitions from peers and corporate giants, location, huge range of services, marginal benefits, perishable nature of the food, Issues regarding sustainability, and digital hitches threatens the ongoing progress of online food services. The online food industry stands at the intersection of technology, gastronomy, and consumer behavior, promising both unparalleled convenience and catalyst for change in how we experience and interact with food. Thus understanding its evolution, challenges, and potential implications is essential to comprehend its role in shaping the future of dining and consumption patterns globally.

This paper explores successful case studies, future difficulties, and important change drivers in the context of restructuring business models in the food industry. The ultimate objective is to draw attention to the possibilities for a sustainable food system that benefits businesses, the environment, and humankind. The "online food delivery apps as a new business model" that are being used by hoteliers, caterers, micro size hotels, home meal delivery services, and other food businesses as a novel business model in addition to ordinary traditional business is the subject of this study conducted in Mysore city.

2. Review of Literature

Building Innovative approaches for sustainability is vital for any business for its survival and sustenance. The study focused on the varied literatures available on the concept, definition and elements of an innovative business models. The study highlighted on the two areas; innovation and sustainability (Boons & Lüdeke-Freund, 2013) to have a long-term survival and face the market competition. Further the research suggests combination of a high value proposition would ensure a sustainable business models affirming continuous growth and success. It is the need of the hour to have strategic approaches (Baden-Fuller et al., 2010) for effective customer management and endurance in the market competition. After a thorough analysis of existing literature four components were identified for effective business model and

they are strategic choice, value network, creating value and capturing value (Shafer et al., 2005). Online food delivery services give more visibility and promotion to the hotels and food delivery providers (Adithya et al., 2017). Demand for Online food orders depends on the data that is updated on search engine portals for restaurants. Consumers use evaluations and ratings from both seasoned consumers and critics to inform their decisions and perceptions (Kedah & Ismail, 2015).

The growing popularity of online meal delivery services has been accelerated by the narrowing gap between urban and rural areas and the ease of access to mobile phones (Rosin et al., 2020). Further the hidden cost involved in the form of service charges, high commission on each order, transportation of orders, return of orders and cancelation of orders etc are highly challenging and not motivating (Traynor, M et al.,2022). The intention of people to adopt online food delivery apps is to save time and lighten the work and pricing is not a significant factor that impacts the consumers (Hooi, R., Leong, T. K., & Yee, L. H., 2021, Meuter et al, 2003). The study examined empirically the variables influencing customers' decisions when they place online food orders in an emerging economy like Bangladesh (Tsai, P. H., et al, 2023). Further a similar study on the Indian market exploring the factors that determine the consumer behaviour towards online food delivery apps (Chetan Panse, D. S. R., et al, (2019). Role of customer satisfaction is vital in determining the success of new business models Okumus, Bendegul & Bilgihan, Anil. (2014). There are few literatures on this aspect that contribute to the survival and success of a business. A study described the major factors chosen for the study were Quality, Customer service, Price, Delivery and Time with Quality that determine customer satisfaction on the online food delivery meals (Deepayan Ghosh, 2020).

Though digitalization has brought rapid changes in business operations, yet studies on online food delivery applications are few because the field is still in its infancy especially in India. "Online food delivery apps" are the result of novel business ideas that were made possible by the impact of the COVID-19 pandemic and the need for new business models in response to its unavoidable circumstances (Sakaya, 2022) (Hong, C., Choi, H. H., Choi, E. K. C., & Joung, H. W. D. 2021)). Role of technology in providing superior and quality food services provided through well-built apps would contribute to brand building (Anbumathi, R., Dorai, S., & Palaniappan, U, 2023).

Innovative idea and Digitalization has created a unique platform to explore the ways to meet the customer requirements and preferences. Firms have remodeled their traditional services with new business model of ‘online food delivery apps’ initiated in the food industry. It is purely customers oriented; just with a click of button in their mobile phones they get every type of food at their door steps without much effort. This is possible because of Information and technology and supply chain management. There are many studies on digitalization and its benefits to the business. But digitalization with novel business ideas in the food industry is not undertaken especially in Mysore city.

This study would stand unique and contribute to the betterment of the food delivery service providers, performance of online food delivery apps and framing appropriate policies by the government towards socio-economic concerns of the industry. The research study aimed at evaluation of effective business model by interlinking with forward and backward integration strategies, digitalization and automation of every aspect of the food industry. Concomitantly this process includes huge challenges such as; hidden cost, unstable market conditions, perishable nature of the products, competition, cancellation of the orders after completion of preparation and delivery, high cost to retain standards, threat of giant players in the industry, meeting customers’ expectations, unsatisfied customers, and challenges with supply chain management are proven difficulties faced while implementation of online food delivery system.

Further the scope of serving area is constrained owing to transportation cost, time constraints and customer unwillingness to pay more irrespective of good service and quality. Businesses that are committed to completely changing the operational model optimize every link in the value chain around customer interaction points. Yet fail at times owing to shifting customer preferences. Thus it is a tough challenge for the firms to implement this strategy. The firms should adopt effective auxiliary strategies for survival and success. Effective cost reduction, low profit margin, quality maintenance, and constant customer engagement is vital.

The study tries to evaluate the reconstruction of new business models in the food industry through the implementation of automation and digitalization i.e. "Online food delivery apps". These apps purely operate on the support of digitalization that

provides perceived value to the customers and assure the longevity and prosperity of food delivery companies. The research study aims to understand the role of new business models adopted in the food industry by implementing digitalization and its success rates of the service providers through profitability, customer base and long-term survival. The research chose 4 constructs and they are strategic planning or choices (SC), Digitalization (online food delivery Apps-OFDA), Value propositions (VP) delivered by the service providers and Business Performance (BP). Hypotheses of the study are:

H_0: There exists no significant relationship between the strategic choice of new business models and digitalization in the food industry.
H_1: There exists significant relationship between the strategic choice of new business models and digitalization in the food industry.
H_0: "Online food delivery apps" doesn't enhance value proposition to the customers.
H_2: "Online food delivery apps" does enhance value proposition to the customers.
H_0: "Online food delivery apps" doesn't assure the firm's success and sustenance.
H_3: "Online food delivery apps" assure the firm's success and sustenance.

3. Research Methodology

An exploratory and descriptive research design is adopted to explain how food service operators have embraced the new "online food delivery apps" business Model. Additionally, it looks at how food service providers use digitalization to improve customer service and streamline their operations, as well as how this affects the viability and profitability of their business ventures. The respondents of the survey are Mysore City-based hoteliers, restaurateurs, and caterers who make use of digital apps. Additionally, using a simple random sampling procedure, 59 respondents make up the study's sample size. Primary data was collected by administering a structured questionnaire to the respondents. The questionnaire had two sections, Section I concentrated on demographic characteristics while, Section II concentrated on the perceptional statements on the new business model through the adoption of digitalization. Secondary data was collected from published sources such as journals, reports and other website sources.

4. Data Analysis

Descriptive statistic and interpretation of demographic profile of the respondents obtained through survey is shown in Table 1.

Table 1: Demographic Profile

Sl No.	Variable	Frequency Distribution					Total
01	Gender	Male	Female	Others	-		
	Frequencies	49	10	-			59
	%	83.1	16.9	-			100
02	Age	Less than 25 Years	26- 40 Years	41-55 Years	55 Years& above		
	Frequencies	9	33	15	2		59
	%	15.3	55.9	25.4	3.4		100
03	Qualification	Less Than Degree	Degree & Diploma	PG & Professional	Other Courses		
	Frequencies	8	31	13	7		59
	%	13.6	52.5	22	11.9		100
04	Marital status	Married	Unmarried	Others	-		
	Frequencies	39	16	4	-		59
	%	66.1	27.1	6.8	-		100
05	Monthly Income	Less than Rs. 20,000	>Rs. 20,001 to 50,000	>Rs. 50,001 to 1,00,000	Above Rs.1 00,000		
	Frequencies	6	29	20	4		59
	%	10.2	49.2	33.9	6.8		100
06	Type of firm	Restaurant	Cafes	Catering service	Home supply	Others	
	Frequencies	28	17	8	3	3	59
	%	47.5	28.8	13.6	5.1	5.1	100
07	Location	Urban	Semi-urban	Rural	-		
	Frequencies	33	21	5	-		59
	%	56	36	8	-		100

Other Occupation	Private	Government	Business & Others	None	
Frequencies	10	1	16	32	59
%	16.9	1.7	27.1	54.2	100

Source: Primary Data- Survey

The following are the perception statements framed to understand the impact of new business models implemented by the service providers of the food industry. 27 statements were framed based on four variables. They are business strategic choices, Role of digitalization in building new business model, Impact of value proposition delivered by the online food delivery apps to the customers and impact of online delivery apps on the business performance, success and sustenance.

Table 2: Perception Statements

Sl No.	Statements	Variables
S1	Innovation and novel ideas	Business Strategic Choices (SC)
S2	Increased customer reach through expansion	
S3	Creation of convenience for customers	
S4	Survive competition with other providers	
S5	Additional revenue streams	
S6	New business models are an inevitable strategic choice in the contemporary world.	Digitalization-Online Food Delivery Apps(OFDA)
S7	SWOC analysis would contribute to effective business strategies.	
S8	Digitalization has revolutionized the hospitality industry with new business models.	
S9	Digitalized food delivery apps have streamlined an innovative business operations in food delivery business.	
S10	Fully automated services are the major features of the online food delivery system.	
S11	User interface are easy to understand while placing the order.	Value Propositions OFDA
S12	Higher values propositions attracts increased customers	
S13	Customer engagement is the backbone of digitalized food delivery apps.	
S14	Fulfillment of customer needs at the door steps with all possible value added benefits.	

S15	Hazel free ordering process helps customers to go for online ordering	
S16	Pictorial Illiterates representations enhances easy choice of menu	
S17	Choice of customization of orders is possible digitalized food apps.	
S18	Various payment options are another added feature of the food ordering system.	
S19	Cordial relationship is experienced through online food delivery Applications.	
S20	Survival of a business requires new strategic choices.	Business Performance
S21	Food delivery apps are based on Win –Win situation for both business and customers.	
S22	Order tracking by customers ensures demand and supply.	
S23	Constant increase in demand leads continuous business opportunities.	
S24	Increased flexibility according to market trends is possible through online food delivery apps.	
S25	Increasing customer base assures high revenue generation.	
S26	Online food delivery apps are cost effective to the firms.	
S27	Rating of the restaurants guides the online food delivery service providers.	

Source: Primary Data- Survey

Table 3, as shown below explain the descriptive statistics obtained through questions to studythe perception statement of the respondents

Table 3: Descriptive statistics of perception statements

Sl. .no	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean	Standard Deviation	Chi-Square
	f	%	f	%	f	%	f	%	f	%			
SC1	2	3.4	6	10.2	7	11.9	28	47.5	16	27.1	3.85	1.047	0.000
SC2	8	13.6	7	11.9	7	11.9	23	39	14	23.7	3.47	1.344	0.023
SC3	6	10.2	3	5.1	11	18.6	29	49.2	12	16.9	3.58	1.148	0.000
SC4	6	10.2	6	10.2	10	16.9	26	44.11	11	18.6	3.51	1.209	0.000
SC5	5	8.5	9	15.3	8	13.6	19	32.2	18	30.5	3.61	1.300	0.000
OFDA1	5	8.5	7	11.9	6	10.2	21	35.6	20	33.9	3.75	1.281	0.000
OFDA2	7	11.9	4	6.8	6	10.2	21	35.6	21	35.6	3.76	1.331	0.000
OFDA3	6	10.2	9	15.3	7	11.9	18	30.5	19	32.2	3.59	1.353	0.001
OFDA4	5	8.5	9	15.3	10	16.9	17	28.8	18	30.5	3.58	1.303	0.000
OFDA5	4	6.8	5	8.5	7	11.9	24	40.7	19	32.2	3.83	1.177	0.000
VP1	5	8.5	5	8.5	4	6.8	24	40.7	21	35.6	3.86	1.238	0.000
VP2	9	15.3	14	23.7	7	11.9	19	32.2	10	16.9	3.12	1.366	0.024
VP3	5	8.5	7	11.9	6	10.2	23	39	18	30.5	3.71	1.260	0.021
VP4	2	3.4	3	5.1	1	1.7	22	37.3	31	52.5	4.31	0.987	0.001

VP5	6	10.2	6	10.2	6	10.2	23	39	18	30.5	3.69	1.290	0.001
VP6	7	11.9	7	11.9	5	8.5	22	37.3	18	30.5	3.63	1.351	0.002
VP7	7	11.9	12	20.3	3	5.1	18	30.5	19	32.2	3.51	1.431	0.001
VP8	5	8.5	8	13.6	5	8.5	22	37.3	19	32.2	3.71	1.287	0.002
VP9	8	13.6	10	16.9	11	18.6	19	32.2	11	18.6	3.25	1.321	0.001
BP1	4	6.8	4	6.8	1	1.7	27	45.8	23	39	4.03	1.144	0.000
BP2	6	10.2	2	3.4	3	5.1	25	42.4	23	39	3.97	1.231	0.000
BP3	3	5.1	5	8.5	4	6.8	24	40.7	23	39	4.00	1.130	0.000
BP4	3	5.1	2	3.4	3	5.1	26	44.1	25	42.4	4.15	1.031	0.000
BP5	5	8.5	3	5.1	8	13.6	24	40.7	19	32.2	3.83	1.191	0.000
BP6	4	6.4	5	8.5	6	10.2	24	40.7	20	33.9	3.86	1.181	0.021
BP7	5	8.5	7	11.9	7	11.9	27	35.5	15	32.2	3.71	1.274	0.011
BP8	2	3.4	5	8.5	3	5.1	26	44.1	23	39	4.07	1.048	0.003

Source: Primary data

Table 4: Reliability statistics

Scale Reliability Statistics	Mean	SD	Cronbach's α
Strategic Choice	3.16	0.672	0.633
Digitalization (OFDA)	3.46	0.813	0.621
Value Propositions Delivered	3.43	0.604	0.758
Business Performance	3.40	0.543	0.795

Source: Primary Data- Survey

The above table 4 displays Cronbach's α reliability test findings, which indicate how closely connected a set of items is to one another internally. The study comprises four constructs: firstly; business strategy choice, which includes five items, secondly; digitalization of food delivery services through online food delivery applications, which includes five items, thirdly; Value propositions that are provided through the digitization of the food delivery system include nine items and fourthly; business performance consisting of eight items based on path to success, sustenance, and business performance.

Table 5: Correlation Matrix between Business strategic choices, Digitalization, Value propositions and Business performance

	Items	BSC	OFDA	VPA	BPA
BSC		-			
OFDA	Pearson's r	0.176	-		
	df	57	-		
	P Value	0.032	-		
VPA	Pearson's r	0.106	0.205	-	
	df	57	57	-	
	P Value	0.024	0.019	-	
BPA	Pearson's r	0.037	0.136	0.212	-
	df	57	57	57	-
	P Value	0.014	0.05	0.003	-

Source: Primary data

The reliability scores of Cronbach's alpha may vary with few items tends to be less reliable, and sample size may also affect the results of this test. Otherwise a reliability value of 0.70 and above is considered good. Since the number of items under each construct is less, an alpha value above 0.5 is also considered good. The table 5 depicts the correlation between the four constructs chosen for the study.

5. Results and Discussion

- **Discussion on the demographic profile of the study area:**

The majority of respondents (83.1%) were the male population dominating the industry, yet women (16.9%) have involved in adoption of new business models with the help of digitalization in the online food delivery industry. Almost people from all age groups are into the business but dominated by millennium or Gen Y (26-40 years). Irrespective of professional and general qualifications, people are operating in this food delivery services. Most of the respondents (66.1%) are married, and 27.1% of the respondents are unmarried. Highest monthly income earned is ranged between Rs. 20001 – 50,000 which is a handsome amount in a city like Mysore.

The majority of the operators who have adopted the online food delivery system are restaurants (47.5%), cafes (28.8%), catering service providers (13.6%), home suppliers (5.1%), and rest are others service providers. The majority of the respondents' have their business location (54.2%) in urban areas, 37.3% have in semi-urban areas, and the rest in rural areas, depicting the job opportunities provided by the food delivery business models.

- **Findings and discussion on the Perception statements of the study area:**

The perception statements are based on 4 constructs and related items. They are strategic choices which has 5 items (Innovation, expansion, convenience, competition, and revenue). Digitalization; Online food delivery Apps has 5 items (Business model, digitalization, SWOC, streamline operation, and automation. Value propositions has 9 items (user interface, high demand, customer management, value added benefits, effigy's, customization, easy Payments, and customer support portals) and Business performance has 5 items (strategic choices, win-win situations,

easy order tracking, constant business, markets trends, revenue, cost effective and feedback). The mean value of all the perception statements is greater than 3 and 4.5 depicting a positive perception towards the four constructs and its contribution towards online food delivery industry. Yet there is opinion on the hidden costs, challenges in supply chain management and customer engagement. Results of correlation depicts that, H1 "There exists significant relationship between the strategic choice of new business models and digitalization in the food industry" gets accepted with a positive correlation with an r value of 0.176 and p value less than 0.5 (0.032).

Further H2: "Online food delivery apps" does enhance value proposition to the customers gets accepted with an r value of 0.205 and p value less than 0.05 (0.019) and strategic choice of digitalization with an r value of 0.106 and p value less than 0.05 (0.024). There is a positively correlated and can accept alternative hypothesis H3 "Online food delivery apps" assure the firm's success and sustenance" with an r value of 0.212 and p value less than 0.05 (0.003). Thus the study depicts a positive correlation among business strategic choices, digitalization, value propositions and business performance.

6. Suggestions

Continuous Improvement and Innovation should be the foundation pillars for survival and sustainability. Customer Feedback, reviews and ratings should be considered for future improvisation and quality services. Delivery and pickup options across the rural areas are vital for grabbing wider share of market. Seamless Integration with Hotel Services and guest experience would expand the business opportunities. Offer promotions, discounts, and loyalty programs to incentivize repeat orders and foster customer loyalty with cost effective strategies. Use high-resolution images to provide detailed descriptions of each dish, including ingredients, portion sizes, and any special dietary information.

7. Limitation and Future Direction

Owing to small sample size and time constraints, the study is confined only to Mysore city. A study at wider geographical area would benefit better and its implications can be allowed for generalization. Further, a study on online food

delivery apps is insufficiently researched area and can offer valuable insights that go beyond just the realm of food delivery. It can influence consumer choices, business strategies, societal norms, technological advancements, and even policy decisions, shaping the landscape of the food industry and its interaction with consumers and society at large. Further online food delivery apps being a contemporary area and rapidly growing requires a good research, so that can every aspect of this business model can be streamlined from economic and societal point of view for sustainable growth.

8. Conclusion

Online food delivery apps have revolutionized the way people can access and enjoy food. They offer convenience, variety, and accessibility, making it easier for users to order meals from a wide range of restaurants with just a few taps on their phones. These apps have greatly expanded options for both consumers and restaurants; enabling smaller businesses to reach a larger customer base and allowing users to explore diverse cuisines from the comfort of their homes. However, while they provide immense convenience, there are some concerns to consider. These platforms can sometimes lead to increased consumer reliance on takeout, potentially impacting home cooking habits and health. Additionally, the commission fees charged to restaurants by these apps has raised concerns about fairness and profitability for smaller establishments.

Overall, online food delivery apps have significantly transformed the food industry, offering unparalleled convenience but also prompting discussions about their broader impact on consumer behavior, restaurant economics, and society's relationship with food. As they continue to evolve, finding a balance between convenience, affordability, and sustainability will be crucial for their continued success and positive impact. To conclude, the utilization of online food delivery applications has elevated the shopping experience of the customers, revolutionizing both the manner they eat and the value they receive. These programs have become the go-to options for people looking for a hassle-free and delightful dining experience because of their wide selection of food selections, personalized options, appealing pricing, and efficient delivery services. With only a few taps, customers can satisfy their palates

for a quick lunch at work or a nice meal at home, making online food delivery services an absolute treat for foodies everywhere.

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A.I. Driven Smart Healthcare Enhancing Society 5.0 by Healthcare Information Systems Adaptation and Healthcare 4.0

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Abstract

In the present day and age, there has been an immense shift in the perception of healthcare due to the effect of the advent of technology and healthcare 4.0 as this makes the healthcare facility come to the patient rather than the patient going to the healthcare facility practically. IoT in healthcare or IoHT plays a very prominent role in this aspect. The mentioned IoHT is connected by Information systems a.k.a. healthcare information systems which forms the backbone of delivery in healthcare. Thus, it is these healthcare information systems which need to be adapted accurately on a timely basis for maximizing efficiency and maintaining sustainability. This includes A.I. integration and the implementation integration of automation, robotics, A.R./V.R., chat bots, cloud and big data in the information systems used in healthcare-healthcare information systems. This can be done using the Co-efficient of Progressive adaptation hypothesis which states that: "The rate of change of progressive adaptation of the concerned information system is directly proportional to the efficiency of the same. Vice-Versa." Thus with the with the global healthcare segment to reach a magnitude of US$ 1,211.14 billion by 2034 with a C.A.G.R. of 22.5% from 2024 to 2034, this study aims to explore the role of A.I. Driven smart healthcare in enhancing and optimizing healthcare with special focus on Society 5.0. Progress of this study uses various research methods such as thematic analysis, literature review and ontology thereby creating a holistic blend that indicates the optimization of healthcare for society 5.0 by A.I. and various other implementations in healthcare information systems. The accurate combination of change management and technology at a given point of time is crucial for optimizing the needed adaptation of the concerned healthcare information systems. A.I. implementation and adaptation is an integral

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component of tis mentioned adaptation of the concerned healthcare information system.

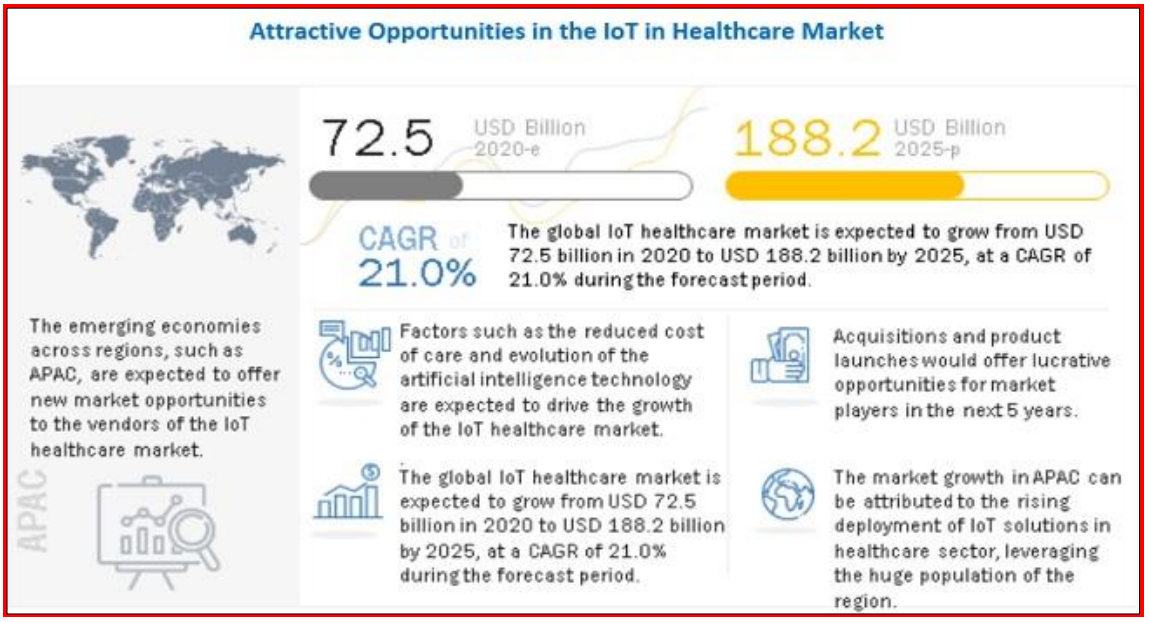
Keywords: Society 5.0, Healthcare 4.0, A.I., Automation, IoHT (Internet of Health Things), Healthcare Information Systems

1. Introduction

As in the present day and age access to internet is practically a 'step away' as anyone with even basic resources can obtain the same thus making use of IoT & IoHT (IoT in Healthcare or Internet of Health Things). As IoT encompasses anything that connects to the internet from a small pocket device to a smart phone/ iPhone, laptop, desktop to a colossal cloud storage facility, it's component of IoHT is any healthcare device that can access the internet. It can range from a pocket pulse- oxi meter to a remote Holter meter to colossal health information center that manages healthcare information of patients on a global scale. The effect of the advent of technology on healthcare information systems substantially breaks all geographical barriers and enables healthcare access to anyone with the option of the internet. All under the Internet of Health Things. Thus includes new devices, new technology and of course digitization (Burgess, 2018; Ranger, 2020).

The various networks connected along with the internet enable and enhance private communication through various devices part of the IoHT (Shahid, 2022; Verma, 2023). This communication can be enhanced effectively by A.I. & automation thereby maximizing the quality and efficiency of the communication i.e. communication of the patient data using the principle of Knowledge management which is providing the right information to the right person at the right time which in this case is the information of the right patient to the right doctor at the earliest possible time (MARKETSANDMARKETS, 2023; Ahmad, 2011; Harrinson, 2021; Dias, 2014; Buchnowska, 2011). Data collection and analysis are included a well before being dispatched. The use of IoHT in the remote patient management sector that is part of healthcare has become the 'new normal' of medical practice to quite an extent and this is endorsed by the consolidation of the Covid Pandemic catalyzing remote patient management part of remote healthcare by making it a high priority requirement during the Covid pandemic and retaining usability of the same even after the Covid Pandemic.

Specific noteworthy points are increased adoption of wearables, electronic health records and smart devices that are part of the IoHT along with increasing interests in self-health measurement and monitoring health in remote locations (Rodrigues, 2023; Jain, 2022). Therefore, the exponential growth of IoT in the healthcare sector on a global is likely to grow to a financial magnitude of US$188.2 billion by 2026 having a C.A.G.R. of 21% (Business Wire, 2020).



(Mirlay, Prominent role of IoT in the field of telemdicine, 2021)

Thus, remote health monitoring needs healthcare information systems that are highly advanced and integrated due to the scope of transformation in digital healthcare. Healthcare Information Systems form the backbone of delivery in remote patient management, IoHT thereby digital healthcare strengthened by A.I. implementation and integration which too has information systems as the backbone of delivery thus making A.I. in healthcare too integrate into the bracket of healthcare information systems (Burgess, 2018). Robotics and Real Time Health systems are well noted components of healthcare information systems thereby adding value and obtaining beneficial results (Al-Jaroodi & al, 2020; Haleem, 2022). Some of these benefits happen to be enhanced organization and co-ordination of the treatment process,

improvised patient safety, enhanced healthcare, transfiguration of clinical procedures, medical error circumvention, improved patient satisfaction, healthcare quality optimization, maximizing efficiency of the healthcare process as well as optimum remote patient management, time management, waste reduction, reduced human interventions, productivity outcomes increasing , streamline digitization, re-imaging of healthcare ,accelerating progress , greater diagnostic precision, enhanced patient experience, higher throughput and data driven insights (Dias, 2014; Technologies, 2023; Khang, 2024; Kaledio, 2024; Kaluvakuri, 2022)

2. Adaptation

As adaptation is crucial for every form of information system constantly on a timely basis, healthcare information systems and RTHS (Real Time Health Systems) that are likely to become the key to the IoT in Healthcare or IoHT too need to be adapted constantly on a timely basis by implementing and adapting A.I., robotics, automation A.R./V.R., chatbots, big data and cloud .These adaptation need to be done internally in order to face the external environment which is dynamic and constantly changing in terms of the PESTEL factors. Thus, the Co-efficient of Progressive Adaptation which states that: "The rate of change of Progressive Adaptation of the concerned information system is directly proportional to the efficiency of the same. Vice-versa "needs to be applied when the healthcare information systems are being adapted by implementing A.I., Robotics, A.R./V.R. and Big Data with Cloud integration. Cloud storage to manage extremely large volumes of patient data given the highly increasing volume of patient data due to the rapid increase in IoHT adoption leading to healthcare access on a global scale is highly significant. Since the organization's information system capacity to adapt to the dynamic and changing business environment is widely acknowledged to serve as an enabler of competitive advantage (Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019; Mirlay, Prominent role of IoT in the field of telemdicine, 2021; Covetus, 2020; Raphael David Schilling, 2017; Abdisalam Issa-Salwe, March 2010). Systematic planning along with the adaptation of information system architecture is the point of focus which in this case is the healthcare information technology's internal architecture that needs to be adapted with systematic planning on how the A.I., robotics, A.R./V.R. and cloud/Big data can be optimally implemented in order to maximize efficiency the integrated aggregate consisting of IoHT devices and

healthcare professionals (Covetus, 2020; Raphael David Schilling J. B., 2017; Merali, Complexity and Information Systems: The Emergent Domain, 2006). This will not just maximize the mentioned efficiency but also maintain sustainability and user satisfaction as the result of the accurate adaptation internally in order to face the external environment of the healthcare sector which is dynamic and constantly changing. For this, just technology is not going to be adequate. The accurate combination of change management and technology is the crucial requirement. Thus this involves the process of re-configuration at regular time intervals that is done by accurately interlinking organizational aspects as well as technological aspects (PILARCZYK, 2016; Ngelechei, 2016). This therefore strongly endorses the point that constant maintenance and information system architecture redesign add value in terms of flexibility and increasing efficiency. Optimum integration of the concerned information systems precisely by optimum strategic management which includes A.I., Automation and A.R./V.R. This when enhanced with the integration of Knowledge Management Systems does enable the competitive advantage from a strategic perspective due to the optimum functioning done after the A.I. integration into the healthcare information systems adaptation (Ngelechei, 2016; Obasan Kehinde A, 2012).

3. Methodology

This study used an analysis of existing literature as well as internet articles to examine the role of IoT in the field of telemedicine focusing on technology adaptation. Literature review was conducted by referring to a variety of journals as well as online sources were considered. The main criteria for selecting a particular paper or source were its relevance to the themes as well as its contribution to the body of knowledge. This was ontologically linked to the prior research done on similar topics were analyzed including research done practically in the field of IoT in tele-health which was researched and published. Further on, with regard to the prominence of IoT in the field of telemedicine, in addition to the various journal articles and other online articles contribution to knowledge, only sources published after 2019 were considered. This was because telemedicine gained prominence during the Covid-19 pandemic. A lack of accessibility to the healthcare facilities prompted the telemedicine sector, on a global scale, to adapt to new and current technologies. These technologies enabled the telemedicine sector to optimize its services by allowing communication between the

doctor and the patient through the various IoT devices such as smart phones, iPads, smart medical devices and tele monitoring medical devices. The findings thus indicate immense scope for this study on how A.I. will tremendously enhance smart healthcare for society 5.0.

4. Analysis

The immense scope for IoT in healthcare on a global scale was noted to have immense growth potential even before the advent of the Covid 19 pandemic which was later consolidated in terms of growth and adaptation during the Covid pandemic when remote patient management and remote healthcare became the 'new normal' of medical practice. This is indeed endorsed by a global survey conducted by Aruba (a Hewlett Packard Enterprise company) in 2017 which found that Seventy-six percent (76%) of the respondents in the survey believed IoT would transform the healthcare industry based on the finding that the healthcare sector benefited from 80% innovation (related to IoT) and resultant cost savings of around 73% further strengthened by the finding of 76% increase in terms of visibility across the concerned organizations by enabling central visibility through information systems. Thus, healthcare providers who using IoHT and implementing the IoHT in their practice tend to have a competitive advantage provided by the aggregate benefits of IoT in Healthcare which includes efficiency benefits of implementing A.I. in the healthcare information systems. Specifically endorsing a statement from the World Health Organization (WHO) noting the requirement on a global scale to reduce face-to face interactions between doctors and patients by still maintaining and improving the quality of the healthcare service optimally. Therefore, the implementation of A.I., robotics, and A.R./V.R. in healthcare information systems as well as healthcare 4.0 in order enhance the healthcare sector and optimize the same for adaptation into society 4.0 , reference to principles such as patient centricity, multi sector and multi-disciplinary approaches, power full digital governance and implementation strategies along with on-site planning and implementation, health system integration, digital user friendliness and system performance monitoring with improvement (or adaptations) in the accurate proportion at a given point of time is highly necessary(i-Scoop, n.d.; Arubane, n.d.; World Health Organization, 2020; Anthony, 2020).

5. Conclusion

With the immense technological disruption and the effect of the advent of technology on the healthcare sector, healthcare access using IoHT(Internet of Health Things or IoT of healthcare) is increasing rapidly on a global scale and substantially eliminating geographical barriers and access barriers to healthcare facility. As access to internet is all that is required and information systems for the backbone of delivery in remote patient management/ remote healthcare- the 'new normal' of healthcare practice as well as the backbone of deliver in IoHT, the concerned information systems need to be adapted internally using the Co-efficient of Progressive Adaptation in order to face the external environment of healthcare which is dynamic and constantly changing based on PESTEL factors. This very well includes implementation of A.I., robotics and A.R./V.R. in the concerned healthcare information systems to provide the aggregate benefits in the aggregate result thereby enhancing and optimizing healthcare for optimum adaptation with society 5.0 and enabling SDG 2030 healthcare goals by practical industrial implementation.

6. Limitations and Future Research Direction

The research done so far concluding the above mentioned indication, indicates immense scope for this study in the future. Therefore, as the research conducted in this study was done using limited sources, the research is to be aimed at studying many more sources on the relevant themes of Industry 4.0, Society 5.0, Healthcare 4.0 using thematic analysis and forming competent research output which in aggregate can be linked and holistically blended with practical information insights from the industry on the mentioned themes. This mentioned link/holistic blend is aimed at being done using ONTOLOGY in the form of the Co-efficient of Progressive Adaptation in the field of healthcare information systems by accurately combining change management and technology at regular intervals of time by implementing the optimum strategy devised that enables the optimum result. This optimum result is the optimum healthcare benefits in the "new normal" of healthcare where the advent of technology changes the dimension of the healthcare sector beyond hospitals and between consultations as technology, remote patient management, A.I., Industry 4.0, Society 5.0, Healthcare 4.0 and other technological advents such as Augmented Reality/Virtual

Reality, Big Data and Cloud together accurately in terms of adaptation and implementation in the healthcare sector.

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