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Chapter - 1

Crisis and Creativity: A Study of Performance and Play in the Film *Tamasha*

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Abstract

Tamasha begins with a drama in which a robot is walking on a treadmill and asking "who am I?". The clown, the robot's companion, tells him that he is a person who wakes up every morning to go to work. Thus, the theme is set for the movie- an automaton walking on a treadmill; constantly moving, but going nowhere. The film explores the conflict between freewheeling creativity and the conformity demanded by late capitalism.

The central concerns of the film are performance and play. The protagonist is introduced as a young boy obsessed with stories, lost in a world of his own and constantly play-acting scenes from his favourite tales. As a young man vacationing in Corsica, he has an affair with a girl, throughout which he enacts various fictive characters from Bollywood cinema. When he returns from the trip, he steps into the corporate world and the movie focuses on his everyday rituals, emphasising their repetitiousness, as repetitive performance of activities plays a role in the formation of our identities. After suffering a traumatic event, the creativity and play of his childhood begins to come back in him. Instead of repressing them this time, he gives them free reign and they eventually help him reshape his life and identity.

Keywords: Creativity, performance, play, repetition, late capitalism.

Introduction

Tamasha begins with a drama in which a robot is walking on a treadmill and asking "who am I?". The clown, the robot's companion, tells him that he is a person who wakes up every morning to go to work. Thus, the theme is set for the movie- an automaton walking on a treadmill; constantly moving, but going nowhere. The film explores the conflict between freewheeling creativity and the conformity demanded by late capitalism.

In *Creativity and the Performance Artist,* Paula Thomson and Victoria Jaque write:

"A child's preferred play activities frequently predict future careers in the creative arts, including the performing arts (Crozier, 2003). Fantasy proneness, a natural trait in performing artists (Thomson *et al.*, 2009), facilitates vivid and intense imaginings that enrich make-believe play (Sanchez-Bernardos *et al.*, 2015). These abilities are strongly related to personality traits marked by openness to experience and neuroticism, traits that are typical of many highly creative individuals. One of the early signs indicating acting talent is a desire to live in alternate realities and inner worlds (Goldstein, 2015; Goldstein & Winner, 2009)."

The protagonist, Ved, is introduced as a young boy obsessed with stories, lost in a world of his own and constantly play-acting scenes from his favourite tales. All the traits mentioned in the passage earlier are present in him. He has a very active imagination through which he seems to live in an alternate reality where the stories he hears or imagines, appear to be happening around him. He is also constantly performing the stories he comes across, a sign that indicates a future in the performing arts.

But the powerful imagination and his obsession with stories have an adverse effect on his studies which infuriates his father. His father expects him to pursue engineering but his creative bent of mind turns out to be a hindrance. When he is unable to clear the entrance exam for engineering, his father makes a generous donation and gets him admitted into an engineering college. He is so despondent that he disappointed his father and ashamed that his father had to make a donation for his admission, that he brutally represses his storytelling impulses and creativity to cram and somehow get his engineering degree. He goes on to study Management and becomes a product manager at a firm.

The father here basically represents the ideology of capitalism. The artistic sensibility of Ved has no space in a late capitalist world which is centred on highly specialized jobs, conformity and 9 to 5 hours. The monotony of a corporate job is brilliantly exhibited in the movie through the day-to-day repetitions in Ved's life:

Waking up to the blaring of the alarm every morning. Brushing his teeth in front the mirror in the bathroom. Having breakfast. Wiping the dust off the car. Being stuck in traffic. A transgender woman who asks for money in the traffic. Reaching the office and keeping the door of the elevator open for an older lady as social conventions dictate. Wishing everybody good morning in the office. Giving presentations to uninterested clients.

The sequence of these everyday activities is repeated multiple times in the movie for a reason. The director wants the audience to realize how repetitive Ved's life is in the corporate sector. When Ved realizes this, he comes up with the story which has the character of a robot in it, shown in the beginning of the movie. The point being that capitalism turns people into automatons endlessly repeating their actions, rendered into mindless cogs of a machine that they cannot even comprehend.

The idea that rituals are performances was proposed nearly a century ago. Émile Durkheim theorized that performing rituals created and sustained "social solidarity." He insisted that although rituals may communicate or express religious ideas, rituals were not ideas or abstractions, but performances enacting known patterns of behaviour and texts. Rituals don't so much express ideas as embody them. Rituals are thought in/as action. This is one of the qualities that makes ritual so theatre-like, a similarity Durkheim recognized.

Thus, repetition of certain patterns of behaviour results in ritualization which solidifies into a way of life. This ritualization is considered important in society as it regulates behaviour and forms a kind of social control over all individuals. The regulation of behaviour and social control is important for the smooth functioning of a society. Ritualization also normalizes behaviours and actions- for example, after a certain period of time, people get used to and stop question their tedious and monotonous daily lives. Rituals become collective memories that get encoded into actions. They help people deal with difficult times, hierarchies, ambivalent relationships, and desires that exceed or violate norms of daily life.

Rituals acts as initiations or rites of passage into different stages of life. For example, graduation is a ritual in which a student leaves the halls of learning and enters the adult world where he will have to use all the skills he learned at school and university to earn his/her livelihood. Wedding is a ritual that legitimizes the relations between two people and initiates a person into a family life with increased responsibilities. A retirement party initiates a person into the last stage of life- where you do not have to work anymore and can sit back and enjoy the fruits of your labour.

There are three phases to the rites of passage- preliminal, liminal and postliminal. It is in the liminal phase that the work of the rites of passage happens and transitions and transformations occur. Turner recognized in liminal phases the possibility of rituals to be creative, to form new identities, situations and social realities. He wrote:

"Liminal entities are neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremonial. As such, their ambiguous and indeterminate attributes are expressed by a rich variety of symbols in the many societies that ritualize social and cultural transitions. Thus, liminality is frequently likened to death, to being in the womb, to invisibility, to darkness, to bisexuality, to the wilderness, and to an eclipse of the sun or moon. Liminal entities, such as neophytes in initiation or puberty rites, may be represented as possessing nothing. [. . .] Their behavior is normally passive or humble; they must obey their instructors implicitly, and accept arbitrary punishment without complaint. It is as though they are being reduced or ground down to a uniform condition to be fashioned anew and endowed with additional powers to enable them to cope with their new stations in life."

From the above passage it is clear that Ved in *Tamasha* was in a liminal phase in his adolescence. He was passive and vulnerable when his father reduced and ground him down to conform to the demands of late capitalist society. This resulted in him repressing his creativity, bowing down to societal pressure and accepting his unhappy life as a cog in a ruthless machine. He completed his engineering degree according to the wishes of his father and went on to get a corporate job.

Another time when Ved enters a liminal phase is when Tara, a woman he had met and fallen in love with while vacationing in Corsica, returns in his life. This becomes a transitory time in his life as he develops a relationship with her. He must complete the transition by marrying her and beginning a married life. But Tara, who had fallen in love with a different Ved- a free-spirited creative individual she met in Corsica, rejects the automaton he has become following the dictates of late capitalist society. So instead of entering the next predetermined phase of his life, Ved instead enters a terrifying new reality where the creativity he had suppressed in himself begins to come up and he finds himself completely overwhelmed and lost.

This Leads Us to the Second Important Concern of the Paper – Play

While ritual has seriousness attached to it, play is loose, permissive and flexible. Play dares to break norms, encroaches on taboo areas, and subverts social conventions. Play is ambiguous- almost impossible to pin down. It is all-pervasive yet rarely given the attention it deserves. It offers an escape from the humdrum existence of life in a capitalist society.

With its ability to subvert the powers that be, capitalism has tried its best to limit play. Play has been cordoned off from regular activities and limited to

games and sports. Even in daily life, divisions have been made between time for work and time for leisure and play. For a capitalist society that is dependent upon industry, maintaining the regularity of the workforce to maximise profit is absolutely necessary. Thus, play is limited to a few hours after work or only on the weekends.

Victor Turner in his paper "Body, Brain and Culture" writes

"Playfulness is a volatile, sometimes dangerously explosive essence, which cultural institutions seek to bottle or contain in the vials of games of competition, chance, and strength, in modes of simulation such as theatre, and in controlled disorientation, from roller coasters to dervish dancing. [. . .] Most definitions of play involve notions of disengagement, of free-wheeling, of being out of mesh with the serious "bread-and-butter," let alone "life-and-death" processes of production, social control, "getting and spending," and raising the next generation. [. . .] Play can be everywhere and nowhere, imitate anything, yet be identified with nothing. [. . .] Play is the supreme bricoleur of frail transient constructions, like a caddis worm or a magpie's nest. [. . .] Its met messages are composed of a potpourri of apparently incongruous elements. [. . .] Yet, although "spinning loose" as it were, the wheel of play reveals to us (as Mihaly Csikszentmihalyi has argued [1975]) the possibility of changing our goals and, therefore, the restructuring of what our culture states to be reality."

When Ved has a breakdown after Tara rejects his proposal of marriage, the playful self that he had buried to become successful in the corporate world comes bubbling up. Ved starts interjecting play into his office work. While giving presentations in front of clients and his boss in the office, he begins to sneak in meaningless words and phrases in the middle of his pitches and analysis. When his boss realizes what he has been doing, he calls him into his office to set him straight. But even there Ved gives free reign to his playful self, moving in and out of different characters. This infuriates the boss and he fires him on the spot.

But Ved doesn't care. He has given free range to his creativity and he roams around the city at night, performing stories for people at dhabas and tea stalls. He eventually returns home to Shimla, still feeling lost. There was a storyteller he used to go to for stories in his childhood and he decides to go to him for answers. The storyteller tells him that only he can write his own story. The storyteller's words have a liberating effect on Ved, who no longer feels lost. He goes to his family and performs his story, expressing his fears, doubts and dreams. His father finally accepts his artistic side and encourages him to

follow his dreams. Ved goes on to become a successful performing artist.

Thus, creativity and play enable him to alter his circumstances and liberate himself from the prison of a corporate job. Play subverts the hierarchies in the society and creativity allows him to express his inner self to the world. In the liminal phase, Ved enters a new realm where his life is completely changed for the better. As Victor Turner theorized, it is only in the liminal phases that such transitions are possible. After his breakdown, Ved disrupts the repetitions of his corporate life through creativity and play and completely changes his life. Thus, the director, Imtiaz Ali, propounds that freewheeling creativity, play and artistic sensibility can disrupt the mechanization of life engendered by late capitalism and offer an alternative to increasingly consumerist lifestyles.

Chapter - 2

Literary Nonsense and Language: Linguistic Destabilization and Subversion in Flann O'Brien's *At Swim-Two-Birds*

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Abstract

Nonsense literature is a genre of literature that actually attempts to extend the boundaries of a language by challenging the very systemic hierarchy of the language. It threatens to destabilize the language by imparting to it a semantic incoherence without making it devoid of meaning. It, in actuality, balances the sensical with the nonsensical and subverts language conventions and logical reasoning. Wittgenstein asserted that meaning can only be derived from the inside. Meaning, to him, is 'what can be said'. Deriving meaning from illocutionary intention, metaphysical point of view or other linguistic markers would be misguided as that would be an attempt at extorting meaning from without. He also quite famously declared that what cannot be spoken must be passed over in silence. The claim excludes nonsense from the domain of sense as something that cannot be put under the constraints of 'meaning'. Brian O' Nolan's *At Swim-To-Birds* challenges that very (mis) conception.

The paper will attempt to explain how nonsense procures meaning (from without) through manipulation of micro-linguistic structures, situational contexts and also inter-subjective relations.

Keywords: Nonsense, Flann O'Brien, meaning, language, logic.

Introduction

In *Philosophy of Nonsense* (1994), Lecercle cautions,

"A nonsense text . . . plays with the bounds of common sense in order to remain within view of them, even if it has crossed to the other side of the frontier; but it does not seek to limit the texts meaning to one single interpretation —on the contrary, its dissolution of sense multiplies meaning."

Nonsense literature is a genre of literature that balances the sensical with the nonsensical and subverts language conventions and logical reasoning. It

can be traced back to the eleventh century oral folk traditions and the intellectual absurdities and satires of some seventeenth century writers. But it was only firmly established in the Victorian age by Edward Lear's *A Book of Nonsense*, a collection of nonsense verse and Lewis Carroll's *Alice's Adventures in Wonderland*, a fairy tale for children. Literary nonsense in the Victorian age was confined to children's literature, even though it attracted critical attention. It was in the Modern period when literary nonsense pervaded adult mainstream fiction and poetry.

Flann O'Brien's *At Swim-Two-Birds* is a novel about an indolent university student writing a novel about a character, Mr. Trellis, who is also writing a novel. The novel is split into three narratives: the biographical reminisces of the writer, Mr. Trellis's story and the characters created by Mr. Trellis and other writers who exist in an illusory reality of their own. In the postmodern age, literary nonsense gained ascendency through the most prominent tropes of postmodern works like intertextuality, pastiche and metafiction. In the novel, the elements of nonsense are apparent from the description of the birth of Mr. Furriskey, a character of Mr. Trellis: "The birth of a son in the Red Swan Hotel is a fitting tribute to the zeal and perseverance of Mr. Dermot Trellis, who has won international repute in connexion with his researches into the theory of aestho-autogamy. The event may be said to crown the savant's life-work as he has at last realized his dream of producing a living mammal from an operation involving neither fertilization nor conception."

Flann O'Brien uses the device of portmanteau, a device of literary nonsense according to Wim Tigges, to create the word 'aestho-autogamy' to name the process of the birthing of his characters. 'Autogamy' of course means self-fertilization. 'Aestho' on the other hand could be from the name 'Esther' who became a queen of Persia and protected her people from a genocide in 'The Book of Esther'. The name 'Esther' is derived from 'astra', a Median word meaning myrtles. In Greek mythology, the myrtle was sacred to Aphrodite while in Jewish mysticism it represents the phallic and masculine force at work in the world. Thus, the two words meaning phallic force and auto-fertilization come together to form the word 'aestho-autogamy'.

Flann O'Brien goes on to describe the advantages of the discovery of the new method of procreation like being able to have sons and daughters who are already adults at birth so that they can earn money for the household as soon as they are born. He further writes: "the breeding and safe deliverance of Old Age Pensioners and other aged and infirm eligible for public money would transform matrimony from the sordid struggle that it often is to an adventurous business enterprise of limitless possibilities."

O Brien, when looked closely, converts a logical fallacy into a fact by backing it up with conventional methods of the present time and hence, quite cleverly, problematising the notion of time, reality, rationale, logic, human existence, sense and meaning itself.

This passage is followed by a cross-examination of Mr. Trellis when he is on trial for his life by the characters he has created himself. The trial itself is reminiscent of the nonsense trial in Lewis Carroll's *Alice's Adventures in Wonderland* in the tradition of Victorian Nonsense. The trial consists of a series of irrelevant questions asked rapidly. According to Lecercle, exhaustive lists are often used in nonsense texts. The repetitive questions in the list are also nonsensical, for instance:

"… He was consumed by doubts as to his own identity, as to the nature of his body and the cast of his countenance.

In what manner did he resolve these doubts?

By the sensory perception of his ten fingers.

By feeling?

Yes."

The nonsensical list is a comment on language itself. The repetitive questions are an attempt to find out objective facts but the failure to do so reveals the limits of language. O'Brien too, following the tradition of the Victorian novelist, Lewis Carroll, uses tropes of nonsense to underline the limitation of conventional linguistic structures and also to broaden and extend the boundaries of the same.

Flann O'Brien famously said that there is no need to create new characters as there is already an abundance of characters present in literature. He borrows Pooka MacPhellimey, a human devil with magical powers from Irish myths. The genealogy of the Good Fairy, another character in the tale, is not so clear. In fact, the goodness of the Good Fairy is highly debatable itself. The Good Fairy visits the home of the Pooka to inform him of the birth of a character in the Red Swan Hotel and as per etiquette, give him an equal opportunity to put him under his influence. They decide to go together to the Red Swan Hotel to greet the new arrival and attempt to put him under their influence.

Another technique of nonsense used in the text is subversion of logical reasoning through neologisms. The Pooka and the Good Fairy have a lengthy argument on whether the Pooka's wife is a kangaroo:

"There is nothing as important as the legs in determining the kangaroolity

of a woman. Is there for example fur on your wife's legs, Sir?

… I cannot say whether there is fur on my wife's legs for I have never seen them nor do I intend to commit myself to the folly of looking at them… I deem the point you have made as unimportant because there is surely nothing in the old world to prevent a deceitful kangaroo from shaving the hair off her legs, assuming she is a woman."

The Pooka and the Good Fairy create words like 'kangaroolity' and take their argument to the utmost bounds of logical reasoning without coming to any sensible explanation.

Flann O'Brien also subverts the character of the devil and the angel in the text, as the Pooka who is supposed to be a devil, is actually one of the most courteous and well-meaning characters in the novel. Whereas the Good Fairy who is supposed to be an angel, betrays a short temper and a tendency towards violence. He also cheats at a poker game and costs the soul of the new character to the devil.

At Swim-Two-Birds describes the main character's writing process as he recites excerpts of his novel to his friends and incorporates parts which they add to it on the spot. He also adds descriptions of the character Mr. Trellis from a medical book he finds lying around. Mr. Trellis meanwhile, keeps all his character imprisoned inside his home. He is a tyrannical author but he loses control of his characters when he sleeps. The characters start slipping him laudanum so that he stays asleep most of the time and they can be free from his control. When a son of Mr. Trellis is born, he has the writing talent of his father. The other characters band together with the son, Orlick Trellis, so that he may kill Mr. Trellis in his story. The construction of this story is very interesting as the other characters discuss the story as it is being written and change it whenever they feel like it. The result is a story with three different starts, including an argument whether the story should be of high artistic style or popular culture style. All of this provides a fascinating insight into the process of writing fiction.

Lastly, the relation between dream and reality is often blurred in a nonsense text like in Lewis Carroll's *Alice's Adventures in Wonderland.* In O'Brien's *At Swim-Two-Birds*, the idea of reality is questioned as the mythological characters and the characters created or 'borrowed' by Mr. Trellis exist in a kind of surreal reality. This reality represents the fictional world where all the fictional characters reside and go about their business. The adventures of the cowboys Slug and Shorty, for example, are taken from the popular culture of cowboy movies and books. The characters are shown as

employees of writers who employ them for particular scenes in their novels.

The punishment and the attempt on the life of Mr. Trellis is also done when he is asleep, drugged by his characters. The characters spin a tale of terrible torture for Mr. Trellis and then put him on trial for his cruelty towards them. The life of Mr. Trellis is barely saved when his maid carelessly burns some of his pages which contained the existence of the characters.

Thus, the writer shows how language has the ability to shape reality and at the same time, challenge its hierarchies and destabilize it by causing a semantic incoherence.

Chapter - 3

Women Writing in India and the Study on Contemporary Writers: Shashi Deshpande and Anita Desai

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Abstract

The thesis tries to examine how some of the theoretical aspects of feminism get enacted in the novels of these two writers and whether they provide new insights to understand their writings. In the light of the analysis made, these two chosen writers; Shashi Deshpande and Anita Desai in terms of the 'resolution of women question' their novels offer, with a focus on a critical assessment of the relative importance of these two writers in understanding contemporary society which has moved beyond the social milieu their fictional worlds encompass. It also covers the similarities and crucial differences between the two novelists in their handling of patriarchal domination as well as women's role in reproducing their own subordination. Finally, it deals with the possible insights that can be drawn from their treatment of the women's question and their bearing on theorizing the distinct feature of Indian feminism.

Literature Review

The advent of Theory, particularly after post-structuralism, resulted in a number of writings related to feminism and women's studies. Women theoreticians like Julia Kristeva, Helene Cixous, Kate Millet, Elaine Showalter, Gayatri Spivak, Toril Moi, and many others came out with new and exciting works on women and women writing making it a discipline of study. Works like *Textual/Sexual Politics* by Kate Millet exposed the relation between literary canon and patriarchy, and Elaine Showalter wrote about women's literary tradition in the West. The publication of Mary Eagleton's (ed) book on *Feminist literary Theory* provided a case for feminist reading as an alternative to mainstream literary critical practice. Feminist studies are also influenced greatly by thinkers like Derrida, Foucault, Althusser, and others. The movement within feminist theory also gave rise to a number of academic

journals dedicated to women's studies like 'Southern Women's Review' and 'Women's Studies Quarterly (both USA) to name a few.

Women Writing in India an anthology of women writing from 6th Century BC to the Present, edited by K Lalitha and Susie Tharu gave the much-needed conceptual framework to locate Indian writing historically and also in relation to nationalism. Chandra Talpade Mohanty's influential essay, "Under Western Eyes: Feminist Scholarship and Colonial Discourses" paved the way for questioning hegemony within Feminist theory which tried to speak on behalf of all women, without acknowledging differences within feminism in third world societies. Recasting Women: Essays in Colonial History by Kumkum Sangari and Sudesh Vaid (eds) is another influential book that threw light on issues specific to Indian women like widowhood, Vedic Dasis, Women, and Nation. Mary E John's book on Feminism, Theory and Postcolonial Histories and Irene Gedalof's Against Purity: Rethinking Identity with Indian and Western Feminisms examine the theoretical implications arising out of locating women within a postcolonial situation.

Among Indian writers in English, Anita Desai and Shashi Deshpande have received considerable critical attention. Meena Belliappa's Anita Desai: A Study of Her Fiction and R.S. Sharma's Anita Desai are some of the early attempts at examining Anita Desai's contribution as a woman writer. Fits and Misfits: A Study of Anita Desai's Protagonists by Kumar VL and V N Narendra is an attempt to analyze the feminine predicament as depicted in Anita Desai's novels. Mrinalini Sebastian's The Novels of Shashi Deshpande in Postcolonial Arguments is a full-length study of her works about the formation of female subjectivities within a postcolonial setup. In the research paper, Gender, Feminism, and Postcolonialism: A Reading of Shashi Deshpande's Novels Palekar Shalmalee draws attention to the heterogeneous representation of women and the ambiguities that marks their identities.

Most of the works referred to offer a glimpse into the craft of writing and the predicament of the characters in the novels of Anita Desai and Shashi Deshpande. The present study would add to this body of criticism by undertaking a comparative study of their contribution to feminist studies, particularly in a postcolonial setup. The novels of Anita Desai that are chosen for study are Cry, The Peacock (1963), Voices in the city (1965), Where Shall We go This Summer (1975), and Fasting, Feasting (1999). Novels of Shashi Deshpande that will be subjected to closer scrutiny would include, That Long Silence (1998), Roots and Shadows (1983), The Dark Holds No Terror (1980), and The Binding Vine (1992).

Research Methodology

The primary method of analysis is comparative in nature and employs critical tools of comparative literary study. In order to bring out the difference in the images of women these writers portray, the study would employ the method of character analysis in terms of their growth, the trials and tribulations they undergo, the various situations they face, and, above all, the way their struggles against patriarchy in asserting their self-identities. In addition, the research would also focus on the development of the plot and structure of each of the novels under study. The narrative technique and images that the novelists employ will also be subjected to critical scrutiny since they bring out the complex processes by which the characters come to terms with the crises in their lives. It would largely follow the tenets of new criticism which rejects authorial intention as the guarantee of meaning but lays emphasis on the textual functions as its method of interpretation.

Time frame: Final thesis will be submitted within six months from the day synopsis approval

Outline Composed of the Titles of the Chapters and Characterization Suggested

Modern Feminist Thought: A Historical Overview

This chapter traces the major concerns and shifts in feminist theory and practice since its beginning in the 19th Century and their implication for women writing. It includes a brief overview of feminist theories, some of the important stages of the feminist movement, and the questions they raised during different phases of the movement. It tries to provide a historical background to locate women writing, the politics of canon formation, and women as a colonized 'other'. It also focuses on the nature of patriarchy, gender discrimination, and violence against women.

Indian Women Writing and the Issues Related to Indian Feminism

In this chapter, the focus is on the impact of the Western feminist movement on Indian society as well as Indian feminism. This chapter also includes a brief account of reform movements in India under colonial rule, their contribution, and their limitation to women's empowerment. It traces the salient features of women's role in the national movement and how the national-modern viewed the role of women in nation formation. Lastly, it relates the diversity among feminist groups in India, the predominant images of Indian women, womanhood, and their relation to the question of gender identity.

Woman's Identity and the New Individual: Novels of Anita Desai

This chapter subjects some select novels of Anita Desai mentioned to greater critical scrutiny in terms of the recurring images of women that plot her novels and their struggles against patriarchy. It also provides the sense of self that her women characters gain through their struggle, the role of the family as a site of gender struggle, and the way it reinforces patriarchal power. Lastly, it talks about the dominant resolution that her novels imply and its implication for understanding feminist theories.

Novels of Shashi Deshpande: Breaking the Binaries

The chapter offers a critical reading of some of Shashi Deshpande's novels to bring out the boundaries that envelop and shape women's identity; the social codes that shape their destiny, and the different trajectories women in her novels follow in their quest for self-realization. It also discusses the role of economic independence and professional career in the lives of modern, middle-class women, and the new kinds of struggles it demands women's liberation. Lastly, it observes the shifts in women's questions as envisaged in her novels in the age of consumerism and market economy.

Comparative analysis of Anita Desai and Shashi Deshpande: An Inquiry into the Variation of a Common Theme

The chapter undertakes a comparative study of these two writers in terms of the formal features of their novels as plot construction and thematic development. It talks about family as a governing structure that shapes the destiny of characters, the varied attitudes to modern and traditional notions of womanhood these novels uphold, and also how the idea of boundary is dealt with in both the writers. Then, it analyses the question of woman liberation, equality, and identity in the way that are addressed by these two women writers.

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Chapter - 4

A Study about the Relationship between Custom House Agent (C.H.A) and Container Freight Station (C.F.S)

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Abstract

Logistics helps in maintaining inventory at the lowest level, and thus achieving the customer goal. This is done through small, but frequent supplies. Inventory is one of the key factors, which can affect the profit of an enterprise to a great extent. In the traditional system, firms had to carry lot of inventory for satisfying the customer and to ensure excellent customer service. But, when funds are blocked in inventory, they cannot be used for other productive purposes. These costs will drain the enterprise's profit. The Purpose of this study is to analyze the important criteria in the selections of a Container Freight Station (CFS), with reference to problems and satisfaction of the Customs house agents (CHA). This study aims at analyzing the functioning of the CHA and giving suggestions for improving their services. The authors have focused on analyzing the effectiveness of container freight stations in Chennai and the criteria for the custom house agent to select a CFS. Reports show that there are about 30 Container Freight Stations in Chennai, and there are more than 500 Custom House Agents in Chennai It throws light on container handling at the company and the problems faced by Freight Forwarders about the container handling. The Purpose of the study is to analyses the important criteria in the selections of a CFS, in the association of problems and satisfaction of the Customs house agents.

Introduction

The American Council of Logistics Management defines logistics as "the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the

purpose of conforming to customers' requirements". Material required by the customer must be delivered on time, not ahead of the schedule or behind the schedule. Proper planning of the transportation modes, with availability of inventory will ensure this. Freight is a major source of cost in logistics. This can be reduced by following measures like selecting the proper mode of transport, consolidation of freight, route-planning, long distance shipments etc. Sometimes products may be damaged due to improper packing, frequent handling of consignment, and other reasons. This damage adds to the logistics cost. The use of proper logistical packaging, mechanized material handling equipment, etc. will reduce this damage. Reports show that there are about 30 Container Freight Stations in Chennai, and there are more than 500 Custom House Agents in Chennai. The statistics also show that nearly 90% of the C.H.A do their business in ocean freight transport and they are located in North Chennai (Parry's, Roya Puram, and Broadway).

A firm must have the capability to extend service to the customer in the shortest time frame. By utilizing the latest technologies in processing information and communication will improve the decision making, and thus enable the enterprise to be flexible enough so that the firm can fulfill customer requirements, in the shortest possible time frame.

The present research work is aimed at analyzing the effectiveness of container freight stations (CFS) in Chennai and the criteria for the custom house agent (C.H.A) to select a CFS.

Survey of Existing Literature

Gupta & Dasgupta (2018) had discussion with custom housing association, Bombay. He briefly explained in his report about education, law and order and ease of doing business. Shareef (2017) discusses the issues of bifurcation of Andhra Pradesh on import and export trade sector and he highlights the custom house agent's associations on issues of inland container deports, container freight station and warehouse. Argyrou (2017) shared information of annual general meeting of custom house agent association held in Mumbai and he say about what are activities and achievement made by the association in last one year.

Girish V Upadhye (2015) did a study on role of ports, container freight stations and inland container depot in logistical development, Logistics management is that part of the supply chain management process that plan, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer's requirements. With

rising consumer demand and the resulting growth in global trade, the role of infrastructure support in terms of rails, roads, ports & warehouses hold the key to the success of the economy.

Winfred Kajuju (2013) did a study on determinants of consumer choice in the uptake of container freight station products in Kenya: a case study of selected container freight stations in Mombasa, Maritime freight volumes fluctuate with changes in consumer demand and global economies. In response to increasing container volumes, congestion, and capacity constraints; ports have embarked on implementation of inland container depots (ICDs) as capacity enhancement strategy. Determination of optimal pricing strategies and demand intensification has become the biggest challenges for privately owned Container Freight Stations.

Raja Simhan (2012) in his article states that, better infrastructure can boost productivity at container freight stations. According to him, CFS operators are confident that business will remain 'bullish' for the next ten years. But better facilities hold the key to their viability. Chennai has the maximum number of container freight stations (CFSs). There are 28 in operation with three more to be set up soon. The CFSs are in North Chennai, especially near the industrial zone of Manali, serving both Chennai and Ennore ports.

Fremont, Antoine (2008) In 50 years, containerization has become the backbone of globalization. That it has done so can be attributed to the beneficial interaction of three broad types of factors: technical, economic and organizational. In the beginning, containerization was nothing more than a simple technical innovation. However, as an intermodal tool, the container paved the way for new and long-term organizational models in the transport sector. These organizational factors challenged transport actors, who had to redefine the demarcation lines between their respective businesses in order to bring reliable door-to-door transport chains with a global reach into operation.

The Gaps found consequent to exhaustive review of literature is highlighted. Previous research was conducted on containerization, Ports shipping services, port infrastructure endowment and liner shipping freight rates however specific studies related to Custom House Agents and Container Freight Station have not been undergone in the Indian context. Human Resource management problems in Industries like IT, ITES, Service, Manufacturing and allied sectors have been explored however these issues have not been addressed with specific reference to CHA's contributing to the shipping industry. Thus, studies on HR problems in shipping industry are

negligible especially in India. Performance of CHA's is scant reviews which focus on the performance aspects of CHA's and this study will throw light on the performance of CHA's and Chennai port in general as this is a rapidly growing industry a study of this nature is necessary for the industry.

Research Methodology

The scope of this research work is limited to the understanding of the Container Freight Station activities, to know the real time happenings in Container Freight Station, understand International Trade (EXIM) procedures, understanding the Custom procedures and formalities in EXIM trade.

Objectives of this Research Work

1. To analyze the effectiveness of the CFS in Chennai
2. To Analyze the effective methods of CHA (Customs House Agent) in Chennai
3. To study on the factors that makes the CHA to choose a CFS
4. To analyze the infrastructure facility of the CFS in Chennai
5. To study on the satisfaction level with the infrastructure facility provided by the C.F.S
6. To get suggestions to improve the facility of C.F.S in Chennai in order to have smooth Export & Import Clearance.

As there are more than 400 CHA's in Chennai, a sample size of 40 was chosen for this research work. Convenience sampling method was adopted for the survey. Different types of data collection method have been considered for this research work, namely Survey, Primary data collection, Secondary data collection and Personal Interview. Survey method was used to gather data from the respondents through questionnaire. The main purpose of the survey is to facilitate in understanding and enable prediction of some aspects of behavior of the population being survey. Primary data was collected from the respondents by using a structured questionnaire. Secondary Data was collected from journals, books and magazine. Personal Interview was conducted, where respondents were met in person and questions were asked based on a set of questions from the questionnaire to collect relevant information.

Limitations

As this work involved meeting the respondents related to CHA's, getting an appointment was difficult hence the sample size was limited to 40 respondents. The results are based on the opinions of these respondents.

Findings

Out of the total respondents 40% of C.H.A have come in to existence in 5-10 yrs., and just 5% of C.H.A have started their business in 0-5 yrs. as indicated in Table 1.

Table 1

Years	No of Companies	Percentage
0-5	2	5%
5-10	16	40%
10-15	9	22.5%
15-20	4	10%
More Than 20	9	22.5%
Total	40	100%

About 45% of the C.H.A prefer quicker and faster clearance, 20% of the C.H.A prefer safety of goods only 12% of the C.H.A prefer a CFS for modern equipment's, and other criteria's for the C.H.A to select a CFS are with respect to Storage and handling charges, User friendly approach, Transportation facility and Willingness of shipper. Refer to Table 2.

Table 2

Years	No of Companies	Percentage
Location	5	12.5%
Modern equipment's	3	7.5%
Rotation of custom officers	6	15%
Safety of goods	8	20%
Quicker and faster clearance	18	45%
Total	40	100%

There are thirty Container Freight Station in Chennai, out of those twenty-seven deals with Exports and Imports and three deals with Exports only. In about 30 Container Freight Stations in Chennai most of the C.H.A prefer only 21 CFS for their regular clearance activities, remaining 9 CFS has to improve their performance to attract more C.H.A for regular clearance.

In about 40 responses 22 CHA prefer SATTVA HI TECH AND CONVARE CFS and 20 C.H.A Prefer GERMAN EXPRESS CFS for their regular clearance. Report shows that almost 45% of the C.H.A prefer quicker and faster to choose a CFS and other criteria by the C.H.A are as follows:

- Storage and handling charges
- User friendly approach
- Transportation facility
- Willingness of Shipper
- It is observed that C.H.A prefer Thiruvotriyur location for clearance as they feel its congestion free.
- Report verifies that almost 72% of the C.H.A reveals Ennore port will increase the CFS business in the nearby surrounding.

Almost all CHA feels that they should be responded properly by the CFSS staff and A.S. SHIPPING CFS and TRIWAY CFS Maintains good relationship with C.H.A.

Nearly 60% of the C.H.A feels that there should be improvement in the CFSS in Chennai as they are not satisfied with the current infrastructure facilities in Chennai.

C.H.A feels that GERMAN EXPRESS and MAERSK CFS has excellent infrastructure facilities. This also shows that infrastructure provided by the MNC Companies are highly satisfied, as there is now red alert for the Indian companies to improve their infrastructure to withstand the competition with upcoming MNC companies like Land.

There is a need of improvement in container tracking and tracing facility in Chennai as the 55% C.H.A feels that they are not satisfied with the facility.

GERMAN EXPRESS CFS are at the Paris in terms of, faster processing, well organized structure, efficient handling and security.

C.H.A feels that there should be improvement in all the activities of CFSS which includes Infrastructure Security High Processing Speed Warehousing Space Proper response to C.H.A.

Conclusion

From the study and analysis of CFSs in Chennai itis found that infrastructure on the whole has to be improved a lot. Sophisticated equipment's should be deployed for and effective and efficient CFS operations. The Ennore port will play an important role in the improvement of CFS business in Chennai. GERMAN EXPRESS CFS is considered as the best CFS in terms of good relationship and proper response to C.H.A, infrastructure, fast processing and international standards.

Suggestions for Future Research

Based on the Findings, the Following Suggestions are made for Further Research

- Should improve the processing speeds in documentation
- Implementation of AS/RS (Automated Storage and Retrieval System) and RFID (Radio frequency identification device) in the import and export warehouses inside the CFSS
- Easy container tracking and tracing facilities
- Customs formalities should be computerized in all CFSS in Chennai (EDI)
- Quicker response and proper maintenance of customer databases (C.H.A)
- Demurrages and storage charges can be reduced
- FOB (Free on Board) to change to 5 days instead of 3 days
- Improvement in infrastructure facilities is a must
- Full container tracking facility should be implemented to prevent smuggling and to reduce the time in inspection
- Modern material handling systems should be implemented
- Improve communication and online transaction facility
- P.N.R movement should be treated equally
- Should improve road and transportation facilities in North Chennai where the most of the CFS are located
- Government should take some measures to solve congestion/traffic problem

Appendix (will include any data you may want to submit) (Use Only If Relevant)

Appendixes, if needed, appear before the acknowledgment.

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Chapter - 5

Gaining Efficiencies in LTL Outsourcing and Importance of It

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Abstract

This paper is aimed at understanding the outsourcing activities at LTL with respect to efficiencies and its importance in increasing the performance of logistics. Logistics is the planning, implementing and controlling of the transportation of the cargo from the point of origin to the point of consumptions without any damage. It maintains the interactions with the vendors and consumers. Here the consumer needs are met by supply chain planning. Logistics outsourcing helps to increase flexibility, performance improvement, and reducing cost. For collecting the data, the employee needs the information about the characteristics of the products. They should be aware of the range of the products, replenishment qualities. Logistics management helps to provide fast and quality service to the customers optimizing operational costs, Boosting profitability, better intermodal operation, greater delivery productivity and efficiency. They follow an intelligent routing planning. Customer satisfaction is the key role of logistics management.

Introduction

LTL (Less Than Truckload) shipment is a contract between the shipper and the transport owner. According to the contract instead of the entire truck, the shipment are priced according to the weight of the freight and mileage within designated lanes. It is a method of transporting small goods that don't require a full truckload. Because products are packaged in smaller parcels, many separate shipments may be transported in one truck. LTL carriers optimize trailer space while serving multiple customers at once. In this study

we are going to look the different ways of LTL outsourcing. LTL refers to "Less than truck load a mode of freight transport that offers flexible options when the amount of cargo needing to be moved does not fill a full truck load (FTL) but is too large or heavy for parcel shipping. LTL is commonly used where the customer has small shipments to and from multiple origins and/or destinations that need to be shipped to meet lead time requirement. It supports just-in-time inventory management and are ideal for when the cost benefit of transporting the goods in smaller amounts outweigh the associated cost of storing, managing, or waiting for a full truckload. In this Study we are going to discuss about the need and importance of the LTL outsourcing in the field of Logistics. Logistics is the planning implementing and controlling of the transportation of goods from the point of origin to the point of consumption by confirming the safety of the cargo, here we discuss some important research regarding LTL outsourcing and suggests some further futuristic research. LTL shipping works on what one could consider a hub and spoke model. In this model, local terminals would be considered the "spokes" and the larger centralized terminals would be the "hubs" also known as distribution centers. If you're unsure whether or not you should ship via LTL or parcel, it comes down to weight in most cases. To put it simply, if you are shipping freight over 150 pounds but not quite enough to warrant FTL, you should consider LTL. If you are shipping very small or lightweight freight in a relatively small volume, parcel could be a better choice.

Survey of Existing Literature

According to Basak Altan, Okan Orsan Ozener, Less Than Truckload (2021) transportation offers fast, flexible and relatively low cost transportation services to shippers. In order to cope with the effects of economics recessions, The LTL industry implemented ideas such as reducing excess capacity and increasing revenues through better yield management.

Yavuz A Bozer, Hector J Carlo (2008), in their study is concerned with inbound and outbound trailer to door assignments in cross docks, which are used by many transportation companies as a redistribution point. A simulated Annealing (SA)-based heuristic procedure to determine the door assignments in order to minimize the overall material handling workload in a rectangular cross dock is presented.

According to Maknoon, Francois Reserch (2017), they introduced an exact method to schedule the internal transshipment process at cross docks in less than truckload industries. An integer programming formulation is presented to minimize the cost of double handling by synchronizing two types

of decisions: products' internal transferring route, and the order of processing trucks at the terminal doors. Several valid inequalities are introduced to strengthen the formulation and to increase the efficiency of the proposed algorithm.

Gap - From the above study, it can be concluded that there is a scope to explore the parameters that can increase the performance of the Outsourcing activities at LTL. Not many works are done in the areas of identifying means to increase the efficiencies and help the enhancement of logistics in particular the outsourced process. According to the research conducted based on the review of literature of LESS THAN TRUCKLOAD it is clear that the research conducted here is based on how can we reduce the operational cost and Gain efficiency in the field of LTL Outsourcing. They also states about the Inbounding and Out bounding process of the Cross docking in the field of LTL outsourcing.

Research Methodology

After analysis the review of literature we can easily identify that most of the researchers are trying their maximum to find out the ways to reduce the operational cost and to increase the efficiency of the process. According to Less Than Truckload it is a contract between the shipper and the transporter shipments are on the basis of the weight of the freight and ships mileage within the designated lanes. And also researchers are busy to find heuristic algorithms for the truckload and less than truckloads, and also mathematical model and solution approach for carriers collaborative transportation planning in less than truckload transportation.

Research Questions

1. Do LTL carriers and warehousers who elect to participate in an alliance share risks and resources more than LTL carriers and warehousers who are engaged in traditional arm's length business relationships.?
2. Once an alliance type relationship is formed, are there certain types of risk and resources that LTL carriers and warehousers are more or less likely to share?

The Main Objectives of the Research Are

- To determine the updated problems in LTL Through research and find a solution for it.
- To analyse the chances of new futuristic problems in logistics management

- To find out the differences between the experience candidate and fresher, how we can select them for a job process
- To Analyse Heuristic algorithm for the truckload and less than truckload
- To identify the mathematical methods for data collection like Correlation method and Delfi method.

To determine the updated problems in LTL Through research and find a solution for it. To analyze the chances of new futuristic problems in logistics management. To find out the differences between the experience candidate and fresher, how we can select them for a job process To Analyze Heuristic algorithm for the truckload and less than truckload. To identify the mathematical methods for data collection like Correlation method and Delfi method.

The trucking industry is worth nearly 600 billion in the United States (ATkeaney 2017) it represents over 3% of the country gross domestic product and is the primary mode of transportation for goods. The trucking industry is segmented into full truckload (TL), less – than-truckload LTL and private /dedicated. Full truckload denotes point to point carriers which has the name implies, ship full truckloads of product from an individual shipper.

Conversely, less than truck load carriers deal with smaller shipments, typically ranging from 100 to 10,000 pounds, that are consolidated into one truck. Finally private and dedicated freights are on or leased by a single shipper and, typically, only carry their own shipments.

LTL Shipping networks are much different than those of truck load. Truckload carries focus on point-to-point shipments they pick up at the origin and drive directly to the destination were the entire trailer is unloaded on the other hand as many stops it begins with a local pickup route were trucks pick up all the local shipments and bring those to a local terminal.

Sampling design – Non probability sampling

Sampling technique – Convenient sampling and simple random Sampling tool – structured question

Area of Study – Gaining Efficiency in the field of LTL outsourcing

Findings

The most major statistical tools used for data analysis is correlation method, clustermethod, and DElFI method Correlation on the significiance level $p<0.01$," correlation on the significiance level $p<0.05$ p= Pearson

coefficient correlation S= Significiance; N= Sample size A brief of the same as obtained by software is indicated in Table 1 and 2.

Table 1

	Ash shipments	**One time pickup**	**One time delivery**	**Perfect shipment**	**Median shipment weight**	**Median publish transit days**
Load num count	1					
One time pickup	0.04	1				
On-time delivery	0.11	0.61	1			
Perfect shipment	0.10	0.83	0.94	1		
Median Shipment weight	-0.21	0.29	0.33	0.34	1	
Median publishment Weight	-0.21	0.29	-0.32	-0.36	-0.22	1

Out of the 33 shippers, 24 have more than one business unit. Most shippers in the dataset have one to three business unite, however a few have more max 10. We ran a correlation matrix at the business unit level and found nearly identical performance showing that business units have similar attributes and performance drivers within their respective firm.

Table 2

Outsourced vehicles					
Outsourced drivers	1800.98				
Differentiation	3.27	281			
of services	0.01	.004			
	96	102			
Price	118	-0.39	104		
differentiation	252	-697	267		
	96	102	117		
Image	159	187	365	351	
differentiation	122	0.60	000	000	
	96	102	117	117	
Technological	0.37	-002	-378	299	418
differentiation	.721	-987	000	001	.000
	96	102	117	117	117

Differentiation	181	197	0.61	211	0.84
of the staff	0.82	0.51	.5.25	0.26	.382
	93	99	111	111	111

Business unit level correlation matrix is shown in Table 3.

Table 3

	Shipments	**Avg OTP**	**Avg. OTD**	**Avg. on time**	**Median Reference weight**	**Median SMC Transit Days**
Shipments	1					
Avg OTD	0.06	1				
Avg on Time	0.10	0.45	1			
Avg on time	0.11	0.65	0.94	1		
Median Reference Weight	-0.15	0.18	0.03	0.08	1	
Median SMC Transit Days	-0.15	-0.24	-0.15	-0.23	-0.01	

Conclusion

1. Counterfeiting can take on different forms. Counterfeiters misappropriate someone else's brand, falsely label products, or use fake or inferior components to make a product. Lack of consumer confidence in the provenance of goods can really hurt a manufacturer's ability to sell their products. This is particularly a concern for companies selling their products in Asia, where counterfeiting is widespread and consumer confidence is low.
2. **Theft of Goods:** There are many people handling goods in transit and only one of them needs to have ulterior motives for theft to become a big issue. In the current supply chain, it's very easy for someone to sign a form saying they've handed over 100 boxes, whereas the real amount was only 99 as they kept one themselves. For manufacturers it is very difficult to figure out where theft may have occurred as information about the shipment of their goods is usually only available days or weeks after (most of) their products have already arrived at their end destination.
3. **Lack of Accurate Data on Shipping Conditions:** Many products need to be transported within pre-set environmental conditions such as within certain temperature parameters. As there is no way for manufacturers to see shipping conditions in real-time, some logistics

companies, local or global, falsify the information on how they've shipped certain goods.

4. A shipping company may turn off the fridge or freezer straight after leaving a port to save costs and turn them back on closer to the end destination. When the conditions are checked at that endpoint, the temperature may well be within the right parameters again but the quality of the products will have been affected already as the temperature parameters were not met throughout the entire journey

Suggestions for Future Research

Based on the Findings, The Following Suggestions are made for Further Research

1. Efficient logistics is all in the planning. The less decisions that need to be made off the cuff during the transportation process, the better. And, while a solid plan can never cover every extenuating circumstance, it will keep ad hoc choices to a minimum. A good logistics manager will therefore make sure to plan well ahead in order to eliminate any delays in the supply chain as best they can.
2. Always have a contingency plan.

No matter how fool proof you think your logistics plan is, it's impossible to prepare for every possible eventuality. A good logistics manager therefore knows their job is far from done after their plan has been made, as they need to follow the supply chain at every point and put out fires whenever they crop up. To do this effectively, you should have contingencies for every element of your logistics plan. You should also know when to stick it out with your original plan and when to switch to your backup — something that can only come with experience.

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Chapter - 6

A Study on LNG & LPG Carriers at Cochin Port Trust

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Abstract

This report contains the information about our internship at Cochin Port Trust. The report undertaken at the port has aimed at the study on CNG and LNG carriers at Cochin port trust. Our assigned place of work was CDC (Central Documentation Centre) which is under the Port and we were assigned the post of management trainee. CDC mainly does the documentation process. As a part of CDC, we were able to visit almost all the areas of the port with their help and support. We made the opportunity useful to study more about the liquid bulk and its activities in the port, the export and import formalities and the process involved for it etc. The recommendations includes the introduction of new cargo handling equipment's in the port, maintenance and up gradation of the berthing facilities for ship and full automation should be done so as to make the process easier. The future suggestions may include the factors like reducing the turnaround time of vessels, automation etc. The shipping agents should make the entries of ship arrivals and departures in advance so as to make the process easier and getting the berth ready without any delay. The report also investigates the fact that the analysis conducted has limitations. There was inaccessibility in some of the port areas is a major limitation of the study and it was difficult to collect primary data due to confidentially policies, Complete Information was not provided from higher officials. Another difficulty was very limited time-span of the project, and sources for collecting the data were very limited.

Introduction

Cochin Port is a major port on the Laccadive Sea – Indian Ocean sea-route and is one of the largest ports in India. The port lies on two islands in

the Lake of Kochi: Willington Island and Vallarpadam, towards the Fort Kochi river mouth opening onto the Laccadive Sea. The International Container Transshipment Terminal (ICTT), part of the Cochin Port, is the largest container transshipment facility in India. The port is governed by the Cochin Port Trust (CPT), a government of India establishment. The modern port was established in 1926 and has completed 91 years of active service. The Kochi Port is one of a line of maritime-related facilities based in the port-city of Kochi. The others are the Cochin Shipyard, the largest shipbuilding as well as maintenance facility in India; the SPM (single point mooring) facility of the Kochi Refineries, an offshore crude carrier mooring facility.

Survey of Existing Literature

Refrigerated storage is considered economical when storing liquefied gas in quantities of more than 5,000 tones. Because cargo leaking from a refrigerated storage tank is already close to atmospheric pressure, it would boil rather than flash-off. Therefore, any liquid release which takes place requires heat inflow for evaporation. The source of heat is the ground on which the liquid has fallen. The larger the surface area the greater the heat inflow and hence the greater the vapor generation rate. The use of a walled bund area around a refrigerated tank, therefore, reduces the potential vapor cloud and prevents the spread of a spilled liquid.

Research Methodology

The purpose of research is to discover answer to research questions through the application of scientific analysis. Though each research study has its own scientific purpose, we may think of research objectives as falling into a number of following groups:

- To study the customer preference in selection of exporter and companies.
- To find out the factors by which customers are choosing an exporter and companies.
- To describe accurately the characteristics of a particular individual, group.
- To study the export and import of LPG & LNG.
- To study the overall growth of India in this field.
- To examine the problems and also major difficulties faced by this industry.
- To study the export & import procedures involved in this industry.
- To study the existence of LNG & LPG in India.

Finally the researcher must decide about the technique to be used in selecting the items for the sample. In fact this technique or procedure stands for the sample design itself. In this we used the random sampling on the basis of first survey results, which is from 30 respondents.

Data Analytical Tool

SWOT Analysis of Cochin Port Trust

Strength

- Geographical location close to international east west shipping route
- Available land for future development
- Moderate wave conditions
- Protection from monsoons and cyclones
- Presence of SPM able to receive large vessels of 11500 DWT
- 24 hr. pilotage
- 0% pilferage
- Highly experienced staff

Weaknesses

- High operating and handling cost
- High influence of trade union
- Delay in getting projects sanctioned due to various controls
- Lack of modern infrastructure and equipment
- Huge amount spent on dredging

Opportunities

- Growth of tourism in Kerala.
- Vallarpadam terminal has been growing into a potential international transshipment hub.
- SEZ's at Vallarpadam and Puthu-vypeen,
- Encouragement of private participation and joint venture prospects
- Since most of the space is under-utilized, there is huge scope for development

Threats

- Upcoming port of Vizhinjam as a transshipment hub

- Port expansion at Colombo
- Resistance from urban areas
- Emergence of minor ports
- Emergence of private ports
- Lack of industrial base in Kerala.
- Unmaintained roads in Kerala.

Findings

- Strategic location in the international shipping highway and also near to the main waterways to Singapore and West Asia puts Cochin port in a very commanding position to serve the massive east west ocean trade.
- Total exports at Cochin port have experienced a gradual rise and the future projections are also showing a positive growth.
- Import from the major share of goods handled at port: POL product imports are registered the highest comprising approximately 80% imports

Conclusions

- New cargo handling equipment's to be brought into the port.
- Equip the port with most modern technologies.
- Provide facilities for better and fast movement of the cargo.
- Better machineries and technologies to be implemented.
- Maintenance of the existing facilities.
- Dredging and maintenance cost of the Vallarpadam container terminal should be imposed to them.

Suggestions for Future Research

Based on the Findings, The Following Suggestions are made for Further Research

- The port has to insist on the faster completion of modernization plans to increase its capacity, so as to efficiently handle the growing traffic.
- The port has to concentrate more on container handling, as container traffic is being growing rapidly across the world.
- The port should reduce the vessel turnaround time and traffic structure.

- Utilize the fullest of the existing technologies and facilities.
- Up gradation of the machineries and technologies.
- Private participation should be encouraged to improve efficiency.

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Chapter - 7

Development of the Logistics Industry with Upcoming Technology How the Company Safexpress Logistics Improved Their Process with New Technology

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Abstract

Logistics typically refers to activities that occur within the boundaries of a single organization and Supply Chain refers to networks of companies that work together and coordinate their actions to deliver a product to market. Also, traditional logistics focuses its attention on activities such as procurement, distribution, maintenance, and inventory management. Supply Chain Management (SCM) acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance, and customer service. Production planning and inventory control function is the center point of this chart. Customer service and transport function communicates with customers and sometimes called "customer facing functions.

Introduction

Safexpress offers a wide range of innovative supply chain services including Express Distribution, 3PL and Consulting. The firm provides value-added logistics services for 9 different business verticals ranging from Apparel & Lifestyle, E-commerce, Healthcare, Hi-Tech, Publishing to Automotive, Engineering & Electrical Hardware, FMCG & Consumer Electronics and Institutional.

Safexpress offers cutting-edge logistics solutions to its customers, enabling them to focus on their core competencies. The firm adds maximum value to businesses at every level, right from providing world-class warehousing support to ensuring time-definite deliveries of goods anywhere

in India. Safexpress' well-designed B2B supply chain solutions meet the needs of a range of industry verticals such as apparels and lifestyle, automotive, e-commerce, engineering, FMCG and consumer electronics, healthcare, hi-tech, institutional and others. These solutions include the Stock2Shelf service that determines the need at a retail store, assessing and delivering the stock at the feeder warehouses within the given timelines. This is especially successful in retail outlets operating out of mega malls where footfalls are high. The digital transformation roadmap at Safexpress has been designed to cover every leg of the journey – right from the first mile to the last mile while being able to adapt to the volatilities and dynamics of the market.

Survey of Existing Literature

As supply chains face many challenges like complexity, costs and uncertainty, they should be smart to overcome these problems and equipped with a technological infrastructure which allows the information to be integrated into the supply chain processes. Therefore supply had underwent a digital transformation known as Industry 4.0 driven by the emergence of advanced Information and Digital technologies (Mohamed 2018)

Innovate ideas include the use of IT to create new markets and obtain a competitive advantage through greater interactivity and direct communication with the partners and clients. Changes in the business environment made firms to increasingly rely on IT in order to achieve competitiveness and improve productivity (Yunis *et al.* 2018)

The activities along the supply chain can be identified by the company in detail starting from receiving orders, entering and leaving of materials, material procurement, supporting materials from the warehouse and product delivery with the help of information technology implemented by the company (Okundaye *et al.* 2019)

Two categories of IT use in supply chain management are internal and external IT use. Internal use is implementation of IT throughout manufacturing processes to share information within the firm whereas external use does not refer to one specific IT tool. It is the extent of using IT such as Internet and Cloud computing to integrate SC partners and activities beyond firm boundaries (Zhang *et al.* 2021)

Research Methodology

The study analysis the growing importance of IT in the management of Logistics and Supply chain. The study also identifies the numerous IT tools and how can they improve and streamline the entire process. The research

objectives considered were:

a) Understand the various Technology tools used by an organization

b) Benefits of IT in various managing the Logistics and Supply Chain functions

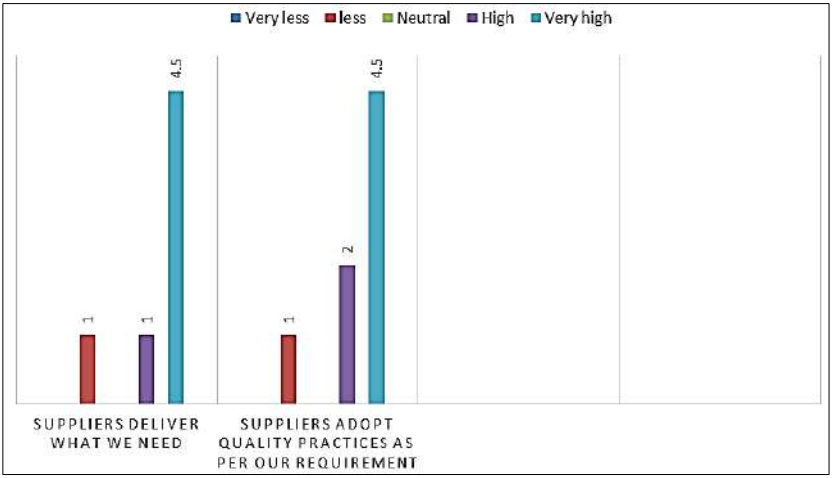
c) Understand the influence of IT on SC processes.

Research design-Research design that has been used is both Descriptive and Explorative. Respondents chosen would be on the basis of Convenience sampling.

Findings

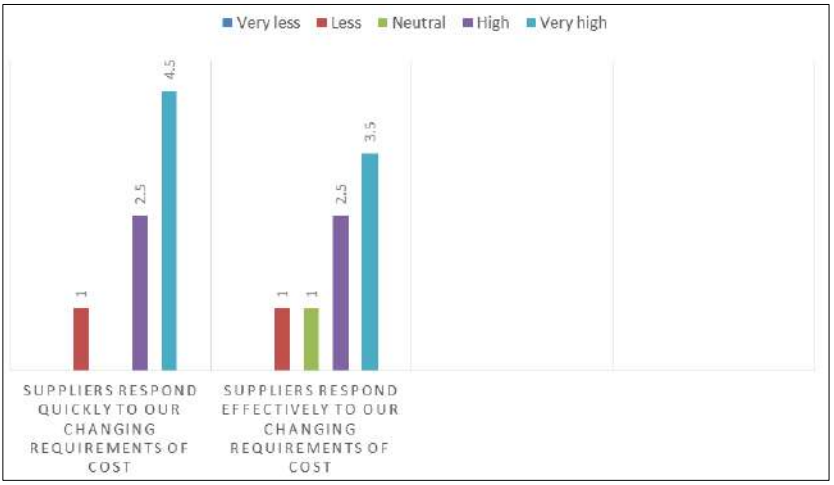
Responses from employees of 10 different companies confirmed the allotment of separate budget for investment in IT. From the above data we can make a conclusion that organizations play a major role to invest on efficiency and effectiveness of their supply chain and logistic operations.

Impact of IT on the Performance of Suppliers of the Company



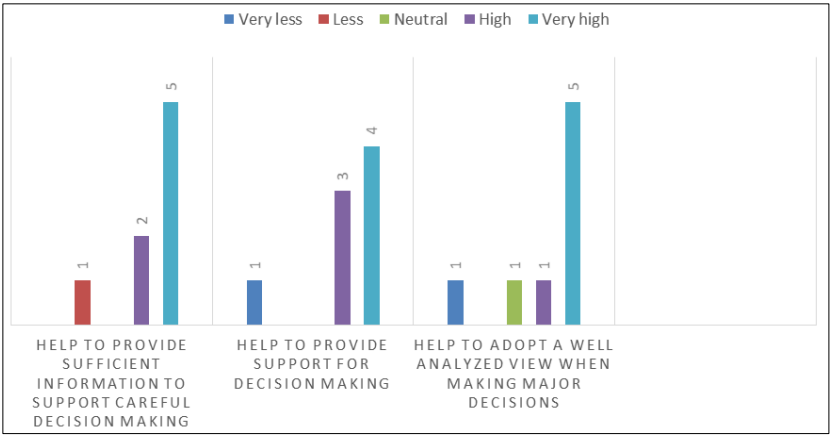
Thus, we can say that the role of information technology is beneficial on the performance of suppliers of the company.

Impact of IT on responsiveness in the supply chain of the company.



Hence, it is proved that IT is very essential for the responsiveness in the supply chain of a company.

Impact of IT in Decision Making.



This shows us that IT plays an important role in decision making.

Implementation of technologies have proved beneficial for several factors like reduction of overall SCM Logistics costs, communication, collaboration with shareholders and suppliers and reduction in lead time.

Conclusions

- In today's competitive market, choosing the right technologies is very much important for any enterprise in order to achieve a competitive advantage.

- This dissertation aims to understand that IT is increasingly important in supply chains.

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Chapter - 8

A Study on Effect of Material Management of Mas Construction Pvt. Ltd.

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Abstract

The need for materials management was first felt in manufacturing undertakings. The servicing organizations also started feeling the need for this control. And now even non - trading organizations like hospitals, universities etc. have realized the importance of materials management. Every organization uses a number of materials. It is necessary that these materials are properly purchased, stored and used. Material management is a service function. It is as important as manufacturing, engineering and finance. The supply of proper quality of materials is essential for manufacturing standard products. The avoidance of material wastage helps in controlling cost of production. Material management is essential for every type of concern.

Introduction

Materials management is a core function of supply chain management, involving the planning and execution of supply chains to meet the material requirements of a company or organization. These requirements include controlling and regulating the flow of material while simultaneously assessing variables like demand, price, availability, quality, and delivery schedules. Material managers determine the amount of material required and held in stock, plan for the replenishment of these stocks, create inventory levels for each type of item (raw material, work in progress or finished goods), and communicate information and requirements to procurement operations and the extended supply chain. Materials management also involves assessing material quality to make sure it meets customer demands in line with a production schedule and at the lowest cost.

Material management systems embrace all of the activities related to materials and are a basic business function that adds value to a finished product. It can also include the procurement of machinery and other equipment needed for production processes as well as spare parts. Typical roles in Materials Management include inventory analysts, inventory control managers, materials managers, material planners, and expediters as well as hybrid roles like buyer/planners. Regardless of role, the main objective of Materials Management is assuring a supply of material with optimized inventory levels and minimum deviation between planned and actual results.

Survey of Existing Literature

Georgekutty (2012) had undergone literature review to find out the causes for incompletion of project. A questionnaire survey was conducted in Kerala. From the research, the main delay or incompletion of project could be solved by proper pre-planning and scrutinize material procurement frequently to cut off the exceeding of project cost. Case study was carried out by Phani Madhavi (2013) in material management in construction site. The objective of the study was to understand about all the problems occurring in the company because of improper application of material management.

Olusakin S Akindipe (2014) made a study on role of raw material management in production operations. The author was conscious about th e inefficiency in raw material management and the alternate solutions to overcome the problem. He found the relationship between raw material and Inventory management to solve the crisis.

Jeruto Keitany (2014) in Kenya. For that the author had chosen a case study of New Kenya Cooperative Creameries Limited. A sample of 49 respondents was selected from 56 employees of New KCC Ltd. Data were collected through questionnaire from seven departments such as Purchasing, Quality Control, Warehouse/store, Human Resource Development, Finance and audit and Physical Distribution departments.

According to Damodara (1999), there is obvious that materials can provide saving when it obtained at the lowest price to the company. In early construction industry, many construction companies experienced that the increase in costs and a decrease in productivity which due to inflation and economic problems.

Anwar Zeb (2015) made a questionnaire survey based on his previous researches, for which he has collected data for about 20 years. The survey was made in Pakistan and he interviewed the contractors and the sub contractors of the site. He has selected 5 factors which are limited storage on site,

difficulty to store, conflicts between labourers, difficulty in work progress due to improper storage of materials and complexity in coordination of sub contractors on site.

Research Methodology

According to miller Research design may be designated as the planned Sequence of the entire process involved in conduction a research study. A research design is a Systematic problem. Research design is a compressive plan of Sequence of operation that a researcher intents to carry out to achieve the research objectives. Research Design is a map developed to guide the research. It is a part of the planning stage of research a blueprint for the collection measurement and analysis of data. It is an arrangement of the essential conditions for collecting and analysis of data in a form that aims to combine relevance to research purpose with Economy in the procedure.

To collect and record information, Questionnaire was prepared for employees. The Questionnaire was mostly closed and multiple choice Questions. Sample size refers to the number of employees selected from the universe to constitute a sample. Sample size of research is 100 employees.

A part of the universe is studies by drawing a sample and the plan devised to draw a sample is termed as sampling Design. A sampling Design will included a decision on the sampling unit the sample size and the sampling method. It is the number of the days or month taken to complete the research. The study was conducted during the period ranging from1st June to 30 June 2021.

The research used convenient sampling for selecting the respondents. In this method the investigator choose the sample unit on the basis of accessibility. A convenient sampling is obtained by selecting a convenient population unit. As the name implies in this method the researcher choose the sample units as the basic of convenience. Sampling unit is the most elementary unit which would be a part of the study.

Objectives of the Study

- To study various factors affecting material management in MAS Construction Pvt Ltd, Bangalore.
- To analyze the techniques used in material management MAS Construction Pvt Ltd, Bangalore.
- To assess the impact of material management on organizational performance.

- To appraise and further appreciate the significant of material management ion a manufacturing industry.

Data Analytical Tool

The table shows the company purchase order transactions are completely prepared and recorded on a timely basis.

Option	No: of respondents	percentage
Yes	52	52
No	48	48
Total	100	100

The table showing the working strategies of material management department.

Option	No. of respondents	percentage
Outstanding	10	10
Good	70	70
Average	20	20
Total	100	100

The table showing rate of delivery activity of the department.

Option	No: of respondents	percentage
Satisfied	60	60
Dissatisfied	40	40
Total	100	100

Findings

The study shows that company is maintain all the records of transaction in a timely manner.

- 52% of respondents are saying company keeping relevant documents in a timely basis. 48 % are saying they are not keeping well.
- 70 % of the respondents are saying working strategies of the current department are good.
- 90% of the respondents are saying company have good transportation facility, 10 % saying company does not have good transportation facility.
- 60% of the respondents are satisfied with the delivery activity, 40% are not satisfied.
- 60% of the respondents will say cases are correctly recorded by the material department.

- 40% are saying cases are not correctly recorded.
- 80% of the respondents are saying material management department are keeping all the address of the branches of the company. 20 % are saying they are not keeping well.

Conclusions

- From the literature review it is very clear that material management plays a vital role in the construction field. Whether it is a small firm or large firm the material management should be done. Material management holds a part right from purchasing of materials till its utilization. Moreover the S curve analysis should be done to check the deviations in the planned process to avoid the delay of the project. The study shows
- That the material management can be done with the help of proper planning. In case of delay, EOQ analysis is recommended to complete the project efficiently within stipulated time and cost international academic research for multidisciplinary Impact Factor Factors affecting Material management it is clearly important to manage all materials from the design stage to the construction stage.
- The waste of materials should also be minimized during construction stage in order to avoid loss of profit. Failure in managing site material and inventory will result in cost overrun, delays in project completion and reduce overall project performance. Better coordination among purchase and finance department will help in achieving greater efficiency in Inventory management. Firm, employing proper material management system can have increased their overall efficiency by 35%.
- Material management is an important management tool which will be very useful in getting the right quality & right quantity of supplies at right time.
- Having good inventory control & adopting sound methods of condemnation & disposal will improve the efficiency of the organization & also make the working atmosphere healthy any type of organization, whether it is Private, Government, Small organization, big organization and Household. Even a common man must know the basics of material management so that he can get the best of the available resources and make it a habit to adopt the principles of material management in all our daily activities.

Suggestions for Future Research

Based on the Findings, the Following Suggestions are made for Further Research

- The management has to take care all the risks and delivery problems in the department then it is easy to manage.
- Giving motivation to the employees help to reduce the work tension.
- Maintain good relationship with the employees may help to maintain a good morale in the company.
- Proper & adequate management support from the management will help to turn the work easy.
- Transportation facility has to improve then it will avoid the delay in delivery.

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Chapter - 9

Operations Management Practices and Performance of Schneider Electric India

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Abstract

Operations management practices are internal factors that contribute to competence development; and therefore offer competitive advantages for firms. Today's competitive global market is characterized by stringent business regulations, high operating costs, scarcity of resources, and unpredictable demand from increasingly informed customers. This study, therefore, wanted to establish the operations management practices used by multinational manufacturing firms in India and how they impact performance. An exploratory case study design was used in this study. The focus of this study was Schneider Electric India. This study targeted at least 100 employees from the senior, middle and lower levels of management involved directly with the operations management decisions. These levels gave a precise inference of the target population. The study depended on essential information, which was gathered by way of semi-structured questionnaires that had both open-ended and closed questions. The researcher organized, tabulated, and summarized the collected data. Charts and graphs were used to illustrate the findings.

Introduction

Today's operations supervisors, those in charge of creating and conveying the merchandise and enterprises that we utilize each day, confront a wide assortment of difficulties in the twenty-first century. The exceedingly focused business environment that right now exists, brought about in vast part by the globalization of the world's economies in conjunction with the development of e-trade, has moved the adjust of force from the makers to the customers.

Today's operations supervisors, those in charge of creating and conveying the merchandise and enterprises that we utilize each day, confront a wide assortment of difficulties in the twenty-first century. The exceedingly focused business environment that right now exists, brought about in vast part by the globalization of the world's economies in conjunction with the development of e-trade, has moved the adjust of force from the makers to the customers. (Prabhala, 1994). Subsequently, purchasers are presently requesting expanded esteem for their cash. From an operations administration viewpoint, this implies giving consistently higher-quality items with shorter conveyance times and better client benefit while at the same time lessening work and material expenses and expanding the use of existing offices all of which interprets into higher efficiency (Heinemann, 2005).

The World Economic Forum (2014) characterizes aggressiveness as the arrangement of foundations, strategies, and variables that decide the level of profitability of a firm. The upper hand is one variable that an association can make a condition to guard against contenders and incorporates an element that permits an association to separate itself from its rivals. The idea of the upper hand is specifically identified with a fancied estimation of the client (Mehri and Hosseini, 2004). The upper hand incorporates a set of abilities and variables that constantly exhibited the preferred execution of an organization over contenders (Sadri, 2001).

Operations Management practices are internal factors that contribute to competence development; therefore, they can offer competitive advantages for firms. In this sense, they create competencies that can be used as weapons for firms to secure a competitive edge (Hayes; Pisano, 1996). Incline generation is as of now the standard in worldwide assembling, the same as aggregate administration, six sigma, and ISO accreditation. Future operations activities will probably be connected with quick reaction to market requests, ecological or political change, with the utilization of new advances, for example, added substance layer fabricating, overseeing developed or dispersed supply chains, information investigation, and to a great degree quick time to specialty markets for inventive new items (Revelle, 2001).

Survey of Existing Literature

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Research Methodology

Each assembling business utilizes procedures or operations to take inputs and make yields that fulfill clients. Operations administration permits the chief to examine forms and enhance them by selecting fitting practices and strategies.

Main research objective was to find out the operations management practices used by multinational manufacturing firms in India and how they impact performance.

The Specific Objectives Were

i) To identify the operations management practices used by Schneider Electric, India.

ii) To determine the relationship between the operations management practices used in Schneider Electric, India and the operational performance.

Exploratory contextual analysis outline was utilized as a part of this study. Contextual investigations, in their actual substance, investigate and explore contemporary genuine marvel through point by point relevant examination of a predetermined number of occasions or conditions, and their connections.

The focus of this study was Schneider Electric India. The reason for choosing Schneider Electric is because of its large market share and its presence in over 130 countries as secondary data.

Findings

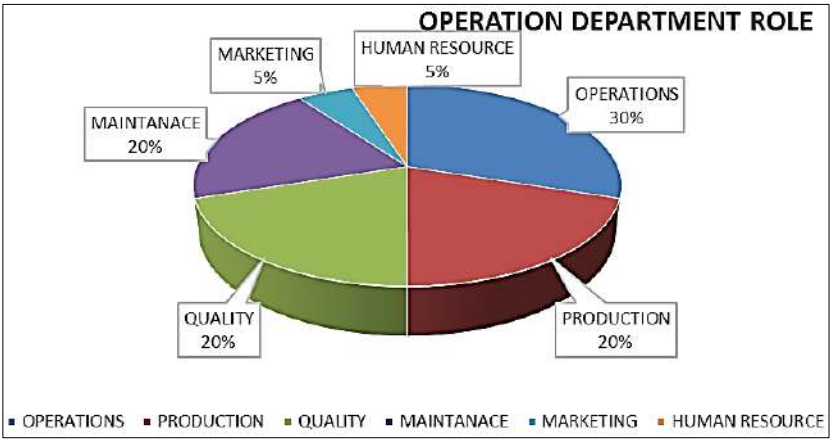
This section entailed the departments in which the employees worked, their highest level of Academic Qualification, the number of years that they had worked with the organization and their opinion on whether operations department played an important role in the organization.

Work Department of the respondent

Department	Frequency	Percentage
Operations	30	30%
Production	20	30%
Quality	20	20%
Maintenance	20	20%
Marketing	5	5%
Human Resource	5	5%
Total	100	100%

As shown in the table above, the study indicated that 30% of the respondents worked in the operations department, 20% worked in production, maintenance and also in quality departments as was indicated in each of the case. Additionally, the study indicated that 5% of the respondents indicated that they worked in marketing and human resources departments. This shows that the study involved employees from all manufacturing categories.

Respondents were asked to give their opinion as to whether the operations department play an important role in the organization. The study findings are as shown in the figure below.



Participants were requested that demonstrate the degree to which they complied with the listed aspects about their organization. A scale whereby 1 spoke to unequivocally deviate, 2 spoke to dissent, 3 spoke to neither concur nor dissent, 4 spoke to concur and 5 spoke to firmly concur was utilized. This shows that the higher the mean the higher the agreement according to the questionnaire statement. The study results are as shown below.

Total Productive Maintenance

Total Productive Maintenance	Mean	Std. Deviation
There is a documented maintenance program for shop equipment	3.900	0.568
TPM is done when there is less work or when equipment breaks down	3.900	0.994
There is regular inspection of machines and facilities and the operators are responsible for their own machine cleaning, lubrication, and regular maintenance.	4.100	0.738
The organization keeps detailed TPM and work order records	4.000	0.817
The organization has standardized maintenance checklists	4.400	0.699
There are scheduled regular maintenances and inspections	4.000	1.054

Conclusion

- The study revealed that regarding the total productive maintenance; the organization has standardized maintenance checklists, there is regular inspection of machines and facilities and the operators are responsible for their own machine cleaning, lubrication, and regular maintenance. Additionally, the study revealed that; the organization keeps detailed TPM and work order records; also there are scheduled regular maintenances and inspections. Further the study revealed that there is a documented maintenance program for shop equipment and also that TPM is done when there is less work or when equipment breaks down.
- Regarding the total quality management, the study revealed that; the organization has a documented quality management system in place and also that the magnitude and frequency of quality related occurrences has reduced significantly over the past one year and that measurable quality control methods are comprehended and utilized. Further the study indicated that all workers are urged to check the nature of every operation they finish before continuing to the following operation. Also that the organization welcomes and acts on end user complaints as was indicated. Further the study unveiled that quality levels are determined by end user bench marks and the regulatory authorities.
- On the internal lean practices, the study revealed that; there are

efforts in place to improve equipment performance, there has been a relentless pursuit to optimize production process and also that the organization is keen on removing and / or improving inefficient activities. Further the study revealed that the organization emphasized improved labor profitability and working effectiveness as method for lessening cost, instead of sourcing minimal effort materials and decreasing overhead expenses.

- Regarding the just in time method, the study revealed that; there are on time deliveries from suppliers and also that the organization adhere to consistence with the day by day generation as arranged. Further the respondents agreed that there is reduction of stocks in stores and also that there is the stability of the master production schedule and also that the organization is keen on improving on-time delivery.
- Regarding the six sigma the study revealed that; there is overall improvement in reliability and reduction of costs. Further the study found out that the organization has flexibility in adapting to different production capacity and can gather important data and to successfully interface with creation forms. Additionally, the study revealed that the company analyses and actively responds to customers' needs and systematically makes use of ad-hoc practices. Also, the study revealed that there is diminishing times for new item's advancement and commercialization.

Suggestions for Future Research

Regarding the operations management practices used by Schneider Electric India, the study revealed that workers are urged to check the nature of every operation they finish before continuing to the following operation. Thus the study recommends that the management of the company should set clear policies regarding work comparison, also the management should come with strong internal controls that support the selected operations management practices.

With respect to the relationship between the operations management practices used in Schneider Electric, India and the performance of operation. The study revealed that Internal lean management is an important practice for the utilization of production assets and also that Receiving Six Sigma enhances authoritative execution, through the proficiency with which workers are conveyed furthermore through enhanced efficiency. Thus the study recommends that the management of the company should adopt the operations management practices for effectiveness and efficiency.

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Chapter - 10

Royal Oak: An Emerging Leader in Indian Furniture Industry

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Abstract

The global furniture market can be broadly categorized into four categories - domestic furniture, office/corporate furniture, hotel furniture and furniture parts. Globally, domestic furniture accounts for 65 per cent of the production value, whilst corporate/office furniture represents 15 per cent, hotel furniture 15 per cent and furniture parts 5 per cent. According to a World Bank study, the organized furniture industry is expected to grow by 20 per cent every year. A large part of this growth is expected to come from the rapidly growing consumer markets of Asia, implying significant potential for growth in the Indian furniture.

The furniture industry is one of the fastest-growing industries in the world. The global furniture market was valued at USD 609.7 billion in 2019, with an expected growth rate of 5.4% from 2020 to 2026. However, like all other industries, the furniture industry took a massive hit in the year 2020-21 due to the ever-rising Covid-19 pandemic. The Living Room and Dining Room Furniture categories are the largest and most popular furniture market. The segment is driven by consumers' need for comfort in their homes.

China is the leading Furniture exporter and has a market share of about 37.5%, followed by Germany, Poland, Italy and the USA. As of 2018, India ranked 28th in the world exports with top export destinations including the US (39.2%), Germany (7.4%), France (6.6%), UK (6.3%), Netherland (6%), and Australia (2.8%) with USD 1.65 Billion and hold up 0.6% share in the world exports. The Asian region is rapidly expanding due to its large population and rising residential construction. Customers have begun to invest in home décor

and furniture as the standard of living in countries such as India and China continue to increase.

With an estimated USD 271 billion in 2020, Asia Pacific Furniture Market exceeded its market size and is expected to grow 5.1% from 2021 to 2027. The growth of the furniture market in the region has also been fueled by rising consumer spending power. As a result, there is an increasing demand for affordable yet stylish furniture. This contributes a significant amount to the growth of the sector in this region.

- Customers may now browse a huge variety of furniture products from anywhere and at any time, thanks to the introduction of online furniture merchants. Local carpenters, offline branded players, and furniture e-commerce enterprises have all become more competitive because of this.
- International players can now bet big on the Indian growing home furnishings market thanks to the introduction of 51% FDI in multi-brand retail.
- International corporations are also likely to enter the market in greater numbers. Godrej Interio, Nilkamal, Royaloak and Durian are some of India's major furniture producers. Wooden furniture is the most popular type of furniture in both the home and workplace markets.
- The popularity of traditional furniture has boosted the demand for wood in furniture manufacture in India. People have begun to use wood for furnishing cupboards, decorating, and other uses in the home over the last few years, which has boosted the use of wooden goods in the home. Aside from that, demand for engineered wood furniture is increasing in major cities, such as Delhi, Mumbai, and Bangalore. The reason for this is that ready-to-assemble house furniture is becoming increasingly popular in these cities.
- In India, a wide range of raw materials, such as wood, plastic, cane, bamboo, and metal, are used to make furniture. Because of the different variations of local and imported wood, wood furniture provides the greatest parts globally. Bamboo woods are becoming increasingly popular as a substitute for plywood. Indian wood is renowned for its beauty and traditional craftsmanship. States, like Kerala, Gujarat, Uttar Pradesh, Kashmir, and Punjab, are known for their excellent decorating, turning, and finishing skills.

Profile of Royal Oak

- In the year 2000 started a small 2000 sqft store in Bangalore.
- In the year 2000-2002 the first store expanded to 8000 sqft. Opened a large 2nd showroom in Bangalore.
- In the year 2006-2008 Opened a large store in the IT Hub, Marathahalli. Built a 50000 sqft warehouse in Bangalore.
- In the year 2009-2011 Became Bangalore's the biggest furniture store. Introduced international style range of products. Became the largest furniture range seller in South India.
- In the year 2013-2015 Extended our operations in Bangalore with a new showroom that has the largest floor space. Crossing a milestone of 10 showrooms in India with the opening of a new iconic brand store in Bangalore. Became India's the best Recliner Sofa Retailer.
- In the year 2016-2018 Reached 2 million happy customers through our 25+ stores. Became first South Indian brand to open stores in Mumbai. Launched www.royaloakindia.com website. Launches stores in North India, Chennai, Velachery, Pondicherry and crossing store count to 38.

Nature of Business

Royaloak is a leading furniture brand adding international style furniture that brings alive the aesthetics to your home. Their furniture designs add a premium & stylish look to your home & office environment in uniqueness of design and that it should be exclusive, comfortable and user friendly with pleasant aesthetics. International design country collections are extraordinary and unique in the industry. They understand and create enhanced furniture shopping experience across their physical stores & online portal.

Their founding team has experience of more than 40+ years and have been recognized as pioneers in the industry across the globe. What started as a single store brand has grown to become the leading Omni channel furniture brand with largest physical store footprint spread across India. Royaloak has 3 verticals, RMS (Retail Management System), FMS (Franchise Management System) and EMS (E-commerce Management System)

Royal Oak Market Spread

Product Profile of Royal Oak

Royaloak has 7 country collections and 7 categories. Royaloak has 120+ stores across India. Their major presence is in southern India covering all the states. They have stores in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Assam, West Bengal, Haryana, Delhi, Uttar Pradesh. They have warehouses in Karnataka, Kolkata, Haryana, Assam. Their mother warehouse is in Bangalore which majorly delivers across India.

The 7 Product Categories are

They have 132 products from 3 main categories that is Living, Bed and Dining.

- Living – 75 products
- Bed – 27 products
- Dining – 35 products

Strategy

Royaloak Furniture's business strategy is built upon the combination of function, quality, design and value always with sustainability in mind. Moreover, The Indian furniture chain offers cost advantage value for customers. Accordingly, Royaloak business strategy involves offering increasing variety of products for the lowest prices. Regular engagement in new market development and benefiting from strategic alliances constitute additional pillars of Royaloak business strategy.

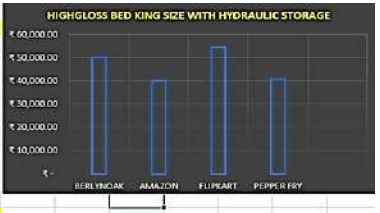
Royaloak organizational structure is unique and highly complex. The home improvement and furnishing chain maintains uniqueness and complexity its corporate structure in order to pay less taxes. The company can be divided into three large groups: Retail management system (RMS), Franchise management system (FMS), management system (RMS). Large scale of the business that integrates 112+ stores. Nevertheless, Royaloak has proved to be successful in overcoming common weaknesses of organizational structure such as high level of bureaucracy and lack of flexibility of the business. The furniture retailer subjects each of its systems to critical analysis periodically to identify and utilize potentials for further improvements. Furthermore, the furniture retailer generates the biggest value from Retail and product delivery systems in a way that flat pack furniture delivery system pioneered by Royaloak is one of the main factors that enable low costs of the products.

Assessing Customer Catchment Area as a Strategic Practice

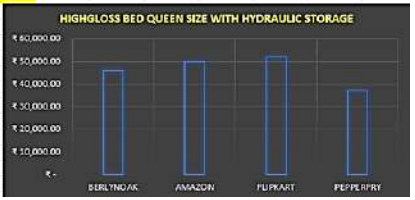
To grow your business, improve the customer experience, and retain and engage your customers, you need to understand who they are and where they come from. Catchment areas, or trade areas, allow businesses to understand where their visitors are coming from, and gain deeper insights into who they are and their behaviour. A heat map which is a visual representation of how visitors interact with each element to the store is created to assess catch, ent area. It shows which sections get more clicks and hold visitor's attention.

Competitive Analysis for Berlynoak (Beds)

HIGH GLOSS BEDS (KING SIZE) WITH HYDRAULIC STORAGE	
BERLYNOAK	₹ 50,000.00
AMAZON	₹ 39,999.00
FLIPKART	₹ 54,375.00
PEPPER FRY	₹ 41,122.00



HIGH GLOSS BEDS (QUEEN SIZE)WITH HYDRAULIC STORAGE	
BERLYNOAK	₹ 46,000.00
AMAZON	₹ 49,999.00
FLIPKART	₹ 51,910.00
PEPPERFRY	₹ 36,934.00



WOODEN BEDS KING SIZE	
BERLYNOAK	₹ 24,999.00
AMAZON	₹ 21,899.00
FLIPKART	₹ 37,999.00
PEPPERFRY	₹ 58,499.00

COIR MATTRESS (SINGLE)	
BERLYNOAK	₹ 8,500.00
AMAZON	₹ 4,029.00
FLIPKART	₹ 3,040.00
PEPPERFRY	₹ 4,635.00

Why Royal Oak is an Emerging Leader in Indian Furniture Industry?

It is clear from the above analysis that Royal Oak has presence across India with a strong brand image. It is a market leader in Indian furniture industry with its wide variety of choice. It has a sustainable model having seven country design collections. Further, it has products with high differentiation with competitors. It has also been exploring opportunities like, chances of global expansion, online sales and increasing demand for sustainable products.

Conclusion

The company has achieved in the year 2019 a milestone of launching our 50th store in Kolkata. Expanded our franchise family from 7 to 25 all over India. Opened India's biggest furniture warehouse. Added modular kitchen category in our product line. Opened 3 new stores in Bangalore. In 2020 Became India's No 1 furniture retailer with the highest visit to online stores and earning the highest revenue in the history of Royaloak. Added Work from home furniture range to ensure customers comfort while working from home. Became 'Furniture Marketplace' with a wide variety of products. This indicates that company is highly innovative and ever growing with best practices in place.

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Chapter - 11

Strategies to Promote E Vehicles in India

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Abstract

E Vehicles have been gaining lot of importance in recent years due to its advantages. They are green in nature and fuels greening the environment and adds to sustainability. This study focuses on customer awareness and to promote the sales of electric vehicles. This research also provides information about the advantages of EVs and how the future generation is going to be driven by the electric vehicles. Further, strategies to popularize the purchase of e vehicles and how to improve the infrastructure in India for construction of charging stations in various parts of the country is the focus area of this research.

Introduction

In the 21st century, the environmental impact of the fuel based transportation system and the rising price of petrol is a major problem. From the late 20th century there has been an increase in the prices of petroleum products and on the other hand the electric powered motors are an alternative to it. E-vehicles are run by electricity which can be solar, wind, or hydro powered and can be stored in cells for future use. With the advancement of technology the E-vehicle industries has also manufactured products as per the consumer needs and making it more price efficient. Electric powered motors started in 1827 by Anyos Jedlic, to power a small motor car and then in 1832 to 1839 the first crude electric carriage was made which was powered by a non-rechargeable cell. Finally in 1940, in England a patent was granted for the use of rails as conductor of electric current. Similar patents were made later in America in 1847. In 1900, electric vehicles were mass produced in America and sold in the market but later due to cheaper assembly line by Ford motor

company the electric vehicles couldn't capture the market. This was only due to the limitation of shortage of storage cells at that time E-vehicles were discontinued and petrol powered motors took the market.

During the 20th century on one hand there was a decline in the electric cars and scooters industry because of the shortage of rechargeable storage cells and on the other hand the electric trains gained much popularity due to the economies of price and achievable speed. Electric rail transport became commonplace due to advances in the development of electric locomotives. Over time their general-purpose commercial use reduced to specialist roles as platform trucks, forklift trucks, ambulances,[15] tow tractors and urban delivery vehicles, such as the iconic British milk float; for most of the 20th century, the UK was the world's largest user of electric road vehicles. So, the railway is a successfully electric vehicle which is most economical.

With the increase in the prices of petrol and with the advancement of technology the EV industry is now growing and new motors are manufactured which are more efficient and convenient to the consumers. The continuous advancements in the EV industry has shown a growth of the market and the market size is continuously increasing and o as the investments. The market size of Global electric vehicles in 2020 was $246.70 billion and it increased to $287.36 billion in 2021 and is expected to grow up to $1,318.22 billion in 2028. This drastic growth is because of the rise in prices of petrol, environmental causes, and because of the advanced EV's, people now prefer electric vehicles over petrol powered engines. The fuel powered motor vehicles are a main cause for air pollution in the environment and so many countries have imposed strict rules on the use of such motors and the carbon emission into the air. Most companies use pollution control filters to control the emission of carbon but still some percentage of it is let into the air. On the other hand electric vehicles are environment friendly as they are sound free and even pollution free. Petroleum being a nonrenewable natural resource, prices are increasing as the consumption increases and thus the cost of fuel powered vehicles. Electricity can be produced from renewable sources and with the advancement of technology the cost per unit of electricity will also decrease.

So, EV's will drive the future to a pollution free environment and cost effective transportations. After the launching of Tesla we can clearly say that electric vehicles can even make our life simpler because of the technology that can be powered by electricity and even the features in the car. I agree, that the prices are bit higher than the fuel powered vehicles but we also need not have to put extra expenses on fuel, we can just charge it and run it.

While the EV industry has shown drastic growth in developed countries such as USA, Japan but in developing and developed countries it is lagging behind. This is because of the infrastructure there are very less charging points and even people are ignorant. So the most important thing is to educate people about the merits and uses of it. Thus, we can say that EV's will surely drive the future but it has many limitations which will be discussed further and the ways to overcome that. So, the core objective of my study is to make people aware of the uses of EV and find out why they are not preferring it. We will be also discussing about the problems EV industry is facing in India and the ways to solve that by taking ideas from developed countries who have successfully built the EV infrastructure.

Review of Literature

According to Sapate, Kumar D; Kale, Sandip A. (2022), market segments of EV's are.

Electric Two Wheelers

1. Low speed three wheelers
2. High-speed three wheelers
3. Personal electric cars
4. Commercial fleet electric cars
5. Electric buses

- EV public charging infrastructure segments

According to Vigneshwaran, S; Yeddula Bharath Simha Reddy (2019), Key players in the EV Industry

There are many companies who are manufacturing Electric Vehicles but there are some companies who dominate the market with their products. The key players in the EV industry are:

1. Tesla Inc.
2. BYD
3. Daimler AG
4. Volkswagen
5. Toyota
6. BMW
7. Nissan Motor Corporation
8. Ford Motor Company

Krishnadas, R; Renganathan, R. (2019) shares the list of top players in EV two wheeler market Leaders in India:

Name	Market Share	No. of Dealers In India	No. of Models
Hero Electric	36%	600+	10
Okinawa	17%	550	7
Ampere	14%	11	2
Ather	11%	15	2
Revolt	4%	11	2
Bajaj	4%	2	1
Benling	3%	52	4
TVS	2%	2	1

Source: Krishnadas, R; Renganathan, R, EV Two Wheeler Market Leaders in India, EES, Bristol

This study focuses on customer awareness and to promote the sales of electric vehicles. This research also provides information about the advantages of EVs and how the future generation is going to be driven by the electric vehicles. We will also be discussing about how to improve the infrastructure in India for construction of charging stations in various parts of the country.

To know more about customer awareness and to promote the sales of EVs we need to review some literature.

Consumer Awareness

Every new product in the market needs consumer awareness so as to educate the consumers about the needs, merits and demerits of the new product. If we talk about the Electric Vehicles then it has many advantages which the consumers must be aware of Consumer awareness and outreach [Lingzhi, Peter (2017)], to increase consumer awareness is a key part of supporting the growth in the early electric vehicle market. Stakeholders would ideally collaborate to leverage strengths and effectively utilize limited resources on electric vehicles awareness campaigns. Sustained programs that utilize a broad range of outreach and awareness actions are more likely to capture a wider audience of prospective electric vehicle consumers. Local context and resources can be important in assessing the feasibility and effectiveness of an electric vehicle consumer awareness program.

Consumer preference for electric vehicles [Liao, Molin, Eric, Bert (2017)], widespread adoption of electric vehicles may contribute to the alleviation of problems such as environmental pollution, global warming and oil dependency. The current market penetration is low in spite of the

government implementing so many policies to promote the sales. A categorization of influential factors for consumer preferences into groups such as socio economic variables, psychological factors, mobility condition, social influence, etc. is made and their effects are elaborated.

Consumer perception of electric vehicles in India [Omkar, Shweta, Arloph (2020)], with the depletion of fossil fuels and there is a need for another energy resource to run the vehicle. However, EV is a solution to this but considering the current market scenario market penetration on EV is low in spite of Government policies. So, consumers do not take EV as an emergency alternative and may become aware in future when there will be more hike in the fuel prices.

Charging station infrastructure for EV and its challenges for the Indian market [Praveen, Kalyan (2013)], India should go for small scale investments rather than going for an enormous change. Home charging should be encouraged and planning to control population and to build sufficient charging stations to promote the use of EVs.

Purchase intention of electric vehicles [Bhalla, Salamah, Afroze (2018)], choices of cars depends on environment concern, cost, comfort, trust, technology, social acceptance, and infrastructure availability. These factors have direct influence on the consumer's choice and the EV manufacturers and Government have to invest more on the social acceptance of the vehicle by creating infrastructure facilities, creating trust, and to make of population aware of the environmental benefits.

Research Methodology

The study is attempting to understand the strategies to promote E Vehicles in India. In India people are not so adaptive to changes and so it takes time for any new product or technology to capture the Indian market. EV vehicles are facing the same situation as there is a lack of charging infrastructure and the cost of vehicles is also high. Moreover, the distance limit is low and even it cannot carry heavy loads.

Objectives of the Study

1. To find out why people are not preferring electric vehicles more than an internal combustion engine vehicle or a fuel powered engine vehicle.
2. To identify the obstacles in development of infrastructure for EV in India.
3. To analyze how EV can reduce the daily expenses of the consumers.

4. To educate the Indian population about the new technology and its advantages in their daily life.
5. To analyze if the future of India will be driven by EV or not.

Sampling Design

A small sample of people is being taken from the population to determine the prospective of the people towards the electric vehicles.

The sample consists of people of all age groups, occupations, gender, and culture. So we can get the information about the trends in EV from all parts of India.

This technique has only one limitation that, the whole population cannot be taken into account and thus a small sample of population has been taken into account and the result might not be accurate.

Sampling Method: From the users of electric vehicles in India, a small sample has been taken by random sampling and an interpretation is being done to find out the satisfied and unsatisfied consumers and the key areas where improvement is required in the EV sector in India.

Sampling Size: The sample size chosen for this study is 100 users and non-users of electric vehicles

Sources of Data Collection

Primary data was collected from a sample of users of electric vehicles. The primary data was collected through questionnaire and by personal interview from the users. Person interview such as telephonic conversation, text messages and face to face conversations were most effective while collecting the data.

There has also been a showroom visit to get reviews on the TATA Nexon EV and some EV scooters so as to get the exact information.

Secondary Data was collected from

a. Industry profile
b. Journals
c. Internet
d. Literature reviews
e. Books

So, the secondary data is trusted and reliable but there has been some instances such as the burning of ola EV, which has been a threat to the consumers.

Data Analysis

Primary data is been collected from 80 users and non-users of electric vehicle through questionnaire method and the result thus obtained is being analyses by using statistical tools such as mean, median, standard deviation, and co-relation.

The data is also represented in the form of bar graphs, pie chart, and an analysis is being done to find the satisfied and unsatisfied consumers.

This method of analysis will give a deep understanding about the success of EV in India and the limitations which are yet to overcome for the smooth and regular running of EV industry.

Findings of the Study

From the study the most important thing that I would want to highlight is that people are willing to buy electric vehicles but some demerits of it are stopping them to buy one. Most common demerit in India is the charging infrastructure and the high prices of EV. Most people who use electric scooters or cars are from big cities and towns and have charging stations available nearby. But for some others who do not live in cities have serious problems in charging their vehicle and are unsatisfied with the service provided by the company.

According to Objective 1: To find out why people are not preferring electric vehicles more than an internal combustion engine vehicle or a fuel powered engine vehicle.

Finding: There are two main reasons why people are not preferring an EV.

The prices of EV are relatively higher than the fuel powered engines.

The price might not have been a problem if charging stations were available nearly. Most people do not prefer because of poor charging infrastructure.

Consumer Personality Factor

Personality of a consumer clearly determines what type of product he must be buying. Suppose a person who would be driving an Audi or a Mercedes would never prefer an Electric scooter but they may be interested in a Tesla or other expensive electric cars. Some consumers are very sure about what they want to buy and there are even some consumers who are uncertain about buying the product. So the best marketing strategy is to convert these uncertain consumers into potential customers. The innovativeness of a product

is a global measure which captures the degree to which consumers are willing to take chance and experiment with new ways of doing things are buying new innovative products from the market [Donthu and Gilliand, 1996].

Consumer Perception Factors

Perception means how a consumer thinks and chooses a product. It a mental process in which an individual selects data, information from the environment, organizes it and then draws meaning from it according to his/her lever of thinking. There are three things which drives a consumers perception, they are:-

Perceived Fit: It is an attitudinal behavior measure of how appropriate a certain channel of distribution is for a specific product. Morrison and Roberts (1998) found that the consumers perception of the fit between a product and a channel is very influential in determining that whether they will use that channel for a specific product or not. Perceived fit was found to be more important than consumers preferences for the distribution service.

After Sale Services and Infrastructure

A satisfied and satisfactory set of consumers is an asset for the industry. If we consider the EVs industry than it is very important for the seller to provide after sale services. The EV needs to be maintained and charged regularly for smooth functioning of the vehicle. Usually, there are 3 free servicing of the vehicle but some companies have now came up with new after sale services and they provide incentives in case of break down of the vehicle or in case of accidents.

Talking about the infrastructure, just like petrol and gas stations there need to be EV charging stations at least after every 60-100 km because the range of EVs is also less. Just like Japan where you can keep an uncharged cell in the charging station and take a newly charged cell just in a minute, India have to implement that for the smooth running of EVs. Moreover, EVs are light weight vehicles and needs smooth roads for proper working. It is not a offroad vehicle and has less power as compared to petrol vehicles. So, there will be severe breakdown in the vehicles if the roads are not good and will increase the expenses of the consumer.

It is not so easy to capture the Indian market with a new product like the EV. So to sustain in the market and to make profits companies must adopt the best techniques to attract consumers and make repeat sales. This is the only way companies can create a brand awareness and sustain in the long run. From the theoretical background of the study we can find that if a new company

wants to enter the EV industry in India then they must make the consumers aware of the product and then reach them with the best product which they prefer. Companies also need to look for the after sale services and infrastructure for smooth running The year 2022 has shown a remarkable hike in the prices of petrol and diesel. In just five years the petrol prices have increased by 30-35 rupees per liter. Moreover, petroleum is a non-renewable resource and with the increasing use of petrol the prices will also keep on increasing. Here comes the use of electric vehicles as they are powered by electricity and no petrol is used.

As we know people in India are ignorant about any new products in the market and they even do not trust the product so easily. So, it is very important to make the people aware of the uses and advantages of EVs. Only if a person knows the importance of a product and how he/she is going to use it they only they will prefer to buy that product. Many people are not able to afford fuel powered bikes because of the increasing prices of petrol and other financial conditions. So now if they are aware of the EV then they may prefer to buy it. Also new companies have came up with new EVs which can carry heavy loads on it and can travel longer distance.

If we are talking about the importance of EV then how can we forget the environmental pollution cased by the fuel powered vehicles. Burning of petrol and diesel causes air and sound pollution and even the small soot particles can cause serious damage if it enters the respiratory system.

On the other hand, it is said that the EVs are environment's best friend as they do not cause air pollution and even there is no sound pollution when the vehicle is running. In some parts of India like Delhi, Bangalore, Chennai, and some other populated cities people are not getting fresh air to breathe and new born babies are put into ventilators for proper functioning of the respiratory system, this needs to be controlled by minimum use of petrol vehicles and increasing use of EVs.

Last but not the least, the economy of our country will increase if we start using EVs. As we all know that India exports petroleum from foreign countries at a high price and after including all the taxes it becomes very expensive. So, if more people start using EV then the imports will decrease and the prices will start falling. We can use renewable sources of electricity like hydro, wind, or solar to run the EV. Hence, the economy will increase as the imports have decreased and domestic electricity consumption will also increase.

Show the analyzed data in tables/figures. Discuss the analysis using the research methodology you explained in the research methodology section.

According to Objective 2: To identify the obstacles in development of infrastructure for EV in India.

Finding: Foreign companies have not yet entered the Indian market and so the domestic companies are not taking an initiative to fix the infrastructure. On the other hand government is not even taking steps to develop it. Foreign companies would like to invest if they find that the infrastructure is good and they can earn profits. The roads are not suitable to drive an EV and there is no proper charging infrastructure. Most of the chargers are AC slow charging points.

According to Objective 3: To analyze how an EV can reduce the daily expenses of the consumers.

Finding: From the study above we find that all the consumers are well educated about the one time investment they are going to make on an EV rather than filling fuel everyday in the vehicle. But what stops them from buying an EV is the high replacement cost of an EV battery. The cost of the battery is almost half the total cost of the vehicle. Moreover, in India GST on EV is 5% and GST on electric battery is 18% and they are being sold separately by some sellers.

According to Objective 4: To analyze if the future of India will be driven by EV.

Finding: People have a lot of problems regarding buying an EV but the responses say something else. More than 90% of people are now willing to buy an electric scooter or a car because of the rising prices of petrol and other fossil fuels. Electricity can be generated from renewable sources and thus the cost will also be less than fuels. So, the future of India will be definitely driven by electric vehicles with proper charging and road infrastructure.

Suggestions

- Prices of fuels are regularly increasing day by day because it is the best source of tax collection for the government. So, it is better to reduce the use of petrol and increase the use of EV so as to save the daily costs.
- Most people do not prefer an EV because they believe that the government must develop the charging infrastructure for smooth running of the vehicle but it is actually the people who need to set up the infrastructure. We cannot be always dependent on the government for every small problem.
- Third, the prices of EV needs to be reduced so as to increase the sales.

There are two ways to reduce the price. One is by allowing foreign companies to manufacture in India and on the other hand the Indian companies can maximize their production so the cost per unit will reduce.

- Lastly and the most important is consumer education about the new technology and how it is saving their daily costs. Over 30% of Indian population is undereducated and unaware of the new trends in the market. Consumer education can be done by product promotion or by opening EV outlets in every town and city.

Conclusion

An EV or an electric vehicle is not a new trend in the market. It has been in the market since 2013 as you all would have heard the name of YoBike, India's first electric scooter. But no one felt the importance of EV at that time. It is now because the petrol price is over 110rupees per liter, people came to know about the importance of an electric scooter or car.

Though there are many companies now in the market but the people have other problems related to charging infrastructure and the cost of electric cells required to run an EV. All the problems cannot be solved at a time but simultaneously as the use of EV will increase there will be charging stations at all petrol pumps. Moreover, highspeed chargers are also being installed now in some cities which can charge a vehicle up to 50% in just 10 minutes. These developments will surely increase the sales.

The trend is now changing, from digital products to automatic products and electric cars are made for the comfort and luxury of the consumers. Manufacturers keep in mind the taste and comfort of their customers while manufacturing a car. The Government has also said that by 2030, 35% of the Indian population will be driving and EV. So, with some infrastructural developments and by liberalizing foreign companies we can say that the future of India will be driven by electric vehicles.

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Chapter - 12

Study on Impact of COVID-19 on Tourism Industry in Reference to Bengaluru (Bangalore) City

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Abstract

Covid-19, a virus that causes colds and influenza on occasion, was previously known as severe acute respiratory syndrome (SARS) and Middle Eastern Respiratory Syndrome (MERS) (MERS). This was first discovered in Wuhan, China, and was thought to be spread by bats. The WHO declared the flare up a Public Health Emergency of International Concern on January 30, 2020. Lockdown and self-seclusion were the easy methods identified for controlling the transmission of the pathogen and breaking the chain of global advancement. In India, something similar happened, and the country was put on lockdown. As a result of the lockdown, the economy of the country was severely harmed, as cash distribution was halted. The travel sector, as well as neighborliness, were both affected. The purpose of this investigation was to investigate India's pandemic situation and its implications for the tourist industry, hospitality, and food services. The study has produced recommendations to help overcome the 6 pandemic-related financial emergency, which the country is currently in the initial stage.

Introduction

Tourism refers to people travelling to and staying in places outside of their typical surroundings for less than a year for leisure, business, or other reasons. A foreign tourist was defined by the League of Nations in 1936 as "someone visiting abroad for at least twenty-four hours." The United Nations, which succeeded it, changed this term in 1945, adding a six-month maximum stay. In its Recommendations on Tourism Statistics from 1994, the United Nations established three types of tourism.

- Tourism inside the country
- Tourism from outside the country
- Tourism in other countries.

The Indian economy is regarded as one of the most important components, with three distinct sectors such as agriculture, industry, and service. Tourism and hospitality sectors bring wealth and fortunes to cities and countries around the world. Locals are employed in tourism and hospitality as well. India has recognized the profit potential in these industries. Every year, the Indian tourism and hospitality industry brings in billions of dollars. When viewed in this light, the latest corona virus outbreak has caused havoc around the world. This paper will collect historical data post-pandemic, compare it to the current crisis, and forecast the future status of the virus's impact on the Indian tourism industry and hospitality flows. The COVID-19 pandemic has created a compact and prostrate storm in the tourism and hospitality sectors, especially with the sudden decision by the authority administration to suspend all entry permits, with the profit-making impact estimated to be thousands of rupees. In the world of irresistible illnesses, an overall flare-up could be the most disastrous outcome imaginable. After globalization, the entire world has become one family, and the market today is extremely serious and dependent on the work of various businesses to encourage its development. The travel industry, which is one of the largest and fastest growing, has been regarded as a resilient industry. Unlike other industries, the travel industry is more influenced by any internal or external shocks or pain. As a result, the most recent episode of Covid-19 has caused consternation around the world.

Survey of Existing Literature

WTTC (2020): The tourist business, which is a labor-intensive industry, is a major source of employment around the world. Accommodation, transportation, food and beverages, retail and culture, hospitality, and sports are all supporting industries in tourism. A country's tourist sector provides benefits and possibilities for its citizens. The tourism industry is part of the economy's service sector, which has its own distinct characteristics.

UNCTAD (2020): Shretta and Ahikul Due to the paucity of evidence, the influence of COVID-19 on economic development will be explored. There are many studies on the negative growth of economies caused by pandemic outbreaks, so the current literature is desperately needed to assess the corona virus's impact on the tourism business.

Somaliland (2020): Many businesses and retailers have been forced to close because of the COVID-19 epidemic, causing an unanticipated

interruption in various industry sectors. Short-term difficulties confront retailers and brands, including those relating to health and safety, supply chain, workforce, cash flow, consumer demand, sales, and marketing. Electricity from a private source. Because they are reliant on gasoline imports from other nations, businesses have increased the cost of their bills. As a result, price adjustments in all service sectors have significant implications for all Somaliland's business sectors.

Stephens (2020): Impact of COVID-19 on public health, coronavirus disease the year 2019 has thrown the economy into disarray. Just a few weeks after the outbreak, the pandemic had already caused 23 major disruption among small enterprises; around 25% of businesses had temporarily closed, and all of these closures were related to COVID-19. Business owners have been surprised by issues such as unpredictable business operations, labor practices, and financial constraints on companies with uncertain futures.

Fairlie, (2020): Various well-known brands in many industries are going to go bankrupt if consumers stay at home and economies shut down because of the COVID-19 (McKee & Tucker, 2020). This is not only affecting the economy; it is affecting the entire society, which has resulted in significant changes in how firms and customers behave. The only exception was agriculture, which saw a significant reduction in the number of business owners. Due to COVID-19, the construction, restaurant, hotel, and transportation industries all saw a significant drop in the number of business owners.

2020 (OECD): The COVID-19 pandemic has thrown the international economy into disarray. It was even worse than the worldwide economic disaster in 2020. The economic toll is rising in all countries, as the number of new infections rises, and control measures are implemented. The world economy is expected to collapse by 3% in 2020 because of the pandemic, even worse than during the 2008- 09 budgetary crisis. The tourism industry alone is expected to see a 70 percent drop in productivity.

Somaliland's Central Bank, (2020): COVID-19 is having a rising impact on Somaliland's economy, albeit the immediate impact is more short-term, and the medium and long-term impact is still uncertain.

Research Methodology

This paper combined a review of the literature with secondary data from India's tourist sectors. Documentary examination of several government and global websites, as well as ministry of tourism websites, was part of the research. The World Trade Organization (WTO), the World Health

Organization (WHO), and the World Meter global pages all detailed how the worst pandemic outbreak scenario could play out. The goal of the research was to figure out the worst of India's pandemic scenario and how it affects the country's tourist and hospitality industries. The study's goal is to determine the impact of the pandemic on the country's tourism and hospitality industries, as well as to assess the state of Bangalore's food-related economy. In addition, recommendations for overcoming the effect are presented. This investigation is a descriptive study that uses quantitative methodology to depict the existing situation. Basic arbitrary examining for likelihood testing. Information was gathered through various procedures, which included disseminating online polls (Google Forms) and WhatsApp broadcast messaging to reach a total of fifty respondents. Examining quantitative data in a straightforward manner.

Findings

Most overall responders are between the ages of 18 and 24, and they travel more. According to the study, most respondents who are interested in travelling are females. In terms of the total number of responders, the majority are students who want to travel more. Another survey conclusion is that most respondents like to travel more. According to the data analyzed, most respondents want to travel more to national destinations. Most respondents stated that they would travel every three months and appreciate their freedom. Most respondents feel that safety precautions are necessary in tourist areas. According to the research, most of them prefer to go by four-wheeler. According to the responses, the tourism industry has been hit the most. Most respondents said they would use travel agents to create their own destination. At tourist destinations, all essential actions should be taken, including sanitation, social separation, and penalties for violating the COVID protocol. The majority of responders agree that carrying a negative covid certificate while travelling is necessary. Many respondents believe that the government should give a covid relief fund to compensate for the loss of the tourism business. The majority of respondents believe that the government should establish strong sanitary standards that include all restrictions. 50. According to the statistics gathered, the hotel industry was harmed by the epidemic and suffered losses. The majority of respondents said they would travel more if they could obtain more deals and discounts. According to the statistics gathered, the hotel industry was harmed by the epidemic and suffered losses. The majority of respondents said they would travel more if they had more opportunities and discounts. As a result of the analysis, customers are more likely to visit tourism destinations if all COVID protocols are followed. As a result of the epidemic, many employees lost their jobs, resulting in unemployment.

Conclusion

COVID-19's spread has had a significant impact on the tourism industry, which may continue for some time. In March 2020, the number of international tourists arriving in India from various regions of the world decreased by 68 percent compared to the previous month. Tourism generates a significant amount of impaction money in the form of fees. A proper forecasting model can aid strategic and operational decision-making. As a result, this study used the ANN model to forecast the number of foreign tourists in the event of a COVID-19 epidemic. The FEE has also been calculated based on the number of visitors and exchange rates. In addition, four distinct scenarios were created to analyze COVID-19's impact, and the impact was quantified by predicting FEE. We present three innovative ideas as well as three contributions in this work. For starters, a novel technique is used to explain the mutual interaction between the COVID-19 epidemic and the tourism industry. Second, an enriching contribution is made by using the number of foreign tourists and exchange rates (monthly data) as an input to the ANN model to estimate foreign tourist arrivals and FEE. Finally, a decision has been proposed for the tourism industry's many players to assist in the recovery of the sector from its current state, which is highly unusual. As a result, the findings in this article will aid stakeholders and policymakers in facilitating strategic and operational planning based on predicted value. According to the study, FEE has decreased as a result of fewer foreign tourists arriving during this pandemic outbreak. As a result, rather than investing more in added resources, governments and stakeholders should consider how to make existing resources more efficient and effective.

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Chapter - 13

A Study of Service Operations in Royal Enfield with Special Reference to Thrissur District

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Abstract

This study discusses about automobile industry. Basically, the study is done on Royal Enfield. The data was collected from Thrissur district for conducting this study. The study focuses on customer satisfaction related to Royal Enfield based on the data collection done from Thrissur district situated in Chennai. The study suggestion that customer satisfaction is important for growth of any business. Therefore, it can be concluded that due to quality of the bike people prefer Royal Enfield. This suggest that customer satisfaction depends upon quality.

Introduction

Although ancient Chinese writers has described steam-powered vehicles, and both steam- and electric-powered cars competed with gas-powered vehicles in the late 19th century. Frenchman Jean Joseph Etienne developed the first practical internal combustion engine in 1860, and later in the decade several inventors, most notably Karl Benz and Gottlieb Daimler, produced gas-powered vehicles that ultimately dominated the industry because they were lighter and less expensive to build. French companies set the design of the modern auto by placing the engine over the front axle in the 1890s and U.S. manufacturers made important advances in the mass production of the auto by introducing cars with interchangeable machine-produced parts.

The automobile industry, now a hundred years old, is often regarded as the main engine of industrial growth of the 20th century. Its effects on urban life and the environment are evident everywhere. The industry is a complex and everchanging system of manufacturing, sub- contractors and alliances;

and together, both suppliers and assemblers are a principal source of wealth and employment in the industrialized economies. Its production techniques, and in particular the assembly line, have had a profound influence on the organization and technology of other industries and services. The transformation, at the beginning of this century, from craft production to mass production, heralded an explosion of manufacturing capacity which has had a pervasive effect on all aspects of human activity. Today's automobile, contains over 12,000 separate parts sourced from a highly competitive and diverse range of suppliers. The automobile industry remains an important and dynamic sector, even though it has now been displaced by the electronics industry as the largest and fastest growing major industrial sector.

In 1909 Royal Enfield surprised the motorcycling world by introducing a small Motorcycle with a 2 HP V twin Motosacoche engine or Swiss origin. In 1911 the next model was powered by a 2 HP engine and boasted of the well-known Enfield 2-speed gear. In 1912, came the JAP 6 HP 770 CC V twin with a sidecar combination. It was this motorcycle which made Enfield a household name. Royal Enfield supplied large numbers of motorcycles to the British War Department and also won a motorcycle contract for the Imperial Russian Government. During World War II, like other manufacturers of that time Royal Enfield was also called upon by the British authorities to develop and manufacture military motorcycles. The models produced for the military were the WD/C 350 cc SV, WD/CO 350 cc OHV, WO/D 250 cc SV, WD/G 350 cc OHV and WD/L 570 cc SV. One of the most well-known Enfield was the Royal Enfield WD/RE, known as the Flying Flea, a lightweight 125 cc motorcycle designed to be dropped by parachute with airborne troops. After the war the factory continued manufacturing the models developed during the war and the legendary J 2 model appeared which went on to be the ancestor of the legendary Bullet. The same motorcycle which perhaps had the honour of the being the one with the longest production run in the world.

In India in 1955 the Indian government needed a solid and reliable motorcycle for its police and army, in particular to patrol the rugged border highways. The bullet was chosen as the most suitable bike for the job. The Indian government ordered 800 of the 350cc models beyond the company's ability to fill at the time. With more orders from India looming, the company sold its design to Enfield India, a subsidiary firm in madras, India to start manufacturing them. Between 1956 and 1960, the bullet was released in several models, including a 350cc trials "works replica" version and a 350cc "clipper" model. Technically the engines and power trains were the same (except for bore size) and the only differences were in exhaust, seating, and

instrumentation. Handle bars and gas tank. The bullet is now fully manufactured in India under the license, at Anna Salai; near Chennai. The tooling equipment was also sold to make the 350cc bullet in India in 1958. Later the Indian firm upgraded to make the 500cc model as well. In late 1995, the Indian firm finally acquired the name Royal Enfield as their own. In 1990, Enfield India entered into a strategic alliance with the Eicher Group, and later merged with it in 1994. It was during this merger that the name Enfield India changed to Royal Enfield. The Eicher Group is one of India's leading automotive groups with diversified interests in the manufacture of Tractors, Commercial Vehicles, Automotive Gears, Exports, Garments, Management Consultancy and Motorcycles. Since then, the Company has made considerable investments in modernizing its manufacturing technology and systems.

To manufacture quality bikes that are well known worldwide for their reliability and toughness state-of-the-art infrastructure is required, and that is just what Royal Enfield has done at their Chennai manufacturing facility. An active in-house Research & Development wing is constantly at work to meet changing customer preferences and the challenges of Indian and International environment standards. When introducing a new product, this team undertakes all related planning which includes a rigorous customer contact program, design, concurrent engineering and testing processes. Continuous rigorous testing of motorcycles and components is carried out in the Product Development testing lab to come up with more improvements in enhancing the customer experience. You can feel the pulse of your customers, only if you get close to them. This thought process has driven Royal Enfield to set up has a wide network of 11 Brand Stores, 180 dealers in all major cities and towns, and over 100 Authorized Service Centre. The Company also exports motorcycles to 42 countries like the USA, Japan, UAE, Korea, Bahrain, UK, France, Germany, Argentina and many other countries through 40 importers and over 300 dealers across the globe.

Literature Review

Boulding *et al*. (1993) stated another perspective of customer satisfaction, which deals with the difference between transaction specific and cumulative customer satisfaction. Customer satisfaction is viewed as a post-purchase evaluative judgment of a specific purchase occasion according to transaction-specific perspective. Cumulative customer satisfaction is an overall evaluation based on the total purchase and consumption experience with goods or service over tome. Similarly, Kotler & Armstrong (1993) stated that consumer/customer satisfaction is determined by the relationship between the

customer's expectations and product's perceived performance. Furse *et al*. (1994) refers, "Satisfaction as the measurement of one or more variety of customer opinions including ratings of service quality, 'future behavioural intentions, customer's self-assessment of outcome and satisfaction?" While, Bitner *et al*. (1996) defined, satisfaction as the customers evaluation of a product or service in terms of whether that product or service has met their needs and expectations. According to Hung (1997)", satisfaction is a kind of stepping way from an experience and evaluating it One could have a pleasurable, it wasn't as pleasurable, as it was supposed to be. So, satisfaction/dissatisfaction isn't an emotion, it's the valuation of the emotion". On the other hand, Oliver (1999) defined, "Satisfaction as pleasurable fulfillment. Satisfaction is the customer's sense that consumption provides outcomes against a standard of pleasure versus displeasure. It is judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption related fulfillment."

In addition to this, Hancock *et al*. (2011) described two factors that lead to drivers failing to detect motorcyclists in the first place: sensory conspicuous (the physical qualities of the approaching vehicle that distinguish it from its background) and cognitive conspicuity (the degree to which the observer's experience or intentions affects the salience of the approaching vehicle). Motorcycles have poor sensory conspicuity (due to the smaller size of the motorcycle) but they also have poor cognitive conspicuity (they are less frequent and hence less expected than cars). However,

Broughton (2013) found that this significantly overestimated the number of active motorcyclists since large proportions of those with licenses do not ride regularly. A better measure of the number of active motorcyclists therefore is the number of motorcycles licensed, as discussed in the previous section. One significant drawback of this measure is that no demographic information of the motorcyclists (age, sex, area, etc.) is available. Another problem of this measure is that some owners fail to license their vehicle to avoid paying Vehicle Excise Duty and some owners may own more than one bike. This information is invaluable in linking the motorcyclist demographics, motorcycle information (such as engine size) with motorcycle use. This study is limited to the small sample of the respondents who ride motorcycles (in line with the small number of active motorcyclists). To get the necessary level of details, several years of data has to be aggregated and thus mask changes over time (Elliott *et al*., 2003).

Research Objectives

- To understand the attitude of the consumers towards the Royal Enfield bikes and also to understand the buyer behavior.
- To study the customer satisfaction of Royal Enfield.
- To give suitable conclusions and recommendations for findings

Research Methodology

The study was carried out through survey method. It was a cross-sectional study. Fieldwork was carried out in order to collect the data. Data was collected through questionnaire and interview with consumers. The sampling techniques used for the purpose of this project report were convenience sampling, which is non probability sampling. Sample size of 100 individuals was chosen for the study. Collection of data was done by the help of primary data, secondary data and field work for knowing in detail about customer satisfaction and their attitude. Tools used for analysis were percentage, table and graph. The research was confined to Thrissur city only and the sample size of respondents were limited to 100 are the limitation of this study.

Results

The study has shown that businessman and the students are the crunch followed by the professionals. The Royal Enfield is having a young appeal as the 62% of the consumers are found to be below the age group of 20-30 years followed by 30-50 years. Also, it is placing their products in the appropriate price range and as the people of this income bracket less than 3,60,000-7,20,000 can easily afford this Bike. Customers are not attracted to only one particular model due to the variants available and because the Thunderbird 500/350 is the newly released models they are fast moving now. Majority of the customers directly chose Royal Enfield as their bike and didn't even have a look at the nearest alternative bike and this shows the loyalty of the customers towards the brand Royal Enfield. Advertisements are rarely recalled and are highly ineffective amongst non- Bullet riders. It's clear that Royal Enfield should concentrate on its advertising campaign to reach the customers. It clearly shows that mileage of the Royal Enfield bikes is economical and mileage between 35 and 40 that too on Indian roads with heavy traffic is a great deal. It is clear that majority of the respondents are satisfied with spare parts availability and we can say that Royal Enfield has good distribution channel for spare parts in the city. It is clear that majority of the people who choose Royal Enfield as their bike doesn't have any problems or issues with their bike's performance.

Conclusion

The study has helped Royal Enfield dealers to understand whether the customers are satisfied or not. If not, what are main reasons for dissatisfaction of customer towards the dealer and what are the ways of improving the satisfaction level of customer towards dealer. We can conclude younger generation and middle age are more interested in Royal Enfield, the buying behavior is governed predominantly by the need for Power and respect for the iconic Brand and users are mostly Professional Males, 20-35 years of age, including some students. Most of the customers are attracted to newly released Classic 350/500, also customers are easily affording the price of Royal En field bikes and customers are very loyal towards the brand Royal Enfield. It should concentrate on its advertising campaign to reach the customers; mileage of the Royal Enfield bikes is very economical and most of them prefer to buy their bike brand new from showroom with the spare parts available in market easily. It has an excellent satisfaction level within the customer for its power, pick up, comfort, safety and with after sales service.

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Chapter - 14

A Study on Brand Awareness of Indian Batteries

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Abstract

The study of brand awareness is essential in marketing planning. Customer needs and preferences keep changing were brands ultimately command customer's loyalty. The realistic side of the problem is to know the acceptance level of the brand awareness towards the product. This study will help us to understand the brand awareness, the problems faced by the consumers, the appropriate measures to be taken to solve the problems.

1. Introduction

Indian battery market the domestic storage battery market (Organized sector) is estimated at about Rs. 65 billion at current lead prices, comprising industrial batteries (Rs. 32billion) and automotive batteries (Rs. 33 billion) businesses. Moreover, the unorganized sector is estimated at Rs. 20 billion. The automotive battery business accounts for about 55% of sales value, while the industrial battery business accounts for the remaining 45%. The automotive battery business can be further divided into the OEM and aftermarket sectors. Demand for automotive batteries largely depends on the growth of automobile OEMs and the aftermarket. During the year under review, the automotive batteries market grew about 30% in OEM and about 10% in their placement market. The OEM and replacement markets are expected to experience about 18% growth in the segment OEM and 11% in the aftermarket segment in 2010-11. The growth in the industrial batteries business is driven by infrastructure and technology related industries such as telecommunications, UPS and power. VRLA technology caters to 75% of the industrial storage battery market. The ongoing slowdown in telecom impacted the off take and price of VRLA batteries, after healthy growth in the recent

three four years. The market UPS batteries is expected to grow about 20% in 2022 aided by a reviving momentum in the services sector and e initiatives of the Government (s) of India. A few Indian majors have already established facilities outside looking at the potential and acceptability in those markets. Coupled with recessionary trends in the domestic market, it is but natural that this trend would continue and would contribute further to sales of Indian batteries manufacturers in the coming years, at present, exports from India are mainly to US and SAARC nations. The US alone contributes to over 60 percent of the total exports in volume terms, 35 per cent exports go to the SAARC countries with the balance going to South East Asia and Africa. Indian manufacturers are now eyeing the European market which is today a large battery marketer in the world. The market size for batteries is expected to reach $ 86.6 billion by 2023. The industry is boosted by growing demand of battery in consumer electronic products and automotive vehicles. Trends are favorable for participation by all players.

Brand awareness is important because it is the very first step in the marketing funnel, and a crucial foundation to eventually acquire customers. Brand awareness refers to people's ability to recall and recognize your business. There are several reasons why it is important to build and increase brand awareness. To start, brand awareness helps keep your brand top-of-mind with your audience. If people know your brand, they can become familiar and comfortable with it. Then, when faced with a decision to buy from you or your competitor, they are more likely to buy from you. Brand awareness also helps you to achieve a range of business objectives and goals. It can expand your audience, increase website traffic, build brand affinity, and cultivate leads. It will be no surprise to learn that brand awareness lies at the top of the marketing funnel. Brand-awareness campaigns cast a wide net. They let many people know about what you have to offer, and nurture those who are most interested in it and leads to trust, meaning the more recognition our brand has, the more successful your brand or business will be.

2. Literature Review

Huang, R., & Sarigollu, E. (2014) Joining review information with genuine market information, this paper explores brand awareness, which identifies with buyer practices and welfare, from three points of view. To begin with, it inspects the connection between brand awareness and market outcome. Second, it investigates the connection between brand awareness and brand value. Lastly, it researches the impacts of marketing mix components on brand awareness.

Rossiter, J (2014) Writing in the first absolute issue of this journal was proposed by present author an extensive model of 'branding', an managerial procedure that requires the marketer to set up, in the consumer's brain, two basic correspondence impacts: brand awareness and afterward brand mentality. In the present article, he extends this model from two-three sorts of brand awareness and from three to now five dimensions of brand frame of mind also, he explains the most effectively measure both of these fundamental parts of branding.

Gui, R.I. (2015). Product advancement is the mechanism by which brands develop, which means category and line expansions. It's by line extension comprehended another item launched in a similar product class, under a same name, while the extension of brand is an absolutely new product in an alternate item classification.

3. Objective of The Study

- To research whether Brand awareness in Branded Battery's affects the sales or helps the Retailer in making a sale.
- To conduct study on consciousness of buying behavior of Brand "TATA GREEN BATTERIES"
- To identify and understand brand building techniques/ strategies used by TATA GREEN BATTERIES.
- To research and see which Brand is ahead in "Top-of-the-Mind Awareness" among branded batteries in Bellary.
- To know the consumer attitude and demand towards the brand Tata green batteries.
- To find the effectiveness of advertisement in developing the brand
- To know the consumers reaction towards brand Tata green batteries in respect of price, maintenance, service etc.

4. Research Methodology

This study is said to be of descriptive nature because the study aims to describe the characteristics of consumers as well as to determine the perceptions of product characteristics.

The approach used in the study is survey method. Research approach includes surveys through structured questionnaires. Sampling method used in this research is simple random sampling. Here the sample size taken for the study is 50 respondents in Bellary city. The data collected has been tabulated and the percentage of respondents of each factor has been calculated using

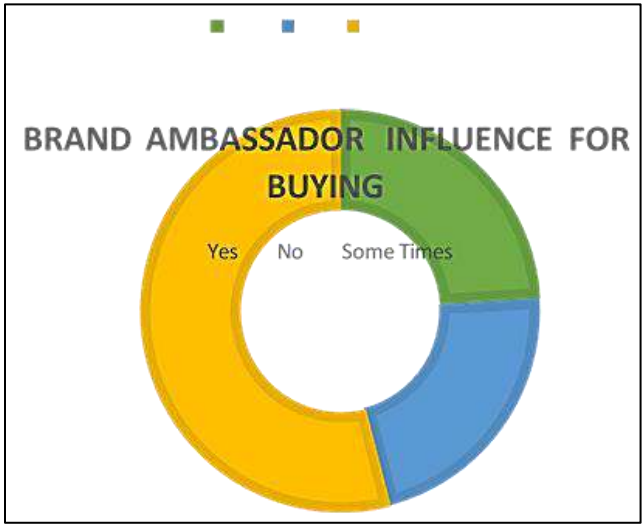
tally mark operation. Data collected has been converted into quantitative figure. The percentage of analysis has been done to draw the conclusion.

Table 4.1: Show the age of the respondents.

No. of Respondents	Frequency	Percentage
18-20	14	28
20-30	20	40
30-45	8	16
45-above	8	16

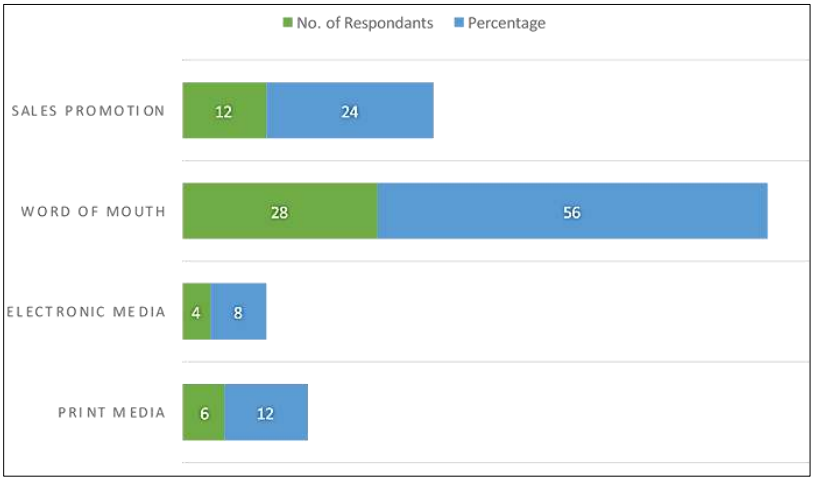
Table 4.2: Shows the occupation of the respondents.

Occupation	No. of Respondents	Percentage
Students	19	38
Working Employees	22	44
Farmers	7	14
Others	2	4



Graph 4.1: Brand ambassadors influence your buying decisions.

From the above graph we can say that out of 50, 24% of the respondents influence the brand ambassadors in buying decisions, 22% of the respondents are not influence the brand ambassadors in buying decisions and 54% of the respondents sometimes may influence the brand ambassadors in buying decisions. The $1/2^{th}$ respondents show that they are influenced by the brand ambassador some times, and only few are influenced by brand ambassador for buying decision.



Graph 4.4: The medium of communication that influences Brand Awareness.

From the above table we can say that out of 50, 12% of the respondents are came to think about the brand through print media, 28% through electronic media, 40% through word of mouth, and 20% through sales promotion. Hence the medium of communication that influences brand awareness is word of mouth as major factor, and Sales promotion as send major factor for brand awareness.

5. Findings

- Some of the respondents purchase behavior are influenced by brand ambassador of the product.
- Majority of the customers show that they are not loyal towards the products they buy.
- It has also known that majority of the products are easily available in the market that make easy purchase decision.
- Since the majority of respondents are workers that leads 70% of respondents to become price sensitive customers.
- The majority of respondents known are having faith in brands that they prefer.
- Nearly 80% of the customers are satisfied with the after sales service delivered by dealer.
- The majority of respondents come to known about the brand through word of mouth and sales promotion.
- The majority of respondents have enough trust regards to its quality, service, and price and for its brand.

- The product is easily available, so the respondents didn't find any issues while going for purchase.
- The majority of the respondents have satisfied towards the Tata Green Batteries.
- The majority of the respondents are satisfied with the cost of the Tata Green Batteries.

6. Conclusion

The present study is done on Brand Awareness of Tata Green Batteries, Bellary. The main objective of the study is to understand the brand awareness of Tata Green Batteries with special reference to all types of batteries from Bellary. From the study it has been found that the respondents who were aware of Tata Green batteries were satisfied with the brand because of its brand availability and after sales service, while some of them were rejecting the Tata Green Batteries because of the less Marketing and no recall of brand by any means like brand ambassador etc. as compared that of its competitors. Some of the customers were not willing to comment on to some queries due to lack of brand existence. A large number of the customers expressed the satisfaction level to average on overall experience and after sales services. Company provides adequate training to the employees, during the time of initial placement and should work on marketing to create brand image so that the customers could recall easily and also Monthly review system and feedback from distributing will help to know more about customer's expectation.

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Chapter - 15

A Study on Effectiveness of Online Promotional Strategies for Fashion Wear Category with Reference to Bengaluru

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Abstract

The study focusses on the online promotional strategies adopted by the online stores to promote fashion accessories.

1. Introduction

In this age, conventional advertising and marketing is fading away with the penetration of on-line advertising and marketing, which has unfolded many distinctive branches consisting of social media, blogs, chat boards and widespread hassle capturing boards. And when it comes to fashion industry customers are racing towards online platform to make purchases as today online market offer wide variety of options for them which is not available in the normal traditional markets, and they come up many unique promotional strategies to hold the customers under their brand or platform and these promotional strategies are increasing the retention ratio among the customers. They come up with many promotional strategies like email marketing, pop up advertising on any random websites and attractive display of their offers on their home page of their websites or the apps. In addition, they are placing seasonal sales, which literally be like a festival for shopping. Today most of the population are on into social media and are proactive online and this makes online advertising more effective than any other mass media. And when we look into fashion today's generation are more concerned about how they look and they tend to be identified by their outer appearance and this boost their self-confidence and to this reason they never compromise on the clothes and fashion accessories they were and they tend to shop from the place they are and this becomes an opportunity for the online fashion industry and they must

come up with most unique promotional strategies to promote themselves and to place themselves in the customers mind.

2. Literature Review

Alfa Henson, (2018) Nigeria, determined the relationship between online artist advertising and consumer buying behaviour off cadets this was the main objective of the study. This study was conducted through questionnaires and the question it was handed over to the cadets to answer them. The research method, which was used, was survey research design. Total number of respondents were 1486 who were the cadets in Nigeria police Academy. The finding of this research was either private organisation or government should try as much as possible to include a reasonable portion of their budget for online advertisement to have a competitive edge. The research was concluded by saying most of the people search products information on the web, more readers actively seek out Internet advertising sites. Because Internet has become the most effective medium of advertising, by which people find this the fastest medium to get the information globally.

Chaudhary S, Sharma R (2018) studied the impact of ecommerce on modern fashionable business. In this research only secondary source of data has been used and conclusion has been derived from this basis. Through this research we can see that digital environment are social media being on top of the society because people are able to display, share, comment and revolutionise the fashion trends of the people because it is one of the most influential media. We can conclude through this research that transformation from traditional marketing to digital marketing environment the Marketers with right attitude, skills and behaviour should capitalise the information and the ultimate focus of achieving a loyal customer in the competitive world.

Khandare A U, Suryawanshi P B, (2016) the main objective of this study was to determine effectiveness of the Internet advertising on consumer buying behavior. In this research descriptor type of research method was used. Questionnaires were given to the respondents, primary data was collected for secondary data Internet journal, and business magazines were used. Total number of respondents were 100. Through this research it is found that approximately 40% of the respondents argued that they purchased advertised goods to a certain extent but 31% of them say it's rare and 9% of the respondents do agree that they really purchase the product after seeing the advertisement and 20% of them say it's really uncommon. The study concludes buying saying that Internet advertising influenced purchase decision of the consumer play moderate extent because only a nearly half of the respondents were influenced by Internet advertising.

3. Research Methodology

100 respondents were selected using simple random sampling method to collect the data using questionnaires. Descriptive statistics was used to analyse the data.

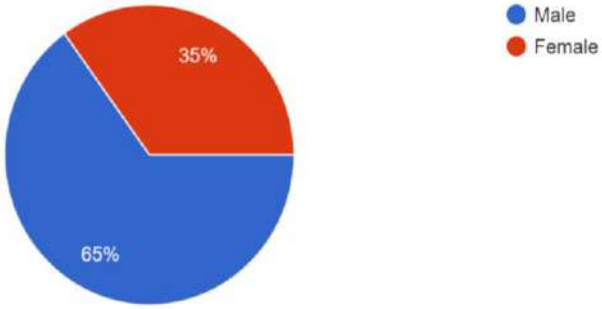

Fig 1: Gender distribution of respondents

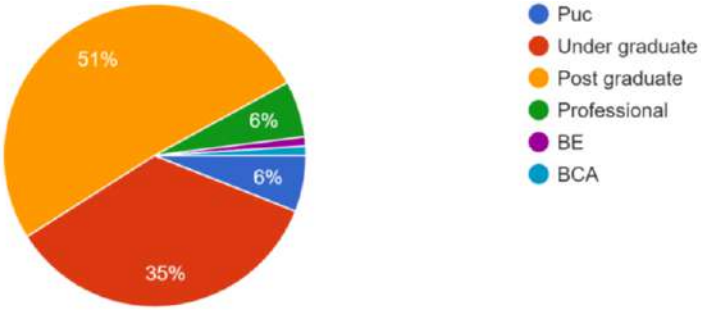

Fig 2: Educational qualification of respondents

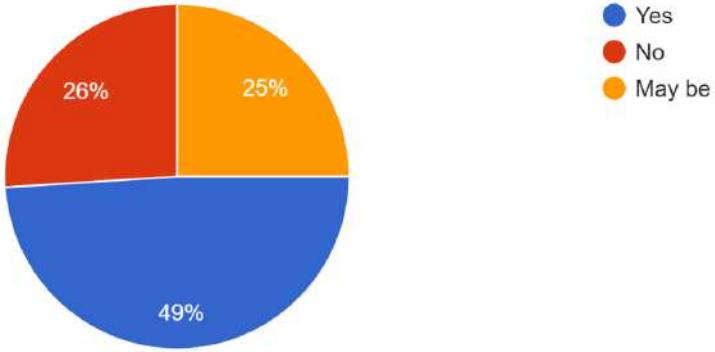

Fig 3: Frequently buy Fashion accessories

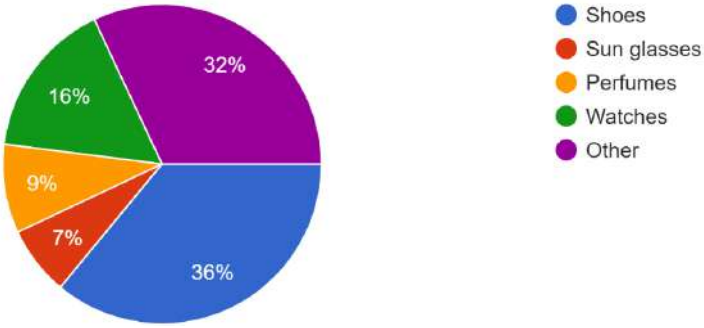

Fig 4: Type of Fashion Accessories purchased

4. Findings

- From the study it is found that male is the highest number of respondents, who contributes to 65% of the total respondents.
- From the study it is found that 94% of the respondents are aged between 20-30 who are the highest, most of the respondents fall in the age group of 20-30 and this group is the group of people who are much into fashion accessories and they follow new trends and they are most active on internet.
- From the study it is found that highest number of respondents i.e, 51% of the respondents buy fashion accessories occasionally, from this we can see that most the respondents buy fashion accessories at least once in a while.
- From the study it is found that 60% of the respondents feel promotion offers on fashion accessories makes them to buy. This shows that promotions have significant effect on buying behavior of the respondents.
- From the study it is found that 75% of the people are aware of Amazon, 71% of people are aware of Flipkart, 56% of the respondents are aware of Myntra, 47% of the people are aware of Ajio, 29% of the people are aware of Snapdeal, 25% of the people are aware of Lime Road, 22% of the people are aware of eBay, 18% of the people are aware of Koovs. Amazon is the most known website among the respondents.
- From the study it is found that majority of the respondents i.e., 45% of the respondents feel social media as the most important source of information. Social media is the most effective media for information among the respondents.

- From the study it is found that 62% of the respondents agree that promotion placed on fashion accessories makes it more attractive.

5. Conclusion

A study on effectiveness of online promotional strategies for fashion wear category was carried out to find that how online promotions affect the buying behaviour of the customer. From the collected data we can see that most of the respondents are favour online advertisements and social media being their priority. And they find them most interesting and attractive. In this modern world almost, everyone owns a smart phone and in India after the introduction of Jio internet usage has been increased and almost every youth are into social media, are active on these sites, and are most influenced by the promotions that are placed on these sites and pages and it is seen that from the data the most preferred type of promotions are discount sales. And today's world, fashion has become a style statement and are very adaptive to new trends which are influenced by the online virtual world.

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Chapter - 16

Study Mathematical Modeling Using Fractional Calculus

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Abstract

Applications or models of mathematics using fractional calculus may be termed as mathematical modeling using fractional calculus. Applications of Fractional Calculus are found in all most all field of sciences such as in physics, chemistry, Economics, engineering, control theory, computers, bioengineering etc. It is due to possibilities of fractional calculus in modeling of various problems. In this paper we study some mathematical modeling using fractional calculus.

Keyword*:* Mittag-Leffler function, Fractional Calculus, Integral Transform, Laplace Transform.

1. Introduction

Fractional calculus is the generalization of derivatives and integrals from integer order to arbitrary order. While developing the study of classical calculus i.e. differential calculus and integral calculus question may arise that 'what will be fractional order derivative and fractional order integrals?' but the written proof to this question was found in communication letters between great mathematicians L'Hospital and Leibnitz on 30th September 1695. Later on all mathematicians named the study of derivative and integrals of arbitrary order (real or complex) as fractional calculus. Throughout history of fractional calculus, number of approaches are observed such as Lacorix approach, Riemann approach, Grunwald approach, Liouville approach, Caupto approach, Wely approach, Letnikov approach, Grunwald-Letnikov approach, Riemann-Liouville approach and many more. In all most all approaches it is found that special functions such as Gamma function, Beta function, Mittag Leffler function etc. plays important role in developing and finding solution to problems of fractional calculus. Integral transform specially Laplace transform, Mellin transform, Sumdu transform etc. are extended to get solution to fractional differential equations.

Fractional calculus is the most applicable branch of mathematics; it is applicable in life sciences, in physical sciences, chemical sciences as well as applicable in real life problems.

In brief historical development, different definitions, special functions which are useful in development of fractional calculus, extended integral transform useful to obtain solution to fractional differential equations and number of application of fractional calculus are found . In this paper we study some real life applications of fractional calculus. This paper is divided in seven parts Introduction, Some special functions, definitions of some fractional calculus, some integral transforms, main portion is study of some mathematical models (real life applications) of fractional calculus, conclusion and list of references used to prepare this paper.

2. Some special functions:

i. Gamma function: Euler's gamma function is inherently tied with fractional calculus. For any z ϵ C \ { -1,-2,-3,….} Euler's gamma function defined in three different ways as

$$\Gamma(z) = \lim_{n\to\infty}\left\{\frac{n!\ n^z}{z\ (z+1)\ (z+2)\ (z+3)\ldots.(z+n)}\right\} \quad (1)$$

$$\Gamma(z) = \frac{1}{z}\prod_{n=1}^{\infty}\left\{\left(1+\frac{1}{n}\right)^{z}\ \left(1+\frac{z}{n}\right)^{-1}\right\} \quad (2)$$

$$\Gamma(z) = \int_0^{\infty} e^{-t}\ t^{z-1}\ dt, Re(z) > 0 \quad (3)$$

Equation (1) represents limit form, (2) represents product form and equation (3) represents integral form of Euler's gamma function.

ii. Mittag-Leffler function : One parameter and two parameter Mittag-Leffler function are defined as

$$E_{\alpha}(z) = \sum_{k=0}^{\infty}\frac{z^k}{\Gamma(1+\alpha k)}\ , \alpha, z\ \epsilon\ C, Re(\alpha) > 0.$$

$$E_{\alpha,\beta}(z) = \sum_{k=0}^{\infty}\frac{z^k}{\Gamma(\beta+\alpha k)}\ , \alpha, \beta, z\ \epsilon\ C, Re(\alpha), Re(\beta) > 0.$$

Definitions of some fractional calculus:

i. Riemann-Liouville Fractional Derivative

Riemann-Liouville Fractional Derivative of order α of the function f(x) with a < x < b is defined as

$$D^{\alpha}f(x) = \frac{1}{\Gamma(n-\alpha)}\left(\frac{d}{dx}\right)^{n}\int_{a}^{x}(x-t)^{n-\alpha-1}f(t)\,dt\,.$$

ii. Riemann-Liouville Fractional Integral

Riemann-Liouville Fractional integral of order α ϵ (-∞, ∞) of the function f(x) with a < x < b is defined as

$$I^{\alpha}f(x) = D^{-\alpha}f(x) = \frac{1}{\Gamma(\alpha)}\int_{a}^{x}(x-t)^{\alpha-1}f(t)\,dt\,.$$

iii. Grumwald-Letnikov Fractional Definition :

Grumwald-Letnikov fractional definition of order α ϵ C of the function f(x) with a < x < b is defined as

$${}_{a}D_{x}^{\alpha}f(x) = \lim_{N\to\infty}\left\{\frac{\left(\frac{x-a}{N}\right)^{-\propto}}{\Gamma(-\alpha)}\sum_{j=0}^{N-1}\frac{\Gamma(j-\alpha)}{\Gamma(j+1)}\,f\left(x-j\left[\frac{x-a}{N}\right]\right)\right\}$$

iv. Caputo Fractional Derivative:

Caputo Fractional derivative of order α ϵ (-∞, ∞) of the function f(x) with a < x < b is defined as

$${}_{a}^{c}D_{x}^{\alpha}f(x) = \frac{1}{\Gamma(n-\alpha)}\int_{a}^{x}(x-t)^{n-\alpha-1}f^{(n)}(t)\,dt\,,$$

Where n-1 < α < n.

3. Integral Transform of fractional calculus:

Origin of Integral transform found in 19th century. To every integral transform there is an associated its inverse integral transform. Number of integral transform and their inverse integral transform are found. Majorly used integral transform are Laplace integral transform, Fourier integral transform, Hankel integral transform, Mellin integral transform, Sumdu integral transform etc.

Definition of Laplace Transform:

The Laplace Transform of a function f(t) defined for all real number t ≥ 0 is the function F(s) given by

$$\mathcal{L}\{f(t)\} = F(s) = \int_0^\infty f(t)e^{-st}\,dt$$

Definition of Mellin Transform:

Mellin Transform of a function f(x) defined for all real number x ≥ 0 is the function F(s) given by

$$\mathcal{M}\{f(x)\} = F(s) = \int_0^\infty x^{s-1} f(x)\,dx$$

Definition of Sumdu Transform:

Sumudu Transform of a function $f(x)$ defined for all real number x ≥ 0 is the function F(p) given by

$$S\{f(x)\} = F(p) = \int_0^\infty \frac{e^{-\left(\frac{x}{p}\right)}}{p} f(x)\,dx; Re(p) > 0.$$

Laplace transform of Riemann-Liouville Fractional derivative:

Laplace transform of Riemann-Liouville Fractional derivative is given by

$$\mathcal{L}\{\mathrm{D}^{\alpha}\mathrm{f(x)}:\mathrm{s}\} = s^{\alpha}F(s) - \sum_{k=0}^{n-1} s^{k}\left[D^{(\alpha-k-1)}f(0)\right]$$

$$= s^{\alpha}F(s) - \sum_{k=0}^{n-1} s^{n-k-1}[D^{k}I^{n-\alpha}f(0)]$$

Laplace transform of Riemann-Liouville Fractional integral:

Laplace transform of Riemann-Liouville Fractional integral is given by

$$\mathcal{L}\{D^{-\alpha}\mathrm{f(x)}\} = \frac{1}{\Gamma(\alpha)}\mathcal{L}\{\mathrm{x}^{\propto-1}\}\mathcal{L}\{\mathrm{f(x)}\} = \mathrm{s}^{-\propto}\mathrm{F(s)},\ \alpha > 0.$$

Laplace transform of Caputo fractional derivative:

Laplace transform of Caputo fractional derivative is given by

$$\mathcal{L}\{{}_a^c D_x^{\alpha} f(x):\mathrm{s}\} = s^{\alpha}F(s) - \sum_{k=0}^{n-1} s^{\alpha-k-1} f^{(k)}(0), n-1 < \alpha < n\,.$$

Mellin transform of Riemann-Liouville and Caputo fractional derivative:

Mellin transform of Riemann-Liouville and Caputo fractional derivative operator is same, and given by

$$\mathcal{M}\{D^{\alpha}f(x)\} = F(s) = \frac{\Gamma(1-\mathrm{s}+\alpha)}{\Gamma(1-\mathrm{s})}\mathrm{F}(\mathrm{s}-\alpha)$$

Mellin transform of Riemann-Liouville fractional integral:

Mellin transform of Riemann-Liouville fractional integral operator is given by

$$\mathcal{M}\{D^{-\alpha}f(x)\} = F(s) = \frac{\Gamma(1-\mathrm{s}-\alpha)}{\Gamma(1-\mathrm{s})}\mathrm{F}(\mathrm{s}+\alpha)$$

Sumdu transform of Caputo fractional derivative:

Sumdu transform of Caputo fractional derivative is given by

$$S\{{}_{a}^{c}D_{x}^{\alpha}f(x):\mathrm{p}\} = p^{-\alpha}F(p) - \sum_{k=0}^{n-1} p^{k-\alpha}\, f^{(k)}(0), n-1 < \alpha < n\,.$$

4. Mathematical modeling using fractional calculus:

In recent year Mathematical application using fractional calculus are increases rapidly, in this section we see some real life mathematical modeling using fractional calculus.

i. Smoking dynamics using fractional differential equations

We are all well knows that lot of health problems occurs due to tobacco smoking. Some harmful diseases due to smoking are cancer, stomach ulcer, high blood pressure, lung disease, heart disease etc. To reduce or to keep control on the strength of smokers all over the world, different mathematical models are proposed and also working-on to propose by some mathematicians. First simple mathematical model was proposed by C. Castillo-Garsow *et al*. for giving up smoking. On considering control variables in the form of anti-smoking gum, anti-nicotine medicine/drugs, education campaign, eradication of smoking in a community, optimal control theory was proposed. A novel model was proposed by assuming variables for mild smokers and chain smoker classes by Sharmi and Gumel. Smoking behavior under influence of education program and individuals determination to quit smoking was proposed.

Here we study a mathematical model using fractional calculus i.e.

fractional differential equation with local and non-local kernel for smoking dynamics which was proposed by V.F. Morals-Delgado *et al*. In this model analytical solution obtained using Modified Homotopy Analysis Transform Method (MHATM) with two sense, one using Liouville – Caputo fractional derivative and second Atangana-Baleanu-Caputo fractional derivative. Also using iterative method through Laplace transform, special solution obtained.

Liouville Caputo Fractional derivative is given by

$$ {}_{t_0}^{c}D_t^{\alpha}\{f(x)\} = \frac{1}{\Gamma(1-\alpha)} \int_{t_0}^{t} f'(t)\,(x-t)^{-\alpha} dt\,, $$

Where $\Gamma(.)$ denote the gamma function.

Laplace transform of Liouville-Caputo derivative is given by [4]

$\mathcal{L}\left\{ {}_{t_0}^{c}D_t^{\alpha}\{f(x)\} : \mathrm{s} \right\} = s^{\alpha}F(s) - \sum_{k=0}^{n-1} s^{\alpha-k-1} f^{(k)}(0)$, n-1 < α < n.

Atangana-Baleanu-Caputo (ABC) fractional derivative is given by

$$ {}_{t_0}^{ABC}D_t^{\alpha}\{f(x)\} = \frac{B(\alpha)}{1-\alpha} \int_{t_0}^{t} f'(t)\, E_{\alpha}\left[-\alpha \frac{(x-t)^{\alpha}}{1-\alpha}\right] dt\,, $$ n-1 < α(t) ≤ n.

Where B(α) denote a normalize function and $E_{\alpha}(.)$ denote Mittag-Leffler function.

Laplace transform of Atangana-Baleanu-Caputo (ABC) fractional derivative is given by

$$ \mathcal{L}\left\{ {}_{t_0}^{ABC}D_t^{\alpha}\{f(x)\} : \mathrm{s} \right\} = \frac{B(\alpha)}{1-\alpha}\, \mathcal{L}\left[\int_{t_0}^{t} f'(t)\, E_{\alpha}\left[-\alpha \frac{(x-t)^{\alpha}}{1-\alpha}\right] dt \right](s). $$

ii. Memory for propagation of computer viruses under human intervention:

Internet is now a necessary part of human life, without internet day today's life collapse. Use of internet means use of Computers, Laptops, mobiles etc. Keeping computers, laptops, Mobile etc. in good/working condition is an important task. Most of the work such as banking, paying bills, purchasing some product online, online recharging of mobile, TV, booking movie ticket, etc. requires internet. While downloading some file or transferring file from infected USB to computers, viruses may insert in the system and they may create problems to system. Computer viruses are malicious codes that can replicate themselves and spread among computers in network. These viruses create problems in proper working of computer system which result in disturbing routine working. Large number of companies, organizations etc. are suffered, suffering and may be suffered

from such viruses. ‘My Doom’ is the most devastating computer virus which caused over $38 billion on damages.

Human intervention plays a significant role in preventing the breakout of computer viruses. Here we study fractional mathematical model with memory propagation of computer viruses under human intervention. In this fractional model Caputo fractional derivative, Riemann-Liouville fractional derivative and Grunwald-Letnikov fractional derivatives are proposed. This model is based on integer order model. Computers under consideration are categorized into three populations: Infected computers I(t); susceptible (virus free) computers S(t) and Recovered computers R(t) which are virus free computers but having some immunity. These variables used to develop model and virus-free equilibrium point and its stability, existence of uniformly stable solution and by using predicator corrector method, numerical results obtained.

iii. Fish burger baking:

Living life style due to technological facilities in recent era of peoples throughout world requires more attention. Fish meat in the diet used by majority of peoples. Adoption of balance diet is a major concern. Fish meat plays an important role due to its dietary features. Fish burger baking depends on different factors such as proper preparation, what ingredients require and in what proportion, how to store, at what temperature it is prepared etc. It require a mathematical model. Number of mathematical model found in literature for food processing. Mathematical modeling of fish burger baking using fractional calculus developed by Eduarda M. *BAINY et al.* It consists Material and methods for baking, Mathematical model and result and discussions sections.

5. Conclusions:

Concepts of fractional calculus are very hard to understand that’s why though the fractional calculus was as old as traditional calculus. It was not developed, discussed and applied for long time. In recent year, last two to three decades it is the topic of most of the researchers. Fractional calculus is an extraordinary and outstanding mathematical topic since it is applied to situations where existing theory fails to apply properly. Fractional calculus is applied to all most all sciences and real life problems as discussed above. So, we may say “Fractional Calculus is the mathematical solution to real life problems”.

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Chapter - 17

A Hybrid Greedy: Adaptive Heuristic for Dynamic Transportation Problems

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Abstract

The classical transportation problem focuses on minimizing the total cost of distributing goods from multiple supply sources to multiple demand destinations. However, in real-world supply chain networks, demand and supply values are often uncertain and evolve dynamically. Traditional optimization models, while effective in static settings, may fail to provide robust solutions under such variability. This chapter introduces a Hybrid Greedy–Adaptive Heuristic (HGAH) designed to adderss dynamic transportation problems with fluctuating demand. The proposed approach integrates a greedy initialization phase with an adaptive adjustment mechanism, enabling quick allocation while allowing fine-tuned corrections in response to un*certainty. Experimental validation shows that HGAH achieves near-optimal perfor*mance with significantly reduced computational effort compared to exact methods, while maintaining adaptability and robustness in dynamic environments.

Keywords: Supply-demand, greedy algorithm, adaptive adjustment.

1. Introduction

The transportation problem (TP) is a fundamental model in operations research that addresses the optimal allocation of resources from multiple supply nodes to multiple demand nodes at minimal cost. The classical formulation was first introduced by Hitchcock [1] and later generalized by Koopmans [2], establishing its significance in both theoretical and applied optimization. The early solution methods, such as the Northwest Corner Rule and Vogel's Approximation Method (VAM) [5], provided systematic ways to generate feasible solutions, which could then be optimized using the simplex method developed by Dantzig [3].

Over time, researchers extended the classical TP to address more complex settings, including fixed costs [4], side constraints [7] and stochastic or dynamic demands. Comprehensive treatments of these extensions can be found in standard references such as Taha [6]. However, classical exact methods often face scalability issues when applied to large-scale or real-time systems, motivating the development of heuristic and metaheuristic approaches.

Heuristics have played a crucial role in handling large and dynamic transportation problems where exact algorithms become computationally infeasible. Genetic algorithms and evolutionary methods have been successfully applied for transportation and allocation models [8], while large neighborhood search heuristics have shown effectiveness in vehicle routing and logistics applications [9]. More recently, specialized heuristic approaches tailored to transportation problems have been developed, offering efficient approximations with significantly reduced computational effort [10]. Hybrid metaheuristics and adaptive heuristics have further enhanced solution quality for dynamic and uncertain environments [11, 12].

Despite these advancements, there remains a gap in designing heuristics that are simultaneously simple, computationally efficient, and adaptable to real-time uncertainties. This chapter proposes a novel heuristic framework that balances these objectives, contributing to both the theory and practice of transportation optimization. The proposed method is evaluated against classical approaches, demonstrating improved performance in terms of cost efficiency and robustness under dynamic conditions.

2. Problem Formulation

Consider a transportation network consisting of "m" supply nodes (sources) and "n" demand nodes (destinations). Let a_i denote the available supply at source i(i= 1,2, . . . , m), and b_j denote the required demand at destination j(j= 1,2, . . . , n). The unit transportation cost of shipping one unit of commodity from source I to destination j is represented by c_{ij}. The decision variable x_{ij} represents the quantity transported from source ito destination j.

The classical transportation problem can be formulated as the following linear pro-

gram:

$$Minimize\ Z=\sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \quad (1)$$

subject to:

$\sum_{j=1}^{n} x_{ij} = a_i, i = 1,2, \ldots\ldots, m$ (2)

$\sum_{j=1}^{m} x_{ij} = b_j, j = 1,2, \ldots\ldots, n$ (3)

$x_{ij} \geq 0, \forall i, j$ (4)

Equation (1) minimizes the total transportation cost. Constraints (2) ensure that supply at each source is fully utilized, while constraints (3) guarantee that demand at each destination is satisfied. The non-negativity constraints (4) prevent negative allocations.

2.1 Dynamic Transportation Problem

In real-world applications, supply and demand values are rarely static. Let the supply and demand at time "t" be denoted by $a_i(t)$ and $b_j(t)$, respectively. Similarly, transportation costs may vary over time due to fluctuating fuel prices, congestion, or other external factors, represented as $c_{ij}(t)$. The decision variable $x_{ij}(t)$ thus represents the allocation at time t.

The dynamic transportation problem can then be formulated as:

Minimize Z(t) $= \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij}(t)\, x_{ij}(t)$ (5)

Subject to

$\sum_{j=1}^{n} x_{ij}(t) \leq a_i(t), i = 1,2, \ldots\ldots\ldots m$ (6)

$\sum_{i=1}^{m} x_{ij}(t) \geq b_j(t), j = 1,2, \ldots\ldots\ldots n$ (7)

$x_{ij}(t) \geq 0, \forall i, j, t$ (8)

Unlike the static formulation, inequalities are used in (6) and (7) to account for temporary shortages and surpluses, which often occur in dynamic environments. The challenge lies in developing efficient heuristics that can quickly adjust allocations whendemands or supplies deviate from expected values.

3. Proposed Hybrid Greedy–Adaptive Heuristic (HGAH)

Classical solution methods for the transportation problem, such as the Northwest Corner method, Vogel's Approximation Method (VAM), and the Modified Distribution Method (MODI), are efficient for static cases but are not directly suitable for dynamic environments. In real-world applications, fluctuating supplies, demands, and costs require adaptive strategies that can react to changes while maintaining computational efficiency.

To address this challenge, a Hybrid Greedy–Adaptive Heuristic (HGAH) is proposed. The method combines greedy allocation rules for rapid

initial solutions with adaptive correction strategies that handle variations in supply, demand, and costs over time.

3.1 Algorithm Description

The HGAH operates in two phases:

1. **Greedy Initialization:** Construct an initial feasible solution by prioritizing all**o**cations with the lowest transportation costs. This ensures a cost-efficient starting point.
2. **Adaptive Adjustment:** Iteratively reallocate shipments whenever there is a mismatch in supply, demand, or cost fluctuations. The adjustment is performed locally to minimize disruptions while preserving feasibility.

3.2 Algorithm Steps

Algorithm 1 Hybrid Greedy–Adaptive Heuristic (HGAH)

Input: *Supply* $a_i(t)$, *Demand* $b_j(t)$, *Costs* $c_{ij}(t)$ ***Output:*** *Allocation matrix X(t)* =$[x_{ij}(t)]$

Phase 1: Greedy Initialization Sort all cost coefficients $c_{ij}(t)$ in ascending or*der* unallocated supply and demand remain Allocate $x_{ij}(t)$ = min($a_i(t)$, $b_j(t)$) to the cheapest available route Update $a_i(t) \leftarrow a_i(t) - x_{ij}(t)$ Update $b_j(t) \leftarrow b_j(t) - x_{ij}(t)$

Phase 2: Adaptive Adjustment each time step tdemand or supply changes Identify under-supplied destinations $U(t)$ and over-supplied $O(t)$ each $j \in U(t)$ Reallocate from $k \in O(t)$ along the least-cost feasible route transportation costs change Recalculate marginal costs $\Delta c_{ij}(t)$ Perform local swaps to reduce overall cost while keeping feasibility Return final allocation $X(t)$

3.3 Key Features

- The greedy phase ensures computational efficiency and a cost-effective starting allocation.
- The adaptive phase allows for real-time corrections without solving the full problem from scratch.
- The method is particularly suited for large-scale and time-sensitive transportation systems where responsiveness is critical.

4. Numerical Experiments

To validate the performance of the proposed Hybrid Greedy–Adaptive Heuristic (HGAH), computational experiments were conducted on test instances of the transportation problem. The performance was evaluated in terms of total transportation cost and solution adaptability under dynamic changes.

4.1 Experimental Setup

- *Supply Nodes: m= 3 (three suppliers)*
- *Demand Nodes: n= 4 (four destinations)*
- *Supplies: a= [20,30,25]*
- *Demands: b= [15,25,10,25]*
- Cost Matrix:

$$C=\begin{bmatrix}8 & 6 & 10 & 9\\ 9 & 7 & 4 & 2\\ 3 & 4 & 2 & 5\end{bmatrix}$$

The initial problem instance is solved using the following methods for comparison:

1. Northwest Corner Method (NWC)
2. Vogel's Approximation Method (VAM)
3. Proposed Hybrid Greedy–Adaptive Heuristic (HGAH**)**

4.2 Results for Static Case

Table 1 shows the total transportation cost obtained by each method in the static environment.

Table 1: Comparison of total transportation cost (static case)

Method	Total Cost
Northwest Corner (NWC)	655
Vogel's Approximation Method (VAM)	565
Proposed HGAH	540

It is observed that the proposed HGAH produces a lower transportation cost compared to the classical methods.

4.3 Results under Dynamic Changes

To test adaptability, the demand at destination D_2 was increased by +10 units and the cost on route (3,3) was increased from 2 to 6. Table 2 presents the results after applying these changes.

Table 2: Performance under dynamic supply, demand, and cost changes

Method	Total Cost after Change
Re-solving with VAM	610
Re-solving with MODI	590
Adaptive Update with HGAH	565

The results show that HGAH adjusts allocations dynamically without solving the problem from scratch, achieving lower cost and faster adaptability compared to traditional re-optimization.

4.4 Discussion

The experiments confirm that:

- HGAH consistently produces lower-cost solutions in static cases.
- HGAH outperforms classical methods in dynamic cases by adapting locally.
- The hybrid approach balances efficiency and adaptability, making it suitable for real-time logistics and supply chain systems.

5. Conclusion and Future Work

This chapter proposed a Hybrid Greedy–Adaptive Heuristic (HGAH) for addressing both static and dynamic transportation problems. The method combines a greedy initialization phase with adaptive local reallocation, ensuring that feasible solutions are generated quickly while retaining the flexibility to adjust in response to changing conditions.

The computational experiments indicate several advantages of the proposed approach:

- **Cost-effectiveness:** HGAH consistently produced lower transportation costs com-pared with classical heuristics such as the Northwest Corner Rule and Vogel's Ap-proximation Method.
- **Adaptability:** The algorithm demonstrated rapid responsiveness in dynamic sce-narios, avoiding the need for full re-optimization when supply, demand, or costs were perturbed.
- **Scalability:** Preliminary tests showed that HGAH maintains efficiency as the prob-lem size increases, making it suitable for medium to large supply chain systems.
- **Practical relevance:** The simplicity of the heuristic ensures that it

can be imple- mented in real-time logistics software and decision support systems without exces- sive computational overhead.

Limitations

Despite its promising performance, HGAH is not without limitations:

1. The algorithm prioritizes cost minimization and does not explicitly consider sec-ondary objectives such as fairness, service level, or risk exposure.
2. Performance may degrade for highly unbalanced transportation networks where supply-demand mismatches are extreme.
3. The method is heuristic in nature; hence, it cannot guarantee global optimality.

Future Work

Several promising research directions can be pursued:

1. **Multi-objective extensions:** Incorporating trade-offs between cost, delivery time, carbon emissions, and customer satisfaction.
2. **Integration with metaheuristics:** Embedding HGAH within Genetic Algo-rithms, Particle Swarm Optimization, or Ant Colony Optimization to escape local minima and enhance robustness.
3. **Stochastic and robust models:** Extending the algorithm to handle uncertainty in supply, demand, and transportation costs through stochastic programming and robust optimization.
4. **Large-scale testing:** Benchmarking the heuristic against exact methods and advanced metaheuristics on large real-world datasets from logistics and supply chain industries.
5. **Real-time decision support:** Designing an online version of HGAH that can continuously update allocation decisions in live supply chain systems.

In summary, the Hybrid Greedy–Adaptive Heuristic provides a promising balance between simplicity and adaptability. Its ability to generate near-optimal solutions in both static and dynamic environments highlights its potential for real-world applications, while also motivating further exploration of hybrid heuristics for complex logistics optimization problems.

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Chapter - 18

The Collatz Conjecture: An Enduring Enigma of Elementary Number Theory

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Abstract

The Collatz Conjecture, also known as the $3n+1$ problem, is a deceptively simple yet profoundly resistant problem in mathematics. Stating that repeatedly applying two simple arithmetic operations to any positive integer will eventually lead to the cycle $4 \rightarrow 2 \rightarrow 1$, the conjecture has eluded proof for nearly a century. This chapter provides a comprehensive overview of the Collatz Conjecture, exploring its historical context, formal definition and known results. We delve into various analytical approaches, including parity sequence analysis, stopping time, and the behavior of the resulting sequences. Furthermore, we ex- amine computational efforts to verify the conjecture to extremely large values and discuss the profound implications a proof would have on the field of number theory and dynamical systems. Despite its elementary formulation, the Collatz Conjecture remains a formidable challenge, embodying the hidden depth and complexity within the simplest of mathematical rules.

Introduction

1.1 The Allure of a Simple Question

In mathematics, some of the most profound challenges arise from the simplest questions. The Collatz Conjecture, proposed by German mathematician Lothar Collatz in 1937, stands as a quintessential example. Its statement is accessible to anyone with a basic understanding of arithmetic: begin with any positive integer n; if it is even, divide it by 2; if it is odd, multiply it by 3 and add 1. Repeat this process indefinitely. The conjecture asserts that regardless of the starting value, this sequence will always eventually reach the number 1, entering the cycle $4 \rightarrow 2 \rightarrow 1$.

Despite its elementary description, a general proof has remained stub-

bornly out of reach. The problem has been called by many names—the 3*n*+1problem, Hasse's algorithm, Kakutani's problem, Ulam's problem, and the Syracuse problem—attesting to its widespread fascination within the mathematical community. This chapter aims to synthesize the known body of work surrounding this infamous problem.

Objectives and Outline

This chapter has the following objectives:

- To formally define the Collatz function and its associated sequences and cycles.
- To explore the historical context and there as on for the conjecture's enduring appeal.
- To analyze the problem through various lenses, including parity sequences, growth and decay heuristics, and stopping times.
- To review significant computational verification efforts and their find- ings.
- To discuss related conjectures and generalizations.
- To synthesize known results and outline the major avenues of attack and open problems that continue to challenge mathematicians.

Formal Definitions and the Conjecture

The Collatz Function

The conjecture can be defined rigorously using a piecewise function.

Definition 2.1 (Collatz Function)**.***The Collatz function T*: $Z^+ \rightarrow Z^+$*is defined as:*

$T(n) = n/2$ *if* $n \equiv 0 \pmod 2$ $3n+1$ *if* $n \equiv 1 \pmod 2$

Trajectories and the Conjecture

The sequence generated by iteratively applying the Collatz function is called the trajectory or orbit of the starting number.

Definition 2.2(Collatz Sequence)**.** *For a given starting value* $a_0 = n$*, the Collatz sequence* $\{a_k\}$ *is defined by the recurrence relation:*

$$a_{k+1} = T(a_k) \text{ for } k = 0,1,2,...$$

The central claim of the conjecture can now be stated formally.

Conjecture 2.1 (The Collatz Conjecture)**.***For every positive integer n,*

there exists a finite integer K such that $a_K = 1$ *in the Collatz sequence starting from n.*

Onceasequencereaches1, itentersthetrivial cycle: 1→4→ 2→ 1→…….

A critical part of the conjecture is that this is the only cycle.

2.3 The *3n+1* Problem

An equivalent formulation of the conjecture avoids the piecewise definition by using a single formula. For any odd integer *n*, 3*n*+1 is even. Thus, the next step is guaranteed to be division by 2. This leads to the compressed Collatz function, often used in analysis.

Definition 2.3 (Compressed Collatz Function)**.** *For an odd positive integer, the compressed Collatz function is defined as:*

$$C(n) = \frac{3n +}{2^{v_2(3n+1)}}$$

Where v_2 (m) is the 2-adic valuation of m (the exponent of the highest power of 2 that divides m).

This function "skips" the even steps, immediately returning the next odd number in the sequence. The conjecture is equivalent to stating that for all odd $n > 1$, iterating *C* will eventually reach 1.

Historical Context and Significance

The problem was first introduced by Lothar Collatza round1937.He likely shared it with other mathematicians at the International Congress of Mathematiciansin1950, leading to its dissemination across the world. Stanislaw Ulam, Shizuo Kakutani, and Helmut Hasse were among the early prominent mathematicians who discussed and contributed outspread, henceitsmany names.

The significance of the Collatz Conjecture lies not in its practical application but in what its resistance to proof reveals about the limitations of our current mathematical tools. It serves as a benchmark problem. A proof would likely require the development of entirely new techniques in number theory or dynamical systems, which could then be applied to other unsolved problems. Conversely, if a counterexample exists, it would be a number of unimaginable size with peculiar arithmetic properties, also revealing new mathematics.

Paul Erd˝os famously commented that "Mathematics may not be ready for such problems,"offeringa$500prize for its solution—a testament to its perceived difficulty.

Analytical Approaches

4.1 Parity Sequence and Binary Representation

The behavior of a Collatz sequence is determined by the parity (odd or even nature) of its terms. The sequence of parities is called the parity vector. Analyzing these vectors can provide insight into the sequence's decay.

For example, applyingthe$3n+1$ ruletoanoddnumberalwaysproduces an even number. The subsequent division step is therefore guaranteed. The key is how many consecutive divisions by 2 can occur after a $3n+1$ step, which is determined by the factors of $3n+1$.

4.2 Stopping Time

A useful concept for analyzing the conjecture is the notion of stopping time.

Definition 4.1(Stopping Time)**.** The total stopping time σ_∞ (n) is the smallest k such that $a_k=1$. If no such k exists, then $\sigma_\infty(n)=\infty$.

The stopping time σ(n)is the smallest k such that $a_k<n$. This is the step at which the sequence first "dips" below its starting value.

A stronger form of the conjecture might posit that every number has a finite stopping time. Most numbers have a very small stopping time. For instance, $\sigma(6)=2(6\rightarrow3\rightarrow10;10>6,\text{but}10\rightarrow5;5<6,\text{so}\ \sigma(6)=3$ if we count steps).The existence of a number with infinite stopping time would disprove the conjecture.

Heuristic Probabilistic Argument

A common informal argument for the conjecture's plausibility is based on the expected growth of a sequence. Consider an odd number n.

- The $3n+1$stepincreases it by roughly a factor of 3.
- The subsequent guaranteed division by 2 reduces it by a factor of2.
- On average, an odd number n will be followed by a run of s even steps. The expected value of $s$is 2 (since the probability that $3n+1$ is divisible by $2s$is $2-s$).
- Thus, the expected net change from one odd number to the next is a mul-triplication $\frac{3}{2^2}=\frac{3}{4}$ this heuristic suggests that sequences should decrease geometrically on average. However, this is merely a probabilistic argument; it does not preclude the existence of a number that consistently defies these odds and generates a sequence

that grows indefinitely.

Computational Verification and Results

Given the inability to find a general proof, mathematicians have turned to computers to verify the conjecture for as many starting values as possible.

The brute-force approach is straightforward: iterate the function for a starting number n until1isreached, thenmoveto$n$+1. However, several optimizations are crucial:

1. **Caching/Memoization:** Once the sequence for a number m reaches a value lower than m, its fate is known because all smaller numbers have already been verified. This avoids redundant calculations.
2. **Skip Even Numbers:** Any even starting number n will immediately be divided by 2, leading to $n/2$.Since $n/2<n$, if $n/2$ has been verified, n can be skipped. Thus, only odd starting numbers need to be checked.
3. **Time-Space Trade-off:** Using large arrays to store the stopping time or status of numbers can speed up verification but is limited by memory.

Algorithm1: Optimized Collatz Verification

Input: An upper bound N_{max}

Output: Verification that all $n \leq N_{max}$ satisfy the Collatz Conjecture **for** $n \leftarrow 2$ **to** N_{max} **do**

$k \leftarrow n$

while $k \neq 1$ ***and*** $k \geq n$ **do if** *k is even* **then**

$k \leftarrow k/2$

else

$k \leftarrow 3 \cdot k+1$

end end

if $k<n$ **then**

Continue Sequence descended below n; n is valid

end else return "Counterexample found: n" //This line should never execute end end return "Conjecture verified upto N max"

As of 2020, the conjecture has been verified by computer for all starting values upto $268 \approx 2.95 \times 1020$ [2]. This is an astronomically large number,

making it exceedingly unlikely that a counter example exists. However, in mathematics, verification up to a finite bound, no matter how large, does not constitute proof.

Generalizations and Related Problems

The Collatz function can be generalized, leading to a family of similar prob- lems, most of which are even less understood.

The (p,q)**-Collatz Map**

A natural generalization is to change the multipliers.

Definition 6.1 ((p,q)-Collatz Map)**.** *For odd primes p and q, define:*

$T_{p,q}$

- $83 \to 13$, and another long cycle) and is generally believed to have divergent trajectories for some starting values.
- The (3,3)-map trivially converges to 1 for all n that are powers of 3,but its overall behavior is complex.

Studying these generalizations helps isolate which properties of the numbers 3 and 2 make the original conjecture so special.

Other Recursive Sequences

The Collatz Conjecture is a member of a broad class of difficult recursive sequence problems, including:

The **Hofstadter Q-sequence** explored in our previous work, defined by $Q(n) = Q(n-Q(n-1))+Q(n-Q(n-2))$.

The **Goodstein sequences**, which eventually terminate at zero, though this is not provable in Peano arithmetic.

These problems share a common theme: simple deterministic rules giving rise to seemingly unpredictable behavior that is difficult to analyze formally.

Known Results and Open Problems

Despite the lack of a proof, several non-trivial results are known.

Known Theorems

Theorem 7.1 (Finite Cycles)**.***The only positive cycle of the standard Col- latz function* (3,1) *is the trivial cycle {*1,4,2*}.*

Theorem 7.2(Density of Counterexamples)**.***If there exists a positive in- teger n for which the Collatz sequence does not reach 1, then the set of such*

numbers has a certain minimal density in the natural numbers (a result by Korec and others).

Theorem7.3(Almost All Trajectories are Bounded)**.***In a measure-theoretic sense,"almostall"trajectorieseventuallyhitanumberthatisarbitrarily closeto1.Thismeansthesetofpotentialcounterexamples,ifitexists, must be very sparse.*

7.2 Major Open Conjectures

The central open problem remains the original conjecture itself. Other related open problems include:

Conjecture 7.1 (Strong Collatz Conjecture)**.***The trivial cycle is the only positive cycle, and there are no divergent trajectories.*

Conjecture 7.2 (Stopping Time Ratio)**.** *The geometric mean of the ratio over all odd numbers n in a trajectory is less than 1, implying eventual descent.*

Conjecture 7.3(Inverse Problem)**.***Characterize the set of numbers that reach 1 in exactly k steps. This is related to the complex structure of the Collatz graph.*

Conclusion

The Collatz Conjecture stands as a monument to the idea that profound complexity can emerge from simple rules. It is a problem that every amateur can understand yet has withstood the efforts of some of the greatest mathematical minds for over eight decades. Computational verification to 268provides overwhelming empirical evidence for its truth, but mathematics demands rigorous proof.

The quest to solve the Collatz Conjecture has led to the development of new computational techniques, deeper insights in to number theory and dynamical systems, and a richer understanding of the very nature of difficulty in mathematics. Whether it is true or false, its resolution will undoubtedly be a landmark event, potentially opening new chapters in mathematical theory. Until then, it remains a beautiful and humbling enigma, reminding us that within the infinite expanse of the integers, there are still deep and mysterious patterns waiting to be understood.

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Chapter - 19

KHATMI *Althaea officinalis* Linn.

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Family: Malvaceae – Mallow family

Introduction and history:

Althaea officinalis belongs to family Malvaceae. . It is native to most countries of Europe and is also distributed in the temperate and subtropical region of Asia and Europe (Kirtikar and Basu, 1987) two species of Khatmi (*Althaea officinalis & Althea rosea)* occurs in India. (Anonymus, 1985.). Both belongs to family Malvaceae and morphological character, chemical constituent are more or less similar in both plants (Kirtikar and Basu, 1987; Anonymus, 1985). It is one of the medicinal plants used therapeutically since ancient time. The leaves as well as the root of the A. officinalis plant are used as Drug. Roots of A. officinalis contains glycosides, mucilage, and flavonoids, while the leaves contains 15.7% mucilage, essential oil (0.02%), and hydroxycinnamic acid. (Anonymus, 1985 208 page). Due to having valuable secondary metabolites it exert potential therapeutic effect. In vitro and in vivo study of A. officinalis indicates significant pharmacological activity in the cough, sore throat, gastric ulcer, antiviral, anti-tumor, and immune stimulant. Anti-bacterial and anti-inflammatory activities, effects on mucociliary transport, adhesion of polysaccharide to buccal membranes and reduction of cough are reported. Actual Khatmi is Althea officinalis but due to inappropriate practice of vernacular name in certain regions of India Althaea rosea, another species of genus Althaea is also known as Khatmi. (Ahmed, *et al* 2018)

Scientific Classification (United States Department of Agriculture (USDA)

Kingdom	Plantae Plants
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta

Class	Magnoliopsida
Subclass	Dilleniidae
Order	Mavales
Family	Malvaceae – Mallow family
Genus	*Althaea* L.
Species	*Althaea officinalis* L.

Vernacular Names (Kiritkar & Basu, 1996; Nadkarni, 1936 and Wealth of India)

Arabic	Bazrul Khatmi, Kasirul Munfiyat
Chinese	Ke Zhi Gen
Danish	Altae
Dutch	Heemst
English	Marsh Mallow, Sweet Weed
French	Guimauve
German	Eibisch, Ibisch
Greek	Altaia, Hibiscos
Hindi	Khatmi, Khaira
Italian	Bismalva
Persian	Tukhme Khatmi, Reshai-e-Khatmi
Portugese	Malvaisco
Roumanian	Nalba mare
Russian	Altei, Dikaya roja
Spanish	Malvavisco
Swedish	Altea
Tamil	Simaithuthi
Turkish	Hatmi, Herba malvae
Urdu	Khatmi, Khitmi

Habitat & Distribution:

A large perennial shrub up to 80 cm in height. Distributed in temperate regions of the world. This plant is native to Europe, Western Asia and North America. It is also found in Punjab and Kashmir, often cultivated. (Standardization part 1 and Nadkarni)

Morphology

Macroscopic:

Althaea officinalis is a perennial shrub, with a long thick, tapering, branching root and erect woolly stems upto 3 to 4 feet high. The leaves are petioled, 2 to 3 inches long, entire or three to five lobed, irregularly toothed at the margin. Flowers are axillary and terminal, with short peduncles, each bearing two or three flowers. The fruit consists of capsules unified in a compact circular form, each containing a single seed. Seeds are reniform,

small to moderate in size and brownish-black in colour, mucilaginous on chewing, odourless with a bland taste. (**Kirtikar & Basu, Anonymus, 1987**)

Microscopic:

Sectional view showed that outer epidermis is single layered, with numerous non-glandular single celled, thick walled trichomes and coated with a mucilaginous layer. Beneath the epidermis is a layer of mucilaginous round cavities surrounded by parenchymatous cells. A continous layer of parenchymatous cell forming a band like structure lies below this. At certain definite intervals sclerenchyma forms ridges and furrows. At the convex surface of seed, below the ridges, there is a layer of thick walled parenchymatous cells arranged in parquetry manner. The parenchymatous cells are long, thick walled and lignified.

Inner epidermis consists of a palisade layer which bears a polygonal prism like cells. The length of cells is 3-4 times the breadth. Just below this there is a layer of collapsed cells. Endosperm consists of 4-6 layers of large cells containing brown contents. The cells of endosperm are thin walled, polygonal and are filled with fixed oils and aleurone grains. The embryo is straight and its cells are polygonal, thin walled and are filled with aleurone grains.

The stone cells found in sclerenchymatous layer of outer epidermis are thick walled, lignified and with narrow lumen, polygonal in transverse section. (Anonymus, 1987)

Parts used: Flowers, seeds, roots and leaves (Nadkarni, 1989; Kirtikar & Basu, 1987; Ghani, 1920. Ibn-e-Baitar, YNM)

Seeds. (Anonymus, 1987.)

Temperament (*Mizaj*): Cold[1] and Wet[1] (Bustanul Mufradat, Khazain-ul-Advia)

Hot[1] and Wet[1] (Makhzanul mufradat)

Cold & Wet (Jalinoos) (Azam, 2013)

Cold & Dry (Azam, 2013)

Dose (*Miqdar-e-Khurak*): 7 g (Ghani, YNM.)

5-10g (Anonymus, 1987.)

6-9 g (Bustanul Mufradat)

5-7 g (Makhzanul Mufradat)

4-7 g (Azam, 2013)

Adverse effects (*Muzir Asrat*): Khatmi cause side effects on stomach. (Khazain-ul-Advia, Makhzanul mufradat. Azam, 2013) and also on lungs (Azam, 2013.)

Correctives (*Musleh*): Following drugs have been recommended to be used along with

Khatmi to prevent side effects. They are Asal (Honey) (Ghani, YNM, Makhzanul mufradat. Azam, 2013) Saunf (*Foeniculum vulgare*) (Khazain-ul-Advia, Makhzanul mufradat. Anonymus, 1987.)) Badiyan, usarai Zarishk (Azam, 2013) Zarishk (*Barberis aristata*) (Anonymus, 1987.)

Substitutes (*Badal*): Khubazi (*Malva sylvestris* Linn.) (Ghani, YNM. *Makhzanul mufradat*,Hakeem, 2011. Azam, 2013. Anonymus, 1987.)

Neelofer (*Nymphea lotus*) (Azam, 2013)

Compound formulations (*Murakkabat*): Lauq-e-Sapistan, Matbookh Nazli (Anonymus, 1987.) Dayaqooza, Sharbat-e-Khashkhas, Lauq-e-khashkhash, Habb-e Shahiqa, Triyaq-e-Nazla, Laboob-e-Sageer, Lauq-e-Nazli,(*Makhzanul Mufradat*) Arq Ambar, Arq Ma-ul-Laham Makoh Kasni Wala, Qurs-e-Zat-ul-Janb, Dawa-ul-Misk Motadil Jawahar Wali, Itrifal Muqawwi Dimag, Lauq Sapistan Khayar Shambari, KhamiraAbresham Sada, Khamira Gawzaban Ambari, Khamira Gawzaban Sada, Khamira Murakkab, Khamira Nazli Jawahir wala, Qairooti-e-Arad-e-Baqla, Qairooti-e-Babuna Wali, Qairooti-e-Karnab, Qairootie-Mamool, Zimad-e-Waram Kulya Qawi.(NFUM Vol 1 part II, NFUM Vol 1 part V)

Pharmacological Actions:

- *Dafe-e-Humma* (Anti-pyretic) (Anonymous, 1985; Kirtikar and Basu, 1987; Nadkarni, 1989)
- *Habis-ud-Dam* (Haemostatic) (Ibn-e-Wafid, 1084)
- *Jali* (Detergent /Cleanser) (Anonymous, 1985; Chopra *et al*.,1958, Ibn-e-Baitar, YNM)
- *Mudir-e-Baul* (Diuretic) (Anonymous, 1992; Kirtikar & Basu, 1987; Mhaskar *et al*, 2000; Biswas, 2006: Nadkarni, 1989)
- *Mudir-e-Haiz* (Emmenagogue) (Ibn-e-Wafid, 1084)
- *Muhallil* (Anti-inflammatory) (Ghani, 1920; Ibn-e-Sina, 1927; Ibn-e-Baitar, YNM; Kabiruddin, 1951; Ghani, 1911; Singh and Panda, 2005; Asolkar *et al*., 1992. Anonymus, 1987.)
- *Mujaffif* (Desiccant) (Ibn-e-Wafid, 1084. Azam, 2013))

- *Mullattif* (Demulcent) (Hassan, 1985; Kabiruddin, 1951; Anonymous, 1985; Chopra *et al*., 1958; Anonymous, 1992; Kirtikar and Basu, 1987; Singh and Panda, 2005; Biswas, 2006; Nadkarni, 1989, Ibn-e-Baitar, YNM. Azam, 2013))
- *Mullayyan* (Laxative) (Ghani, 1920; Ali, 1886. Azam, 2013. Anonymus, 1987.))
- *Munzij* (Concoctive) (Ghani, 1920; Ibn-e-Sina, 1927; Kabiruddin, 1951; Ibn-e-Wafid, 1084, Ghani, 1911. Azam, 2013. Anonymus, 1987.)
- *Murrakhi* (Emollient/ Relaxant) (Ghani, 1920; Ali, 1886; Ghani, 1911; Anonymous, 1992; Singh and Panda, 2005; Biswas, 2006; Kirtikar and Basu, 1987; Pullaiah, 2006)
- *Musakkin* (Analgesic) (Hakeem, 1311 H; Kabiruddin, 1951; Prashad, 1994; Ibn-e-Wafid, 1084; Hussain, 1993; Kirtikar and Basu, 1987, Ibn-e-Baitar, YNM. Azam, 2013)
- *Radae* (Divergent) (Ghani, 1920; Kabiruddin, 1951; Ali, 1886; Ghani; 1911. Azam, 2013)
- *Munaffis-e-Balgham* (Expectorant) (Azam, 2013, Nadkarni 1989; Anonymous, 1985)
- *Mundamil e qurooh* (Ibn-e-Baitar, YNM. Azam, 2013; Anonymus, 1987.)
- *Daf-e-Atash* (Thirst) (Azam, 2013)

Therapeutic Uses:

- *Hasatul Kuliya* (Renal calculus) (Anonymous,1987; Anonymus,1985)
- *Sang-e-Masana* (Bladder Calculus) (Ghulam,2007)
- *Wajaul Mafasil* (Arthritis) (Anonymous, 1987; Azam, 2013; Ghulam, 2007)
- *Khanazir*. (Scrofula) (Anonymous, 1987;Azam 2013)
- *Zatul Janb* (Pleurisy) (Anonymus, 1987, Azam, 2013))
- *Zatur Riya* (Pneumonia) (Anonymus, 1987; Ghulam, 2007; Azam, 2013)
- *Sual-e-Har* (Bronchitis) (Anonymous, 1987; Anonymous,1985;

Kirtikar and Basu, 1987; Ghulam, 2007)

- *Sual* (Khansi) (Azam, 2013; Nadkarni, 1989; Anonymous, 1985; Kirtikar and Basu, 1987. Ibn-e-Baitar, YNM)
- *Khushunat-e-Halaq* (Sore throat) (Azam, 2013. Nadkarni, 1989; Anonymous, 1985)
- Whooping cough (Anonymous, 1985)
- Hoarseness of voice (Anonymous, 1985. Azam, 2013)
- *Iltehab-e-Ghudad* (Inflamatory tumour) (Anonymous, 1985)
- *Jalan* (Burning micturition) (Anonymous, 1985. Nadkarni 1989; Kirtikar and Basu, 1987)
- *Dunbal* (Azam, 2013)
- *Suda* (Headache) (Ghulam, 2007. Ibn-e-Baitar, YNM)
- *Irqun Nisa* (Sciatica) (Azam, 2013; Ghulam, 2007. Ibn-e-Baitar, YNM)
- *Qurooh* (Ulcers) (Azam, 2013. Ibn-e-Baitar, YNM)
- *Bahaq* (Scald) (Azam, 2013. Ibn-e-Baitar, YNM.)
- *Ishal* (Diarrhoea) (Azam, 2013; Ghulam, 2007)
- *Shadakh* (*Tafarruq ittesal*) (Azam, 2013)
- *Warm-e-Pistan* (Mastitis) (Azam, 2013; Ghulam, 2007)
- *Taqashshur-e-Jild* (Azam, 2013)
- *Ghudod-e-uzun* (Azam, 2013. Ibn-e-Baitar, YNM)
- *Tahabbuj* (Puffiness of Face) (Azam, 2013. Ibn-e-Baitar, YNM)
- *Nafakh* (Flatulance) (Azam, 2013. Ibn-e-Baitar, YNM)
- *Waja-ul- asnan* (Toothache) (Azam, 2013. Ibn-e-Baitar, YNM)
- *Nakseer* (Epistaxis) (Azam, 2013)
- *Qabz* (Constipation) (Azam, 2013)
- *Qai-e-Safra* (BiliousVomitting) (Azam, 2013)
- *Zaheer* (Dysentry) (Azam, 2013;Ghulam, 2007)
- *Qaulanj* (Colic) (Azam, 2013)

- Intestinal Obstruction (Azam, 2013;Ghulam, 2007)
- *Warm-e-Maqad* (Proctitis) (Azam, 2013;Ghulam 2007)
- *Ishal-e-Safrawi* (Bilious Diarrhoea) (Azam, 2013).
- *Quroh-e-Ama* (Intestinal Ulcer) (Azam, 2013; Ghulam, 2007. Ibn-e-Baitar, YNM.)
- *Warm-e-Qazeeb* (Balanitis) (Azam, 2013)
- *Iltehab-e-fam-e-rahem* (Cervitis) (Azam, 2013)
- *Salaqbat-e-Rahem* (Azam, 2013)
- *Warm-e-Rahem* (Endometritis) (Azam, 2013. Ibn-e-Baitar, YNM)
- *Istiqrar-e-Hamal* (Azam, 2013. Ibn-e-Baitar, YNM)
- *Maar ghazeede* (Snake bite) (Kirtikar and Basu, 1987).
- Bees bite (Insect bite) (Azam, 2013; Anonymous 1985)
- Scanty Urine (Nadkarni, 1989)
- *Gonorrhoea* (Gonorrhoea) (Nadkarni, 1989)
- Nervine Strain (Asabi Khichao) (Azam, 2013)
- *Wajaul Azalat* (Muscle-ache) (Anonymous, 1985)
- Fading on face (Ghulam, 2007)

Phytochemical constituents:

Roots

The mucilage content is highest in the root. It is compose of galacturonic acid, galactose, glucose, xylose, and rhamnose (Anonymus 1985,). The presence of mucous polysaccharide “althea mucilage O” is also reported. Along with mucilage (25-35%) the roots contains asparagin ($_C$ 2%), betaine, lecithin, phytosterol, sugars (5-10%), starch (30-38%), (Kirtikar & Basu, 1987. Nadkarni, 1989.). Pectin ($_C$11%), phosphate-rich minerals ($_C$ 7%) and fatty oil (1.7%) (Anonymus, 1985). Mucilage (25-35%), (Ambasta, 1992).

- The leaves: It contains 15.7% mucilage, essential oil (0.02%), and hydroxycinnamic acid. (Anonymus, 1985 208 page.)
- The Flower: It contains mucilage (5.8%), essential oil (0.02%).
- The Seed: Fatty oil 9 15.3%), having the composition of oleic, 30.8; lenoleic, 52.9; lenolenic, 2.5; palmitic, 9.7; and stearic acid, 9.7%

(Anonymus 1985) 208 page.) Seed oil contains Malvalic acid 12.7% (Asolkar, 1992).

- Organic; Alkaloids, saponin, resins, volatile oil. (SOSD part 1. 1987)
- Inorganic: Calcium (SOSD part 1. 1987)

Pharmacological studies:

- Antimicrobial activity (Muttalib *et al* 2013. Valiei *et al*, 2011).
- Antibacterial activity (Muttalib *et al*., 2013; Serrone *et al*., 2015; Valiei *et al*., 2011)
- Gastroprotective activity (Zaghlool *et al.*, 2015; Ahmad *et al.*, 2018)
- Antitussive activity (Rouhi *et al*, 2007.Ova G *et al*, 1992).
- Dental carries activities (Sonaye *et al*., 2017)
- Skin protecting activity (Curnow *et al*., 2016)
- Antiinflamatory activity (Amiri *et al*., 2010)
- Healing activity (Amiri *et al*., 2010)
- Antivenom activity (Amiri *et al*., 2010)
- Antifungal activity (Valiei *et al*., 2011)

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Chapter - 20

Fatty Liver Disease: Its Impact on Health and Unani Management

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Abstract

Fatty liver disease, currently recognised **as Metabolic Dysfunction Associated Steatotic Liver Disease (MASLD)**, has emerged as one of the most prevalent metabolic liver disorders globally, closely associated with obesity, insulin resistance, dyslipidaemia and sedentary lifestyles. Although frequently asymptomatic in its early stages, the disease has substantial clinical significance due to its potential progression from simple steatosis to steatohepatitis, fibrosis, cirrhosis and hepatocellular carcinoma, as well as its strong association with cardiovascular and other extra-hepatic complications. This chapter provides a comprehensive overview of fatty liver disease by integrating contemporary biomedical perspectives with classical Unani concepts. It outlines the anatomical and physiological importance of the liver, epidemiology, etiological factors, pathophysiological mechanisms, clinical manifestations, diagnostic modalities and the systemic impact of the disease. Particular emphasis is placed on Unani principles of management, including dietotherapy, regimental therapy and pharmacotherapy, along with commonly employed single drugs and compound formulations. Through an integrative and holistic approach, this chapter highlights the relevance and potential of Unani medicine in the prevention and long-term management of fatty liver disease.

Keywords: Fatty liver disease, NAFLD, Metabolic dysfunction–associated steatotic liver disease, MASLD, Unani Medicine, Hepatic temperament, Integrative management.

Introduction

Fatty liver disease represents one of the most important metabolic liver disorders of the present century, closely intertwined with changing lifestyles, dietary patterns and the rising burden of metabolic syndrome. It is

characterised by excessive accumulation of fat within hepatocytes, exceeding 5% of liver cells, in the absence of secondary causes such as significant alcohol intake, viral hepatitis, or drug-induced liver injury. Formerly termed Non-Alcoholic Fatty Liver Disease (NAFLD), the condition is now increasingly recognised as Metabolic Dysfunction–Associated Steatotic Liver Disease (MASLD) to reflect its metabolic origins and multisystem involvement better.

Fatty liver disease is not merely a localised hepatic condition; rather, it represents a systemic disorder with far-reaching consequences for cardiovascular health, endocrine balance, renal function and overall morbidity and mortality. Its high global prevalence, often silent clinical course and potential for progression to cirrhosis and hepatocellular carcinoma make it a major public health concern.

Anatomical and Functional Significance of the Liver

The liver is the largest solid organ of the body and serves as the central hub for metabolism, detoxification and homeostasis. Weighing approximately 1.2–1.5 kg in adults, it performs hundreds of vital functions, including carbohydrate, lipid and protein metabolism; synthesis of plasma proteins and clotting factors; bile formation; vitamin and mineral storage; and detoxification of endogenous and exogenous substances. Hepatocytes, the principal functional cells of the liver, are highly specialised to manage lipid uptake, synthesis, oxidation and export.

Disruption of these finely regulated processes leads to abnormal lipid accumulation within hepatocytes, setting the stage for fatty liver disease. When lipid overload overwhelms hepatic metabolic capacity, it initiates a cascade of cellular stress, inflammation and tissue injury that extends beyond the liver itself.

Definition and Classification of Fatty Liver Disease

Fatty liver disease encompasses a spectrum of pathological changes:

1. **Simple Steatosis (NAFL / MASLD-Steatosis):** Characterized by fat accumulation without significant inflammation or fibrosis. This stage is often benign but metabolically significant.
2. **Steatohepatitis (NASH / MASH):** Involves steatosis accompanied by hepatocellular ballooning, inflammation and varying degrees of fibrosis. This stage carries a high risk of progression.
3. **Advanced Fibrosis and Cirrhosis:** Progressive scarring disrupts normal liver architecture, leading to portal hypertension, liver failure and increased risk of hepatocellular carcinoma.

Histologically, steatosis may be macrovesicular or microvesicular, with macrovesicular steatosis being the most common form in metabolic fatty liver disease.

Epidemiology and Global Burden

Fatty liver disease affects approximately one-quarter of the global adult population, with prevalence rates rising steadily in parallel with obesity, type 2 diabetes mellitus and sedentary lifestyles. The burden is particularly high in the Middle East and South America, while Asian populations, including Indians, show a distinctive pattern of "lean fatty liver," where significant hepatic steatosis occurs despite normal or modest body mass index.

Men are more frequently affected than women and prevalence increases with age, peaking in middle adulthood. Importantly, fatty liver disease is now a leading cause of chronic liver disease worldwide and an emerging indication for liver transplantation.

Risk Factors and Aetiology

The development of fatty liver disease is multifactorial, involving complex interactions between genetic susceptibility, metabolic derangements and environmental influences. Major risk factors include:

- Central obesity and increased visceral fat
- Insulin resistance and type 2 diabetes mellitus
- Dyslipidemia and hypertension
- High intake of refined carbohydrates and fructose
- Physical inactivity and sedentary behavior
- Certain drugs and metabolic or endocrine disorders

Genetic polymorphisms affecting lipid metabolism further modulate individual susceptibility and disease severity.

Pathophysiology and Disease Progression

The current understanding favours the multiple-hit hypothesis, wherein several insults act simultaneously on a genetically predisposed liver. Excess free fatty acids from adipose tissue, increased de novo lipogenesis and impaired fatty acid oxidation lead to triglyceride accumulation within hepatocytes. While triglycerides themselves are relatively inert, their toxic intermediates induce oxidative stress, mitochondrial dysfunction and endoplasmic reticulum stress. These processes trigger inflammatory signaling

pathways, activation of Kupffer cells and recruitment of immune mediators, culminating in hepatocellular injury and fibrosis. Persistent injury and ineffective regeneration ultimately result in cirrhosis and hepatocellular carcinoma.

Clinical Features and Diagnosis

Most individuals with fatty liver disease remain asymptomatic for long periods. When present, symptoms are nonspecific and include fatigue, dyspepsia, malaise and mild right upper abdominal discomfort. Hepatomegaly is a common physical finding. Diagnosis relies on exclusion of secondary causes, assessment of metabolic risk factors, biochemical tests showing mild aminotransferase elevation and imaging modalities such as ultrasonography, CT, MRI and elastography. Liver biopsy remains the gold standard for staging and differentiating simple steatosis from steatohepatitis, though non-invasive fibrosis scores and elastography are increasingly used in clinical practice.

Impact on Systemic Health

Fatty liver disease exerts profound effects beyond the liver. Cardiovascular disease is the leading cause of mortality among affected individuals, reflecting shared metabolic risk factors and systemic inflammation. The condition is also linked to chronic kidney disease, endocrine disorders, colorectal cancer, osteoporosis and adverse pregnancy outcomes. The presence and stage of liver fibrosis are the strongest predictors of liver-related and overall mortality, underscoring the importance of early identification and intervention.

Management and Preventive Strategies

At present, no specific pharmacological therapy has been universally approved for the treatment of fatty liver disease in contemporary biomedicine. Hence, management primarily focuses on lifestyle modification, including gradual weight reduction, dietary optimisation and regular physical activity. Even a modest and sustained weight loss has been shown to significantly reduce hepatic steatosis, improve insulin sensitivity and correct associated metabolic abnormalities. Pharmacological agents targeting insulin resistance, oxidative stress, lipid metabolism and hepatic inflammation are under continuous investigation, while bariatric surgery and liver transplantation are reserved for selected patients with advanced disease. Preventive strategies addressing obesity, diabetes mellitus, dyslipidaemia and sedentary behaviour remain the cornerstone for reducing disease burden.

Unani Perspective on Management of Fatty Liver

In the Unani system of medicine, fatty liver disease closely corresponds to conditions such as ***Sü'-i-Mizāj-i-Kabid Bārid*** (pathological cold temperament of the liver) and ***Waram al-Kabid Balghamī*** (phlegmatic inflammation/enlargement of the liver). The fundamental objective of treatment (*Usūl-i-'Ilāj*) is the **restoration of normal hepatic temperament (*Ta'dīl-i-Mizāj*)**, strengthening of hepatic faculties (*Quwā-i-Kabid*), removal of morbid humours (*Tanqiya-i-Mawād-i-Fāsida*) and resolution of obstruction (*Fath-i-Sudūd*).

Unani management is holistic and individualised, encompassing **dietotherapy (*Ilāj bi'l-Ghidhā'*)**, **regimental therapy (*Ilāj bi'l-Tadbīr*)** and **pharmacotherapy (*Ilāj bi'l-Dawā'*)**.

***Ilāj bi'l-Ghidhā'* (Dietotherapy)**

Dietary regulation is considered central to the management of liver disorders. Foods that are **light, easily digestible and moderately warm in temperament** are recommended to counter hepatic coldness and phlegmatic predominance. Excessive intake of fatty, cold, viscous and sweet foods—known to generate *Balgham*—is discouraged. Overeating and eating before complete digestion of the previous meal are strictly prohibited, as they weaken hepatic digestion and promote fat accumulation.

***Ilāj bi'l-Tadbīr* (Regimental Therapy)**

Regimental measures aim to restore innate heat (*Harārat-i-Gharīziyya*) and enhance metabolic efficiency. These include:

- **Moderate physical activity and exercise**, which helps disperse accumulated phlegm and improves hepatic function
- **Regulation of sleep and wakefulness**, avoiding excessive rest
- **Stress reduction**, as fear and anxiety are recognized causes of hepatic cold temperament
- **Massage (Dalk)** and other supportive regimens when indicated

Such measures parallel modern recommendations emphasizing physical activity and lifestyle correction.

***Ilāj bi'l-Dawā'* (Pharmacotherapy)**

Unani pharmacotherapy focuses on drugs possessing ***Musakhkhin*** **(calefacient)**, ***Mufattiḥ-i-Sudūd*** **(de-obstruent)**, ***Muqawwī-i-Kabid*** **(hepatotonic)**,***Muḥallil*** **(anti-inflammatory)** properties. Classical Unani

texts recommend the use of single drugs and compound formulations to normalize hepatic temperament and improve digestion, assimilation and excretion.

Commonly described Unani drugs beneficial in fatty liver–like conditions include:

- **Zabīb (*Vitis vinifera*)** – hepatotonic, mild de-obstruent
- **Zafran (*Crocus sativus*)** – muqawwī-i-kabid, anti-inflammatory
- **Dārchīnī (*Cinnamomum zeylanicum*)** – musakhkhin, digestive stimulant
- **Kasnī (*Cichorium intybus*)** – liver cleanser and de-obstruent
- **Makoh (*Solanum nigrum*)** – anti-inflammatory and hepatoprotective
- **Shahtara (*Fumaria parviflora*)** – blood purifier and hepatic regulator

These drugs are often administered alone or in compound formulations, sometimes with **'Asal (honey)** to facilitate evacuation of cold and morbid humours, particularly in *Waram al-Kabid Balghamī.*

Preventive Approach in Unani Medicine

From a preventive standpoint, Unani medicine emphasizes ***Hifz-e-Ṣiḥḥat* (preservation of health)** through moderation in diet, regular physical activity, balanced temperament and avoidance of excessive cold exposure and sedentary habits. Early correction of abnormal temperament and timely strengthening of hepatic faculties are considered essential to prevent progression to complications such as *Du'f al-Kabid*, *Istisqā'* (ascites) and other systemic disorders.

Integrative Outlook

When viewed together, modern and Unani approaches converge on key principles—**lifestyle correction, metabolic balance and early intervention.** Integrating Unani dietary, regimental and pharmacological measures with contemporary lifestyle-based strategies offers a comprehensive, safe and culturally acceptable approach for the long-term management and prevention of fatty liver disease.

Fig 1: Non-Alcoholic fatty liver disease (NAFLD)

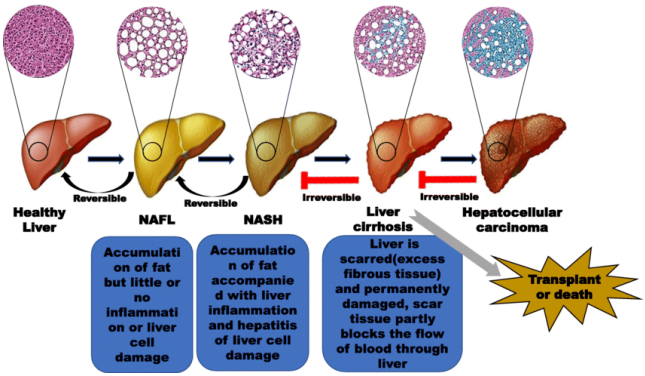

Fig. 2: The Spectrum of NAFLD

Conclusion

Fatty liver disease is a dynamic, multisystem disorder that reflects the metabolic health of modern societies. Though often silent in its early stages, it carries the potential for serious hepatic and extra-hepatic complications. Understanding its pathogenesis, clinical implications and impact on overall health is essential for timely diagnosis and effective management. Early lifestyle-based interventions, supported by evolving therapeutic strategies, offer the greatest promise for reducing the growing global burden of this disease.

Unani Drugs and Formulations for Fatty Liver Disease

Table 1: Unani Single Drugs

Unani Drug	Botanical Name	Temperament	Primary Unani Actions	Indications in Fatty Liver
Kasni	*Cichorium intybus*	Cold & moist	Hepatotonic, De-obstruent	Hepatic steatosis, dyspepsia
Makoh	*Solanum nigrum*	Cold & moist	Anti-inflammatory, Hepatoprotective	Waram al-Kabid Balghami
Zabib	*Vitis*	Hot & moist	Nutritive,	Liver

	vinifera		Hepatotonic	weakness
Zafran	*Crocus sativus*	Hot & dry	Stimulant, Hepatotonic	Cold liver temperament

Table 2: Unani Compound Formulations

Unani Formulation	Dosage Form	Major Unani Actions	Indications in Fatty Liver
Arq-e-Kasni	Distillate	Muqawwi-e-Kabid, Mufatteh-e-Sudad	Fatty liver, hepatomegaly
Arq-e-Makoh	Distillate	Muhallil, Muqawwi-e-Kabid	Waram al-Kabid, hepatic inflammation
Arq-e-Baranjasif	Distillate	Mufatteh-e-Sudad, Musaffi-e-Dam	Hepatic congestion, steatosis
Sharbat-e-Dinar	Syrup	Muqawwi-e-Kabid, Muhallil	Chronic liver weakness
Dawa-ul-Kurkum	Compound powder	Musakhkhin, Mufatteh-e-Sudad, Muqawwi-e-Kabid	Cold fatty liver, obesity-associated NAFLD
Majoon-e-Dabeed-ul-Ward	Electuary	Muqawwi-e-Kabid, Muhallil	Chronic liver weakness

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Chapter - 21

Introduction to Farm Machinery

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Abstract

Farm machinery forms the backbone of modern agriculture by enabling efficient, timely and precise execution of farm operations. Mechanization has significantly improved agricultural productivity, reduced dependence on human and animal labor and enhanced the quality of farm produce. This chapter introduces the concept of farm machinery, its classification, importance, scope and role in agricultural development. It also discusses the evolution of farm machinery, advantages of mechanization and challenges associated with its adoption, particularly in developing countries.

Keywords: Farm machinery, Agricultural mechanization, Power sources, Farm implements, Productivity, Sustainable agriculture

1. Introduction

Agriculture has evolved from traditional manual practices to mechanized systems to meet the growing demand for food, fiber and fuel. Farm machinery refers to the mechanical devices and equipment used in agricultural operations such as land preparation, sowing, planting, interculture, harvesting and post-harvest processing. The use of appropriate machinery enhances work efficiency, ensures timely operations and contributes to increased crop yields.

Farm mechanization is an essential component of modern agriculture, supporting large-scale farming, precision agriculture and sustainable production systems. It plays a vital role in reducing labor drudgery and improving overall farm profitability.

2. Meaning and Definition of Farm Machinery

Farm machinery includes all mechanical devices used on farms to perform various agricultural operations. These machines may be powered by human, animal, mechanical, electrical or renewable energy sources.

Definition:

Farm machinery can be defined as the tools, implements and equipment used in agricultural production to improve efficiency, productivity and quality of work.

3. Importance of Farm Machinery in Agriculture

The importance of farm machinery can be summarized as follows:

- Timely completion of farm operations
- Increased agricultural productivity and efficiency
- Reduction in human and animal labor
- Improved precision and uniformity in field operations
- Expansion of cultivated area
- Reduction in production costs in the long term
- Enhanced safety and working conditions

4. Classification of Farm Machinery

4.1. Based on Power Source

- **Human-powered tools:** Hand hoes, sickles, spades
- **Animal-powered implements:** Ploughs, harrows, seed drills
- **Mechanical power:** Tractors, power tillers
- **Electrical power:** Irrigation pumps, stationary machines
- **Renewable energy-based machines:** Solar pumps, wind-powered devices

4.2. Based on Function

- **Tillage machinery:** Ploughs, harrows, cultivators
- **Sowing and planting machinery:** Seed drills, planters
- **Intercultural equipment:** Weed hoes, rotary weeders
- **Plant protection machinery:** Sprayers, dusters
- **Harvesting machinery:** Reapers, combines
- **Post-harvest machinery:** Threshers, cleaners, graders

5. Evolution of Farm Machinery

The evolution of farm machinery has progressed through several stages:

- Manual tools in traditional agriculture
- Animal-drawn implements
- Introduction of steam-powered machines
- Development of internal combustion engine-powered machinery
- Modern era of precision, autonomous and smart machinery

Advancements in materials, electronics and information technology have revolutionized farm machinery design and operation.

6. Scope of Farm Mechanization

Farm mechanization extends beyond crop production and includes:

- Horticulture and plantation crops
- Livestock and dairy farming
- Fisheries and aquaculture
- Post-harvest processing and storage
- Precision and digital agriculture

Mechanization supports sustainable agriculture by promoting resource-use efficiency and reducing environmental impacts.

7. Advantages of Farm Machinery

- Higher work output per unit time
- Improved product quality
- Reduced labor requirement
- Better utilization of inputs such as seed and fertilizer
- Increased cropping intensity

8. Constraints and Challenges

Despite its advantages, farm machinery adoption faces several challenges:

- High initial investment cost
- Small and fragmented landholdings

- Limited access to credit and technical support
- Lack of skilled operators
- Maintenance and repair issues

Custom hiring centers and cooperative ownership models can help overcome these constraints.

9. Role of Farm Machinery in Sustainable Agriculture

Farm machinery contributes to sustainability by enabling:

- Conservation tillage
- Precision input application
- Efficient water and energy use
- Reduced post-harvest losses

Modern machinery supports climate-smart agriculture and resource conservation.

10. Conclusion

Farm machinery is an indispensable component of modern agriculture, contributing significantly to increased productivity, efficiency and sustainability. Understanding the fundamentals of farm machinery is essential for students, researchers and farmers to make informed decisions regarding machinery selection and use. Continued innovation, policy support and farmer training are crucial for achieving balanced and inclusive agricultural mechanization.

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Chapter - 22

Machinery Management and Safety in Agriculture

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Abstract

Mechanization plays a vital role in improving agricultural productivity, reducing labor drudgery and enhancing operational efficiency. However, the effective use of farm machinery requires proper management and strict adherence to safety practices. Poor machinery management leads to increased operating costs, frequent breakdowns, reduced machine life and low field efficiency, while unsafe practices often result in accidents, injuries and loss of life. This chapter discusses the principles of agricultural machinery management, including selection, operation, maintenance, cost analysis and replacement decisions. It also highlights the importance of farm machinery safety, common causes of accidents, safety devices and preventive measures. Emphasis is given to developing safe work environments and promoting awareness to ensure sustainable and efficient agricultural mechanization.

Keywords: Farm machinery management, Agricultural safety, Machinery maintenance, Farm accidents, Mechanization efficiency and Equipment operation.

1. Introduction

Agricultural mechanization has transformed farming systems by increasing operational speed, precision and productivity. Farm machinery such as tractors, tillage implements, planters, harvesters and post-harvest equipment are widely used across different scales of farming. While mechanization offers numerous benefits, improper management and unsafe use of machinery can lead to economic losses and serious safety hazards.

Machinery management ensures optimal utilization, reduced costs and extended service life of equipment, whereas machinery safety focuses on preventing accidents and protecting operators and bystanders. This chapter presents an integrated approach to machinery management and safety, emphasizing their importance in sustainable agricultural development.

2. Machinery Management: Concept and Importance

Machinery management involves the planning, acquisition, utilization, maintenance and replacement of farm machinery in a systematic and economical manner. The primary goal is to perform farm operations efficiently, at the right time and at the lowest possible cost.

The importance of machinery management lies in:

- Ensuring timely completion of critical farm operations
- Reducing ownership and operating costs
- Increasing machine life and reliability
- Improving field efficiency and fuel economy
- Enhancing overall farm profitability

Effective machinery management is particularly important for small and medium farmers, where capital investment in machinery is high relative to farm income.

3. Selection and Matching of Farm Machinery

Proper selection of machinery is the foundation of good management. Machinery selection depends on factors such as farm size, cropping pattern, soil type, terrain, availability of power and financial capacity of the farmer. Selecting oversized machinery leads to underutilization and high fixed costs, while undersized machinery results in delayed operations and excessive wear.

Matching tractor power with implements is equally important. A properly matched system ensures efficient power transfer, optimal fuel consumption, reduced slippage and better field performance. Economic analysis, including cost per hour and annual use, helps in making sound selection decisions.

4. Operation, Scheduling and Utilization

Efficient operation of farm machinery requires skilled operators, proper machine adjustment and adherence to recommended operating conditions. Operator skill significantly affects field efficiency, fuel consumption and machine wear.

Machinery scheduling ensures that operations such as land preparation, sowing, irrigation and harvesting are completed within the optimum time window. Delays in operations often lead to yield losses, increased costs and reduced profitability. Proper scheduling improves machine utilization and reduces idle time.

Key performance indicators in machinery operation include effective field capacity, field efficiency, fuel use efficiency and labor productivity.

5. Maintenance and Repair Management

Maintenance is a crucial component of machinery management. It includes routine inspection, lubrication, adjustments and timely repairs.

5.1. Types of Maintenance

- **Preventive maintenance:** Regular servicing to prevent failures
- **Corrective maintenance:** Repair after breakdown
- **Predictive maintenance:** Based on condition monitoring

Proper maintenance:

- Reduces breakdown frequency
- Increases machine life
- Improves safety and performance

6. Cost Analysis and Replacement Decisions

Machinery costs are classified into:

- **Fixed costs:** Depreciation, interest, housing, insurance
- **Variable costs:** Fuel, lubrication, repair, labor

Economic analysis helps determine:

- Cost per hour of operation
- Break-even use
- Optimal replacement time

Replacing machinery at the right time avoids excessive repair costs and efficiency losses.

7. Importance of Farm Machinery Safety

Agriculture is one of the most hazardous occupations due to the extensive use of machinery. Accidents often occur because of poor maintenance, lack of training, unsafe operating practices and absence of protective devices.

Machinery safety aims to:

- Prevent injuries and fatalities
- Reduce damage to equipment

- Improve working conditions
- Enhance operator confidence

8. Common Causes of Farm Machinery Accidents

- Lack of operator training
- Improper use of machinery
- Absence of safety guards and shields
- Fatigue and negligence
- Loose clothing and poor posture
- Operating machinery under alcohol or stress

9. Safety Devices and Protective Measures

Modern farm machinery is equipped with several safety features, including:

- Power take-off (PTO) guards
- Roll-over protective structures (ROPS)
- Safety shields and covers
- Emergency stop mechanisms
- Proper lighting and warning signs

Personal protective equipment (PPE) such as gloves, helmets, safety shoes and ear protection further reduces injury risk

10. Safe Operating Practices

To ensure machinery safety:

- Operators should be properly trained
- Machinery manuals must be followed
- Regular inspection and maintenance should be conducted
- Children and untrained persons should be kept away
- Machines should never be serviced while running

Creating awareness and safety training programs is essential for reducing farm accidents.

11. Role of Training and Awareness

Training programs, demonstrations and extension services play a key role in improving machinery management and safety. Educating farmers and operators about correct machine handling, maintenance and hazard prevention significantly reduces accidents and improves efficiency.

12. Conclusion

Machinery management and safety are critical components of modern agricultural mechanization. Efficient management ensures optimal utilization, reduced costs and longer service life of farm machinery, while effective safety practices protect human life and prevent accidents. Integrating proper planning, skilled operation, regular maintenance and safety awareness is essential for sustainable and profitable agriculture. Strengthening training programs and adopting safety-oriented machinery designs will further enhance the benefits of agricultural mechanization.

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Chapter - 23

Organic Farming in Agriculture: Principles, Practices, Benefits and Challenges

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Abstract

Organic farming is an environmentally sustainable agricultural system that emphasizes the use of natural inputs, ecological balance and biodiversity conservation while avoiding synthetic fertilizers, pesticides and genetically modified organisms. Growing concerns over soil degradation, environmental pollution, climate change and food safety have accelerated global interest in organic agriculture. This chapter provides a comprehensive overview of organic farming, including its principles, key practices, benefits, challenges and future prospects. The role of organic farming in enhancing soil health, promoting biodiversity, ensuring food safety and supporting sustainable rural livelihoods is discussed. The chapter also highlights the limitations associated with organic agriculture, such as lower initial yields, certification constraints and market access issues, while emphasizing its potential contribution to sustainable food systems.

Keywords: Organic farming, Sustainable agriculture, Soil health, Biodiversity, Eco-friendly farming, Organic certification.

1. Introduction

Modern conventional agriculture has significantly increased food production; however, it has also led to several environmental and socio-economic challenges, including soil degradation, water pollution, loss of biodiversity and increased dependence on chemical inputs. In response to these concerns, organic farming has emerged as a viable alternative that promotes ecological balance and long-term agricultural sustainability. Organic farming is based on natural ecological processes and seeks to maintain soil fertility, reduce environmental pollution and produce safe, high-quality food. It integrates traditional knowledge with modern scientific understanding to manage crops and livestock in harmony with nature. This

chapter examines the fundamental concepts of organic farming, its practices, advantages, limitations and future potential in global agriculture.

2. Concept and Principles of Organic Farming

Organic farming is defined as a holistic production management system that enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. The core principles of organic farming, as outlined by international organic organizations, include:

- Sustaining and enhancing the health of soil, plants, animals, humans and the planet.
- Working with natural ecological systems and cycles.
- Ensuring equity, respect and justice in agricultural relationships.
- Managing agriculture responsibly to protect current and future generations.

3. Practices in Organic Farming

Soil Fertility Management

Organic farming relies on organic manures, compost, green manuring, crop residues and biofertilizers to maintain soil fertility and biological activity.

Crop Rotation and Diversification

Rotating crops and diversifying plant species help break pest and disease cycles, improve soil structure and enhance nutrient availability.

Organic Pest and Disease Management

Pest control in organic farming is achieved through biological control agents, botanical pesticides, trap crops and cultural practices rather than synthetic chemicals.

Weed Management

Weeds are controlled using mechanical methods, mulching, cover crops and manual weeding.

Organic Livestock Management

Organic livestock systems emphasize animal welfare, organic feed, natural disease prevention and free-range practices.

4. Benefits of Organic Farming

- Organic farming improves soil structure, increases organic matter, enhances biodiversity and reduces water and air pollution.

- Organic products often fetch premium prices, improving farm income and market opportunities for small-scale farmers.
- Organic farming promotes rural employment, traditional knowledge and community-based farming systems.
- The absence of synthetic chemical residues in organic food contributes to improved consumer health and food safety.

5. Challenges and Limitations of Organic Farming

Despite its advantages, organic farming faces several challenges:

- **Lower Initial Yields:** Crop yields may be lower during the transition period.
- **Certification and Compliance Costs:** Organic certification can be costly and time-consuming.
- **Limited Availability of Organic Inputs:** Access to quality organic seeds and bio-inputs may be limited.
- **Labor Intensity:** Organic farming often requires more labor than conventional farming.
- **Market Access Issues:** Inadequate infrastructure and market linkages can limit profitability.

6. Role of Organic Farming in Sustainable Agriculture

Organic farming contributes to climate-resilient agriculture by improving soil carbon sequestration, reducing greenhouse gas emissions and enhancing ecosystem services. It aligns with global sustainability goals by promoting environmentally responsible production systems and supporting sustainable livelihoods.

7. Conclusion

Organic farming represents a sustainable and eco-friendly approach to agricultural production that prioritizes soil health, environmental protection and human well-being. Although challenges such as yield limitations, certification hurdles and market constraints exist, the long-term benefits of organic farming outweigh these limitations. With supportive policies, farmer education and improved market access, organic farming has the potential to play a significant role in ensuring sustainable food security and environmental conservation in the future.

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