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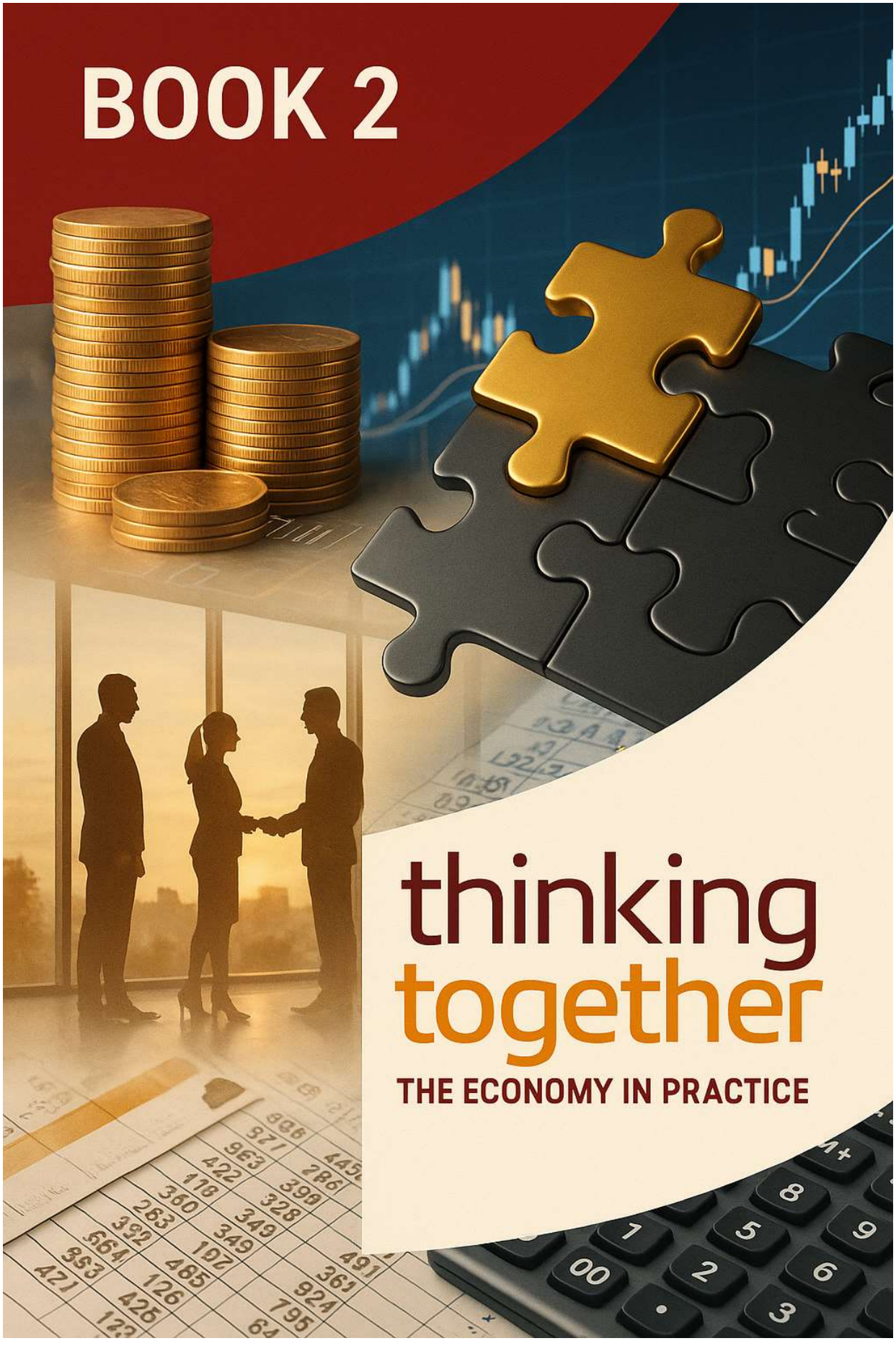

thinking together

THE ECONOMY IN PRACTICE

THINKING TOGETHER
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ÓBUDA UNIVERSITY
2025

THINKING TOGETHER

THE ECONOMY IN PRACTICE

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FOREWORD

In an era defined by rapid change and increasing complexity, this book embarks on a journey of exploration, weaving together diverse perspectives on human experience, the transformative power of technology, and the pressing challenges facing our world today. From the intricacies of human biology and psychology to the evolving landscape of technology, economics, and business, these chapters address subjects central to our understanding of the modern world.

The exploration begins with a focus on women's health, venturing into the complexities of female hormones and the psychological challenges associated with infertility. This highlights the critical importance of understanding the biological and emotional factors that impact the well-being and reproductive health of women.

The collection then transitions to the intersection of technology and education, examining the potential of robots to enhance educational efficiency and economic outcomes. This investigation raises important questions about the future of learning and the role of robotics in shaping educational practices.

Several studies address key economic and business considerations. The analysis of general practitioner financing in Hungary and Austria offers a valuable cross-cultural perspective on the economic realities of primary care in two distinct European contexts. The research on the sharing economy and mobile applications explores the factors driving the acceptance and usage of these innovative platforms, while the study on consumer trust in the retail sector underscores the enduring importance of trust as a source of competitive advantage.

Finally, the collection examines the growing importance of sustainability in green supply chain management practices, highlighting the adoption of environmentally responsible business practices, while the research on leadership development with mindfulness offers insights into cultivating effective and ethical leadership in an increasingly demanding world.

This book aims to provide a diverse and thought-provoking exploration of key issues facing the 21st century. It invites readers to engage with these topics critically, to question assumptions, and to consider the implications for individuals, societies, and the planet. We hope that this collection of insights will inspire further discussion, research, and action as we navigate the complexities of the 21st century.

Andrea Tick

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UNDERSTANDING FEMALE HORMONES: A GUIDE TO THEIR COMPLEXITY AND EVERYDAY IMPACT

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Abstract: Hormones are critical regulators of numerous physiological processes in women, influencing reproduction, metabolism, mood, and stress response. This paper provides a comprehensive overview of key hormones such as oestrogen, progesterone, and testosterone, emphasizing their roles beyond reproductive health. Oestrogen supports bone density, cardiovascular health, and cognitive function, while progesterone aids in pregnancy preparation and mood regulation. Testosterone, though present in smaller amounts in women, contributes to muscle mass and libido. The paper also explores hormonal changes during menopause, highlighting symptoms such as hot flashes and increased risks of osteoporosis, and considers hormone replacement therapy (HRT) as a management option.

Keywords: *female hormones, everyday consequences, systemic approach*

Introduction

Hormones are chemical messengers that have a profound influence on the body, orchestrating everything from growth and metabolism to mood, stress responses, and reproductive functions (Christensen et al., 2012). For women, the balance and interplay of these hormones are especially critical, as they impact everything from monthly cycles to long-term health. Understanding the complexity of female hormones can help demystify many aspects of daily life, from energy levels and mood swings to sleep quality and stress resilience (Brannon, 2020). This article dives into the intricate world of hormones, highlighting their various roles and how they shape women's physical and emotional well-being.

Major Hormones in Female Physiology

The hormonal landscape in women is dominated by a few key players: oestrogen, progesterone, and testosterone. These hormones are essential for regulating reproductive functions, but their influence extends far beyond fertility (Christensen et al., 2012).

Often termed the "primary female hormone", oestrogen is produced mainly by the ovaries, with smaller amounts coming from the adrenal glands and fat tissue. It governs the menstrual cycle and plays a pivotal role in sexual and reproductive health. However, oestrogen's reach goes beyond reproduction–it also helps maintain bone density, skin health, cardiovascular function, and even cognitive processes, such as memory and mood regulation (Salerni et al., 2015). Its neuroprotective properties make it vital for brain

health, which is why fluctuations during perimenopause and menopause can have a notable impact on cognitive functions (Matsumoto, 2013).

Progesterone is a hormone synthesized in the ovaries, primarily after ovulation and during pregnancy by the placenta. Progesterone prepares the uterus for a potential pregnancy by thickening the uterine lining, making it crucial for supporting early embryo development. Beyond its reproductive roles, progesterone has a calming effect on the body, often acting as a natural mood stabilizer. It is known to promote restful sleep and help balance the stimulating effects of oestrogen, contributing to an overall sense of well-being throughout the menstrual cycle (Brannon, 2020).

Although testosterone is commonly associated with male physiology, it also plays an essential role in female health. Women produce testosterone in smaller amounts in their ovaries and adrenal glands. It helps regulate libido, contributes to muscle mass, and supports bone strength. During menopause, testosterone levels decline contributing to reduced energy levels, diminished muscle tone, and reduced sexual drive (Hansen, 2018). Understanding the role of testosterone helps to highlight that hormone health is not just about "female" or "male" hormones but rather about maintaining a balanced hormonal ecosystem.

While the hormonal landscape of women is dominated by the previously mentioned few key players (oestrogen, progesterone, and testosterone), other hormones, such as Follicle-Stimulating Hormone (FSH), Luteinizing Hormone (LH), Anti-Müllerian Hormone (AMH), Human Chorionic Gonadotropin (hCG), and oxytocin, play equally vital roles in the regulation of reproductive health and overall physiological balance (Silva et al., 2018).

Follicle-Stimulating Hormone (FSH), which is produced by the pituitary gland, plays a critical role in the menstrual cycle and the development of eggs in the ovaries. During the first half of the menstrual cycle, FSH stimulates the growth of ovarian follicles, which contain the eggs. In response to rising levels of FSH, these follicles produce oestrogen, which helps regulate the development of the uterine lining in preparation for potential pregnancy. As women age and their ovarian reserve decreases, FSH levels naturally increase, which can serve as an indicator of fertility status. FSH is often measured during fertility assessments, making it a key hormone for understanding reproductive health (Christensen et al., 2012).

Also produced by the pituitary gland, Luteinizing Hormone (LH) works closely with FSH to regulate the menstrual cycle. LH levels surge mid-cycle, triggering ovulation—the release of a mature egg from the ovary. This surge is essential for maintaining the luteal phase of the cycle, during which progesterone levels rise to support the development of the uterine lining. If pregnancy does not occur, LH levels drop, leading to the onset of menstruation. The timing of the LH surge is critical for understanding fertility windows, making it a focus for those tracking ovulation for conception purposes (Brannon, 2020).

The Anti-Müllerian Hormone (AMH) is produced by the small follicles in the ovaries and serves as a marker of ovarian reserve, which refers to the number of remaining

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eggs a woman has. Unlike FSH, which fluctuates throughout the menstrual cycle, AMH levels remain relatively stable, thereby providing a more consistent measurement of ovarian function. AMH levels are often used in fertility treatments to predict how a woman's ovaries will respond to ovarian stimulation. Low levels of AMH can indicate reduced fertility potential, whereas higher levels are associated with conditions such as polycystic ovary syndrome (PCOS), which can affect ovulation (Bhide & Homburg, 2016).

Human Chorionic Gonadotropin (hCG) is a hormone produced by the placenta shortly after a fertilized egg attaches to the uterine lining. It plays a critical role in maintaining the early stages of pregnancy by supporting the corpus luteum, which in turn produces progesterone to sustain the uterine lining. hCG levels rise rapidly in the early weeks of pregnancy, which is why it is the hormone detected by home pregnancy tests. Beyond its role in early pregnancy, hCG also supports immune tolerance of the developing embryo, ensuring that the mother's immune system does not reject the pregnancy (Brannon, 2020). Its presence and levels can provide valuable insights into the health and progression of a pregnancy.

Oxytocin, which is often called the "love hormone", is produced in the hypothalamus and released by the pituitary gland. It is most commonly associated with childbirth and breastfeeding, as it stimulates uterine contractions during labour and helps the milk let-down reflex during breastfeeding. Beyond its reproductive roles, oxytocin also plays a significant part in social bonding and emotional regulation. It is involved in maternal bonding with a newborn, as well as in romantic and social relationships, contributing to feelings of trust and connection. Recent studies have highlighted oxytocin's role in reducing stress and promoting feelings of calm, making it an important hormone for overall emotional well-being (Kumsta & Heinrichs, 2013).

As it is clearly visible, these additional hormones interact closely with oestrogen, progesterone, and testosterone to regulate various stages of the menstrual cycle, pregnancy, and overall reproductive health. Their functions emphasize the delicate balance required to maintain fertility and highlight the body's ability to adapt to different phases of life, from puberty to pregnancy, and eventually to menopause. Together, they create a dynamic hormonal network that affects not only physical processes but also emotional and social experiences, reflecting the profound impact hormones have on every aspect of a woman's life.

The Impact of Female Hormones on Bodily Systems

While oestrogen and progesterone are often discussed in the context of reproduction, their roles extend far beyond the ovaries and the menstrual cycle. These hormones interact with numerous bodily systems, shaping cardiovascular health, supporting brain function, influencing respiratory efficiency, and even playing a role in immune responses (Baldaçara & Silva, 2017). By exploring the wider influence of these hormones, we can appreciate the integral roles they play in maintaining overall health and well-being (Eubanks, 1997).

The cardiovascular system is one of the most significantly affected by oestrogen. Oestrogen helps to maintain the flexibility and integrity of blood vessels, which is critical for smooth blood flow and reducing the risk of cardiovascular diseases. It promotes the production of nitric oxide, a molecule that dilates blood vessels, thereby helping to keep blood pressure in check and ensuring that oxygen and nutrients are efficiently delivered throughout the body (Salerni et al., 2015). Additionally, oestrogen has a positive effect on cholesterol levels; it raises levels of HDL (the "good" cholesterol) and lowers LDL (the "bad" cholesterol). This balance helps prevent the buildup of plaque in arteries, reducing the risk of atherosclerosis and heart attacks. However, as oestrogen levels decline with menopause, this protective effect diminishes, which is why postmenopausal women face an increased risk of cardiovascular conditions. This connection between oestrogen and heart health highlights the importance of heart-healthy lifestyle choices, such as a balanced diet and regular exercise, particularly as women age.

Progesterone, while more commonly associated with pregnancy, also has notable effects on cardiovascular function (Salerni et al., 2015). It has a calming effect on the smooth muscles of blood vessels, helping to prevent excessive constriction and thereby promoting healthy blood flow. In some instances, progesterone can complement the vasodilatory effects of oestrogen, supporting overall cardiovascular stability. However, its influence is more subtle compared to oestrogen, and fluctuations in progesterone levels can contribute to symptoms like bloating and fluid retention, which may impact blood pressure. During the menstrual cycle, the rise and fall of progesterone can influence blood pressure patterns, which some women may notice as temporary changes in energy levels or circulation. Understanding progesterone's role alongside oestrogen paints a more complete picture of how hormones shape cardiovascular health.

Of course, it is not only oestrogen and progesterone that play a critical role in maintaining cardiovascular health, influencing everything from heart rate to blood vessel flexibility. Testosterone also contributes to cardiovascular health, though its role is often less recognized (Salerni et al., 2015). In women, testosterone helps maintain the balance of red blood cell production, which is crucial for oxygen transport and overall energy levels. Adequate testosterone levels can support heart function by ensuring sufficient blood supply to the tissues, thereby reducing the risk of anaemia. Additionally, testosterone has been shown to positively influence the function of blood vessels, contributing to healthy circulation and overall cardiovascular resilience. An imbalance in testosterone can lead to issues such as hypertension or increased cholesterol levels, underscoring the importance of maintaining hormonal balance for heart health. Thyroid hormones, including triiodothyronine (T3) and thyroxine (T4), are pivotal in regulating heart rate and cardiac output. These hormones directly influence metabolic processes, ensuring that the body can efficiently utilize energy. An overactive thyroid, or hyperthyroidism, can lead to increased heart rate and a heightened risk of cardiovascular complications, while hypothyroidism may result in decreased heart function and elevated cholesterol levels (Hulbert, 2000). Therefore, maintaining proper thyroid function is crucial for cardiovascular health, especially as hormonal fluctuations can occur during different life stages.

Beyond the heart, oestrogen also plays a pivotal role in supporting neural health, influencing brain function and emotional regulation (Cutter et al. 2003). Oestrogen has

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neuroprotective properties; it promotes the growth and survival of neurons and helps to maintain synaptic connections, which are essential for communication between brain cells. This is particularly important for memory formation and cognitive processes, explaining why some women experience changes in memory or cognitive clarity as oestrogen levels fluctuate during perimenopause and menopause. Oestrogen's impact on the brain extends to mood regulation as well; it influences the production of neurotransmitters like serotonin, which is closely linked to feelings of well-being and happiness. This is why hormonal shifts can sometimes trigger mood swings, anxiety, or even depression. The decline in oestrogen during menopause can lead to what some refer to as "brain fog" or a feeling of mental sluggishness. These changes underscore the deep connection between hormonal health and cognitive function, emphasizing the need for support strategies during life transitions like menopause.

Progesterone contributes to neural health as well, but in a different way. It has a soothing, sedative effect on the brain, often acting as a natural antidepressant. This calming influence is particularly evident in the luteal phase of the menstrual cycle, when progesterone levels peak after ovulation. During this time, progesterone can promote better sleep quality by interacting with GABA receptors in the brain, which are responsible for relaxation and reducing anxiety (Rapkin, 1999). This makes progesterone a key player in managing stress responses and supporting restful sleep. However, when progesterone levels are imbalanced or drop too sharply, it can contribute to premenstrual syndrome (PMS) symptoms, such as irritability and insomnia. The intricate balance between oestrogen's stimulating effects and progesterone's calming influence highlights how these hormones work together to create emotional stability and mental clarity throughout the menstrual cycle.

The influence of various other hormones on neural function is also profound, affecting mood, cognition, and overall brain health (Brannon, 2020). Testosterone is important for cognitive function in women; it helps enhance memory and spatial awareness. It also contributes to neuroprotection by promoting the growth and maintenance of neurons, which can aid in preventing neurodegenerative conditions. Research indicates that women with optimal testosterone levels may experience improved cognitive resilience, highlighting its role in mental clarity and focus, especially during aging. Thyroid hormones also have a significant impact on brain function. Adequate levels of T3 and T4 are crucial for maintaining energy levels in brain cells and supporting neurotransmitter function. When thyroid hormone levels are imbalanced, cognitive impairments may arise; for instance, hypothyroidism can lead to difficulties with memory and concentration, often described as "brain fog." Conversely, hyperthyroidism can result in anxiety and irritability due to overstimulation of the nervous system (Demet, 2002). Thus, maintaining balanced thyroid hormones is essential for cognitive health and emotional stability.

When it comes to the respiratory system, oestrogen also shows its influence, albeit in less obvious ways (Tam, 2011). Oestrogen can enhance the sensitivity of the respiratory centres in the brain to carbon dioxide, which helps to regulate breathing patterns, especially during sleep. This sensitivity is thought to be one reason why some women experience changes in their breathing or an increased incidence of sleep apnoea after

menopause, when oestrogen levels drop. Oestrogen also plays a role in maintaining the strength of the diaphragm and other muscles involved in breathing, which can influence overall lung function. For women, the decrease in oestrogen during menopause can sometimes coincide with a reduction in lung capacity and efficiency, highlighting how hormonal health can impact physical stamina and endurance over time (Yunget al., 2018).

Progesterone also plays a unique role in respiratory health. It has been shown to stimulate respiration by increasing the sensitivity of the respiratory centres to carbon dioxide, leading to deeper breathing (Baldaçara & Silva, 2017). This is particularly evident during pregnancy, when elevated levels of progesterone help to ensure that both the mother and the developing foetus receive sufficient oxygen. This respiratory stimulation can sometimes cause a sense of shortness of breath during the second half of the menstrual cycle, but it is generally a sign of the body's natural adjustments to hormonal shifts. The interplay between progesterone and oestrogen in regulating breathing patterns showcases how deeply hormones can influence physical functions that are often taken for granted.

In the realm of respiratory function, testosterone and thyroid hormones play complementary roles. Testosterone can enhance respiratory muscle strength, including the diaphragm, which is vital for effective breathing. Improved respiratory muscle function can lead to increased lung capacity and efficiency, particularly during physical activity (Alexander et al., 2022). The relationship between testosterone and overall respiratory function highlights the importance of this hormone in maintaining an active lifestyle. Thyroid hormones, particularly T3, influence the respiratory centres in the brain, helping to regulate breathing patterns. They enhance the sensitivity of the respiratory centres to changes in carbon dioxide levels, ensuring that the body responds appropriately to fluctuations in oxygen demand (Baldaçara & Silva, 2017). When thyroid hormone levels are balanced, this regulation helps maintain optimal respiratory efficiency. Conversely, thyroid dysfunction can lead to breathing irregularities, further emphasizing the importance of hormonal health in respiratory performance.

Finally, hormones like oestrogen and progesterone also interact with the immune system, influencing its activity and responsiveness (Ortona et al., 2019). Oestrogen generally enhances immune function, helping to activate immune cells that fight off infections and repair tissues. This may contribute to the fact that women tend to have stronger immune responses than men, but it also means that women are more prone to autoimmune conditions, where the immune system mistakenly attacks the body's own tissues. Progesterone, on the other hand, has an immune-modulating effect; it helps to reduce inflammation and prevents the immune system from becoming overactive, which is particularly important during pregnancy to protect the foetus. This balance between oestrogen's stimulating effect and progesterone's calming influence on the immune system highlights another layer of their complex roles in maintaining health (Ortona et al., 2019).

When it comes to the impact of hormones on the immune system, cortisol plays a central role. As the body's primary stress hormone, cortisol is essential for managing the immune response, helping mobilise energy and resources during times of stress (Ortona, et al., 2019). However, while cortisol is necessary for initiating immune responses, chronic elevation of cortisol levels can suppress immune function and increase susceptibility to

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infections and illnesses. This highlights the importance of stress management and the need to balance cortisol levels to maintain a healthy immune system. In addition to cortisol, prolactin plays a unique role in immune regulation. Traditionally known for its role in lactation, prolactin also modulates immune responses by influencing immune cell activity. It has been shown to enhance the production of antibodies, which are crucial for fighting infections. Interestingly, prolactin levels fluctuate with stress and can be elevated in women experiencing significant psychological or physical stressors, which may have implications for immune function. The interaction between prolactin and cortisol underscores the complex relationship between hormones and the immune system, emphasising the need for holistic approaches to health that consider stress and hormonal balance (Ortona et al., 2019).

Overall, the role of various female hormones extends far beyond reproduction, influencing key bodily systems including cardiovascular, neural, respiratory, and immune functions. Understanding the intricate ways in which these hormones interact with each system can provide insights into the maintenance of overall health. From the supportive role of testosterone in heart and brain health to the critical functions of thyroid hormones and the regulatory effects of cortisol and prolactin, it is clear that hormonal balance is essential for women's well-being throughout their lives. By fostering awareness of these influences, women can better navigate their health, especially during times of hormonal changes, ensuring a holistic approach to maintaining vitality and resilience.

Hormones and Bone Health

While female hormones clearly affect every sphere of our everyday lives, in aging populations one of the most important aspects is connected to the often overlooked aspect of bone health. Oestrogen and testosterone both play a role in maintaining bone density, ensuring a healthy balance between bone formation and bone resorption, the natural process of breaking down old bone tissue (Rizzoli & Bonjour, 1997).

As women age, particularly after menopause, the decrease in oestrogen levels can lead to a rapid loss of bone density, making women more susceptible to osteoporosis—a condition characterized by weak and brittle bones. Oestrogen's role in supporting bone health underscores the importance of hormone replacement therapy (HRT) as an option for some women during menopause to help mitigate this risk.

Additionally, testosterone's support in maintaining muscle mass indirectly helps bone health by encouraging physical activity and weight-bearing exercises, which are crucial for bone strength (Alexander et al., 2022). Integrating regular exercise and ensuring adequate intake of calcium and vitamin D can be powerful preventive measures against age-related bone loss (Rizzoli & Bonjour, 1997). This aspect of hormone interaction highlights the broader systemic impacts hormones have on the body, influencing how we move and stay active as we age.

Naturally, the relationship between hormones and bone health extends far beyond oestrogen and testosterone. A variety of other hormones play vital roles in maintaining bone density and supporting the musculoskeletal system, working together to ensure bones

remain strong and resilient throughout life. Understanding this complex hormonal network can help explain why maintaining bone health requires a multifaceted approach, especially as women age (Rizzoli & Bonjour, 1997). One of the key players in this network is parathyroid hormone (PTH), which is secreted by the parathyroid glands and is essential for regulating calcium levels in the blood. Calcium is a crucial mineral for building and maintaining strong bones, and PTH ensures that sufficient levels of calcium are available by stimulating its release from bones when blood levels are low. It also aids in the absorption of calcium in the intestines, making sure the body can make the most of dietary intake. However, too much PTH can lead to excessive calcium withdrawal from bones, resulting in conditions like hyperparathyroidism, which can thin bones over time. This delicate balance underscores the importance of not just hormonal regulation but also ensuring adequate calcium intake through diet.

Working in tandem with PTH is calcitonin, a hormone produced by the thyroid gland that helps to lower blood calcium levels by inhibiting the activity of osteoclasts—cells that break down bone tissue. While calcitonin's role is more prominent during periods of rapid growth in childhood and adolescence, it continues to support bone health in adults by helping to maintain bone density (Rizzoli & Bonjour, 1997). Researchers are exploring the potential of calcitonin-based therapies for managing osteoporosis, especially in postmenopausal women, highlighting how this hormone could help counterbalance the natural decline of oestrogen.

The effects of hormones on bone health are not limited to calcium regulation. Growth hormone (GH) and insulin-like growth factor 1 (IGF-1), which are primarily known for their role in stimulating growth during childhood and adolescence, continue to be influential in adulthood. GH, produced by the pituitary gland, prompts the liver to release IGF-1, which in turn stimulates the activity of osteoblasts—cells responsible for building new bone. This process helps maintain bone density and promotes the regeneration of bone tissue (Rizzoli & Bonjour, 1997). As levels of GH and IGF-1 naturally decline with age, it becomes increasingly important to engage in activities that can help sustain their levels, such as regular exercise and a balanced diet rich in protein. These lifestyle factors support the hormonal mechanisms that help keep bones strong, illustrating the interplay between hormonal health and everyday habits.

Vitamin D also plays an integral role in this complex hormonal landscape, even though it functions more like a prohormone. Once ingested or synthesized through sun exposure, vitamin D is converted into its active form, calcitriol, in the kidneys. Calcitriol then facilitates the absorption of calcium in the intestines, ensuring that dietary calcium can be effectively used to support bone strength. Without adequate vitamin D, the body struggles to maintain appropriate levels of calcium, which can lead to conditions like osteomalacia—a softening of the bones. This highlights the importance of monitoring vitamin D levels, especially for women approaching menopause, as it works hand in hand 0with other hormones like PTH to maintain strong bones (Rizzoli & Bonjour, 1997).

The thyroid hormones, triiodothyronine (T3) and thyroxine (T4), add another layer to the regulation of bone turnover (Gogakos et al., 2010). These hormones control the rate at which bones are broken down and rebuilt, affecting overall bone density. When the

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thyroid becomes overactive, a condition known as hyperthyroidism, the accelerated breakdown of bone can lead to increased risks of osteoporosis. Conversely, hypothyroidism, or an underactive thyroid, can slow down bone turnover, leading to different challenges for bone health. Maintaining balanced thyroid hormone levels is crucial, as even slight imbalances can disrupt the delicate equilibrium of bone remodelling, especially in the context of aging.

As women transition through menopause, not only does oestrogen decline, but follicle-stimulating hormone (FSH) levels also rise, leading to another layer of complexity in the regulation of bone health. While FSH is primarily involved in regulating the menstrual cycle, recent research suggests that it may directly affect bone density. Elevated FSH levels during menopause might stimulate bone resorption, independently contributing to bone loss (Rizzoli & Bonjour, 1997). This emerging understanding of FSH's impact emphasises that changes during menopause are multifactorial, affecting women's bones in ways that go beyond the decline in oestrogen alone.

Together these hormones form a complex system that governs the health of the musculoskeletal system. They interact in ways that are sometimes complementary and at other times counterbalancing, ensuring that bones remain strong and adaptable to life's challenges. Recognising the importance of each of these hormonal players provides a more comprehensive understanding of why bone health can be challenging to maintain, especially during the significant hormonal shifts of menopause. It also points to the importance of a holistic approach, combining hormone management with lifestyle factors such as nutrition, exercise, and regular medical check-ups to sustain healthy bones and an active lifestyle throughout life.

Conclusion

As described in current article, female hormones exert a profound and far-reaching influence over multiple aspects of a woman's health, extending well beyond their commonly understood roles in reproduction. Hormones such as oestrogen, progesterone, and testosterone are crucial not only for regulating the menstrual cycle and fertility but also for maintaining the health of various bodily systems. From cardiovascular health and brain function to bone density and immune regulation, the impact of these hormones is pervasive and critical for overall well-being.

Oestrogen, often regarded as the primary female hormone, plays a vital role in supporting heart health by promoting blood vessel flexibility and influencing cholesterol levels, while also protecting cognitive function and mental health through its neuroprotective properties. Similarly, progesterone not only prepares the body for pregnancy but also aids in emotional regulation, sleep quality, and stress resilience. Testosterone, though present in smaller quantities in women, contributes to muscle mass, libido, and energy levels, further highlighting the systemic nature of these hormones (Burrows, et al., 2012). These hormonal interactions demonstrate the intricate balance that exists within the female body, with shifts in hormone levels–such as during menopause–having significant effects on health, including increased risks of cardiovascular disease, osteoporosis, and cognitive decline.

As women transition through various life stages, such as puberty, pregnancy, and menopause, hormonal fluctuations become increasingly pronounced, often leading to a range of symptoms that can affect quality of life. The decline in oestrogen during menopause, for example, not only leads to common symptoms such as hot flashes and mood changes but also increases the risk of long-term health issues, particularly in areas like bone density and cardiovascular function. Hormone replacement therapy (HRT) can offer relief for many women, helping to mitigate some of these effects, particularly in reducing the risk of osteoporosis and improving cardiovascular health. However, it is important to approach such treatments with careful consideration of individual health profiles and potential risks.

Beyond reproduction, hormones such as Follicle-Stimulating Hormone (FSH), Luteinizing Hormone (LH), Anti-Müllerian Hormone (AMH), and oxytocin further underscore the complexity of the hormonal landscape in women. These hormones interact with oestrogen, progesterone, and testosterone to regulate not only reproductive functions but also emotional and social experiences, immune responses, and even respiratory efficiency. The interplay of these hormones is not only essential for physiological health but also influences mental and emotional well-being, reinforcing the need for a comprehensive approach to understanding and managing hormone health. Thus, maintaining hormonal balance is a key factor in promoting overall well-being. Women benefit from being aware of the wide-reaching effects of their hormones, particularly during critical transitions such as menopause. A multifaceted approach that includes hormone monitoring, lifestyle interventions such as diet and exercise, stress management, and, when appropriate, medical treatments such as HRT, can help women navigate these changes and maintain vitality. Additionally, ensuring adequate intake of nutrients such as calcium and vitamin D, along with regular physical activity, supports bone health and helps mitigate the risk of conditions such as osteoporosis, which are exacerbated by hormonal changes.

All in all, the complexity of female hormones and their influence on every aspect of life demands a holistic perspective when addressing women’s health. By recognizing the wide-ranging effects of hormonal shifts, particularly during menopause, healthcare providers and women alike can better understand and manage the interconnected nature of these processes. Ultimately, a comprehensive approach that considers the systemic roles of hormones is essential for supporting long-term health, vitality, and resilience in women as they age.

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PSYCHOLOGICAL ISSUES OF FEMALES RELATED TO INFERTILITY

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Abstract: Infertility is a deeply distressing condition that affects millions of women worldwide, often accompanied by profound psychological and emotional challenges. This review explores the psychological impact of infertility on women, including the prevalence of anxiety, depression, and social isolation. Studies show that up to 50% of women undergoing infertility treatments experience clinical levels of anxiety, and 25% meet the criteria for major depression. The social stigma, marital strain, and cultural pressures surrounding motherhood exacerbate these feelings, leaving women to grapple with guilt, inadequacy, and failure. The review also investigates the role of psychological stress as both a consequence and potential contributor to infertility, examining the concept of psychogenic infertility and its related factors. Moreover, the paper highlights the psychosomatic manifestations of stress, such as sleep disturbances and chronic pain, which further compound the condition. The integration of psychological therapies, such as cognitive-behavioural therapy (CBT) and mindfulness-based stress reduction (MBSR), alongside medical treatments, is identified as crucial for addressing these psychological burdens. This holistic approach to infertility treatment can improve both psychological well-being and fertility outcomes.

Keywords: *female infertility, psychological consequences, social expectation, psychological stress.*

Introduction

Infertility is a deeply distressing condition that affects a significant portion of the global population, especially women. The inability to conceive, whether temporarily or permanently, can result in profound emotional and psychological stress. Psychological distress is often heightened due to cultural, social, and personal expectations surrounding motherhood. Given the growing prevalence of infertility and its widespread psychological impact, it is essential to explore and understand the psychological repercussions associated with infertility and the role of mental health in both its causes and consequences.

As per the World Health Organization (WHO, 2023), infertility has emerged as a global health issue, affecting approximately 10-15% of reproductive-aged couples globally.

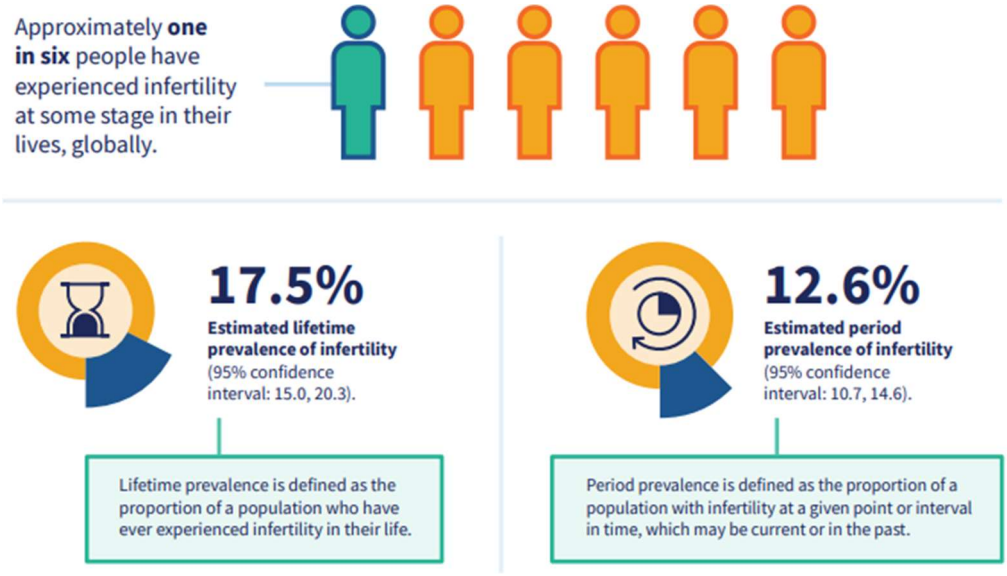

Figure 1 Infographics of WHO on infertility

Source: Infertility prevalence estimates, 1990–2021. World Health Organization (2023)

While the medical aspects of infertility are widely researched, its psychological dimensions require more comprehensive attention. This review will discuss both the psychological consequences of infertility on females and examine if psychological stress may also serve as a causative factor for infertility. It will also highlight potential therapeutic avenues aimed at addressing these interconnected issues.

Infertility: Definitions and Global Data

Infertility is clinically defined as the inability to conceive after 12 months or more of regular unprotected intercourse (Obeagu et al., 2023). It can be categorized into two forms: primary infertility (the inability to achieve a pregnancy) and secondary infertility (the inability to conceive after a previous pregnancy).

According to the WHO, between 48 million couples and 186 million individuals live with infertility worldwide (WHO, 2023). The prevalence of infertility varies regionally, influenced by factors such as healthcare access, cultural practices, and environmental exposure. In high-income countries, infertility treatments like in vitro fertilization (IVF) are more accessible, while in low-income regions, infertility often remains untreated, exacerbating its psychological toll.

Total fertility rate (TFR) depicts the average number of children who would be born alive to a woman during her lifetime, if the age-specific fertility rates of a given year remained constant during her childbearing years (Figure 1). It is computed as the sum of fertility rates by age across all childbearing ages in a given year. It has to be noted that infertility disproportionately affects women, especially in societies where female identity is closely tied to motherhood (Hynie & Burns, 2006). Social stigma, marital strain, and cultural pressures contribute to the heightened psychological distress experienced by women facing infertility.

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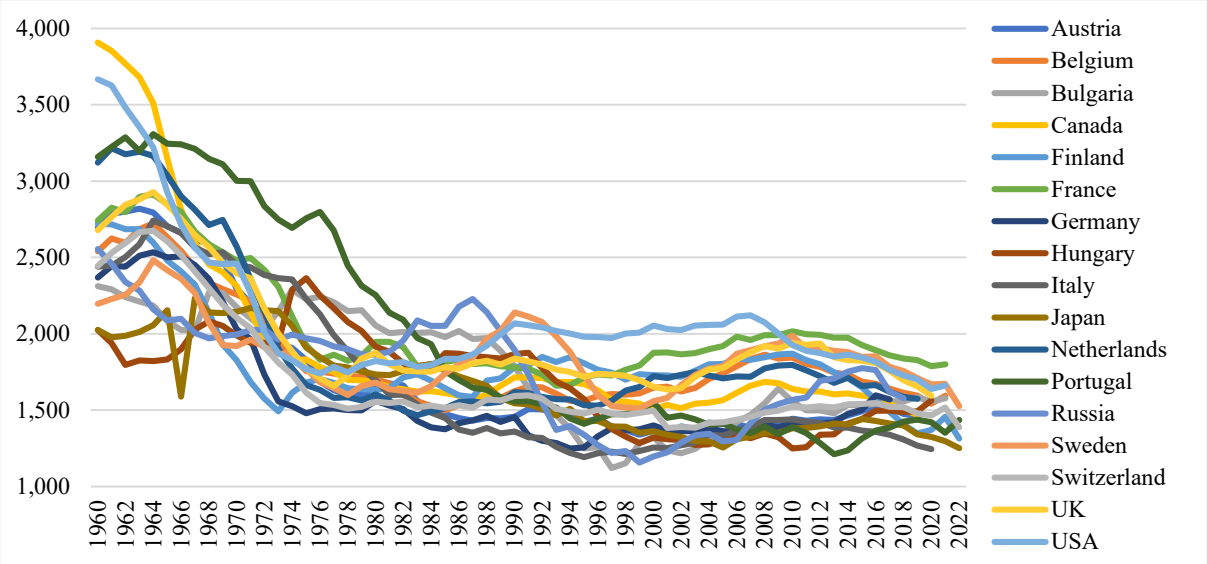

Figure 2 Total fertility rate in the past 60 years by countries

Source: Human Fertility Database Max Planck Institute for Demographic Research and Vienna Institute of Demography (2023)

Psychological Effects of Infertility

Infertility can cause a cascade of psychological issues in women, ranging from stress, anxiety, and depression to psychosomatic manifestations. Research highlights that up to 50% of women undergoing infertility treatment experience clinical levels of anxiety, and nearly 25% meet the criteria for major depression (Szkodziaket al., 2020).

Women often experience overwhelming feelings of inadequacy, guilt, and failure as they navigate infertility. These feelings may stem from societal and cultural pressures or a personal desire for motherhood (Simionescu et al., 2021). A study conducted in the UK found that 42% of women with infertility showed moderate to severe symptoms of depression, while 30% reported clinically significant anxiety (Kiani et al., 2021). This mental burden may be exacerbated by repetitive cycles of treatment failure, further amplifying stress levels. Infertility not only affects women psychologically but also impacts social relationships. In many cultures, women bear the brunt of blame for infertility, leading to stigmatization and social isolation (Bala et al., 2021). Marital relationships are also strained, as infertility introduces significant emotional and financial stress. Research indicates that couples experiencing infertility are three times more likely to divorce (Tabassum, 2023).

Recent studies suggest that the psychological impact of infertility is underestimated (Hanson et al., 2017). A meta-analysis conducted in 2022 estimated that around 60% of women undergoing IVF treatments report high levels of stress and anxiety (Gabnay-Nagy et al., 2020). This growing body of research emphasizes the need for integrated psychological support in infertility treatment protocols.

While it is already proved by many theorists that infertility has a heavy impact on psychological wellbeing, there is still no consensus on what factors to assess in regard to

the issue at hand. As depicted by Table 1, various authors explore the phenomenon from various angles.

Author	Description	Country	Cases
Musa et al. (2014)	Wives experienced significantly higher levels of depression, stress, and anxiety compared to their husbands.	Malaysia	246
Belevska (2015)	Psycho-education helped reduce anxiety and stress, though no significant differences in depression scores were observed between groups.	Macedonia	64
Dashti et al. (2016)	Women with anxiety and depression were more likely to experience sexual dysfunction, including orgasm issues, especially when stress was present.	Malaysia	16
Chi et al. (2016)	Infertile women showed significantly higher scores for anxiety, depression, and stress compared to fertile women.	Korea	206
Aslzaker et al. (2016)	Predictors like anxiety, depression, and stress, along with quality of life and infertility stress, accounted for 25% of the success in IVF/ICSI outcomes.	Iran	79
Yusuf (2016)	Infertile women exhibited significantly higher levels of depression, stress, and anxiety compared to the control group.	Pakistan	200
Naz et al. (2020)	A significant inverse relationship was found between stress, depression, anxiety, and each dimension of the DASS scale.	Iran	120
Rahimi et al. (2021)	Post-intervention therapy significantly reduced depression and stress compared to the control group.	Iran	60
Koumparou et al. (2021)	Stress levels showed significant reductions between intervention and control groups in all measured scales.	Greece	144
Lee et al. (2022)	Infertile women undergoing group therapy reported lower depression and anxiety, with higher IVF success rates in those with pre-treatment counselling.	South Korea	170
Martínez et al. (2022)	Stress-related infertility treatments using cognitive behavioural therapy (CBT significantly improved fertility outcomes over 6 months).	Spain	112
Huang et al. (2022)	Psychological stress negatively impacted IVF outcomes, with stress and anxiety scores significantly correlated with IVF failure rates.	China	300
Singh et al. (2023)	Women with polycystic ovary syndrome (PCOS showed higher anxiety and depression levels, which worsened fertility outcomes.	India	150
Smith et al. (2023)	Anxiety and depression in women undergoing ART treatment were associated with lower success rates, with early interventions proving beneficial.	USA	180

Table 1 Psychological effects of infertility among females

Source: Own compilation

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Psychological stress related to infertility can also manifest physically, as indicated in Table 2. Psychosomatic symptoms such as headaches, digestive issues, sleep disturbances, and chronic pain are commonly reported by women dealing with infertility (Kemeter, 1988). Additionally, the chronic stress associated with infertility may compromise immune function, potentially hindering the effectiveness of infertility treatments (Miller et al., 2017).

Study	Study-specific population	Findings in female subjects	Country	Cases
Reigstad et al. (2015)	8037 women with breast cancer / 138 (1.7%) had previous Assisted Reproductive Technology (ART)	Women exposed to ART had an elevated risk of breast cancer	Norway	8037
Lundberg et al. (2016)	Patient self-reported history of infertility	Infertile women had 1.53 cm3 higher absolute dense volume of breasts (95% CI 0.7–2.35)	Sweden	8963
Luke et al. (2022)	Women undergoing ART	ART induced no increase in breast cancer rates but highlighted other somatic concerns like weight gain and hormone dysregulation.	USA	113,226
Smith et al. (2023)	Women with infertility, especially those with Polycystic Ovary Syndrome (PCOS)	Women with infertility showed higher rates of somatic symptoms, including joint pain and gastrointestinal discomfort, potentially linked to chronic inflammation.	USA	1,254

Table 2 International literature on somatic consequences of infertility

Source: Own compilation

Infertility Caused by Psychological and Stress-Related Issues

There is emerging evidence to suggest that psychological stress is not only a result but can also contribute to infertility. Psychologically conditioned infertility, also known as functional or psychogenic infertility, is caused by psychological factors and affects between 5% and 50% of couples undergoing fertility treatments, according to Skrzypczak et al. (1997). Various elements influence this type of infertility, including personality traits, family relationships, and sexual disorders. For instance, issues such as frigidity, pain during intercourse, and lack of orgasm can impact a couple's ability to conceive. However, it is important to note that lack of orgasm is not a direct cause of infertility, though it can contribute to changes in sexual behaviour (Semm, 1994)

Specific psychological causes of infertility include feelings of guilt, intense pressure to have a child, and fears related to labour. Vaginismus, a condition triggered by traumatic sexual experiences or impotence of the partner, also plays a role (Podolska & Bidzan 2011). Misconceptions about sex and childbirth can create psychological and physical stress, further complicating fertility issues. Additionally, an excessive need for a child can lead to significant psychological stress, while deeply held neuroses and beliefs about sex and childbirth can further impact fertility (Seibel & Taymor, 1982).

From a psychoanalytical perspective, infertility is sometimes linked to subconscious defence mechanisms and repressed conflicts (Harrison, 1986). In men, psychoanalysts like Freud have suggested that sexual dysfunctions, such as impotence, are often related to neurotic tendencies and unresolved childhood issues (Kainz, 2001). The latest reports, including those by Weiss et al., highlight that higher degrees of neuroticism and traits such as passive-aggressive personality, compulsivity, and psychosomatic symptoms are observed in infertile men (Weis et al., 2004).

Meller et al. indicated that many women with depression who are treated for infertility had experienced depression prior to their infertility treatment (Meller et al., 2002). While it is challenging to determine whether depression is a primary cause of infertility, it can lead to conditions like hyperprolactinemia, which may hinder pregnancy (Demyttenaere, 1989). Therefore, early intervention with psychotherapy and pharmacological treatments is crucial for managing depression in individuals undergoing infertility treatment.

Chronic stress has been shown to interfere with reproductive hormones such as gonadotropin-releasing hormone (GnRH), which can disrupt ovulation and menstrual cycles (Aimagambetova et al., 2020). Cortisol, a stress hormone, also has an adverse effect on the hypothalamic-pituitary-adrenal axis, potentially leading to anovulation and other fertility problems (Toufexis et al., 2014). A longitudinal study in 2021 found that women with high levels of stress biomarkers (e.g., cortisol) were 29% less likely to conceive (Ramiya et al., 2023). Furthermore, women who reported higher levels of perceived stress showed a higher risk of ovulatory infertility (Szkodziak et al., 2020). These findings underscore the potential link between stress, psychological well-being, and reproductive function (Swanson & Braverman, 2021).

Treatment for Infertility and Infertility-Related Psychological Issues

Medical treatments for infertility primarily involve assisted reproductive technologies (ART) such as IVF, intrauterine insemination (IUI), and hormonal therapy (Milazzo et al., 2016). These treatments are often physically and emotionally demanding, requiring robust psychological support systems for patients to cope with the associated stress and uncertainty.

Psychological interventions for women dealing with infertility are gaining recognition as a vital component of care. Cognitive-behavioural therapy (CBT), mindfulness-based stress reduction (MBSR), and supportive counselling are commonly used approaches aimed at alleviating anxiety, depression, and emotional distress (Marashi

et al., 2021). Studies show that CBT and MBSR significantly improve psychological outcomes for women undergoing fertility treatments (Hosseini et al., 2020).

Incorporating mind-body interventions such as yoga and acupuncture has also proven beneficial for reducing infertility-related stress (Gaitzsch et al.2020). have demonstrated that women who participated in mind-body programs reported significantly lower levels of psychological distress and higher pregnancy success rates compared to control groups.

Given the interaction between psychological and physical symptoms, psychosomatic therapies (e.g., biofeedback, relaxation techniques) have also been explored as adjunct treatments. These therapies aim to reduce stress levels and improve overall well-being, potentially enhancing fertility outcomes (Rudolf, 2018).

Summary and Conclusions

Infertility is a multifaceted issue with profound psychological consequences for women. The inability to conceive often leads to anxiety, depression, and social isolation, and these psychological challenges are further exacerbated by the medical and financial pressures of infertility treatments. Emerging research underscores the prevalence of these psychological burdens, with stress even playing a role in causing or exacerbating infertility.

Interventions targeting both the medical and psychological dimensions of infertility are critical for improving patient outcomes. Psychological therapies, including CBT, mindfulness, and mind-body interventions, are essential tools to help women cope with infertility-related distress.

In conclusion, infertility is not solely a medical condition but also a psychological one, requiring holistic treatment approaches that integrate mental health care. Expanding research into the psychological aspects of infertility and offering comprehensive psychological support can improve the well-being of women facing this challenge.

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CAN ROBOTS HELP INCREASE THE EFFICIENCY AND RETURN ON INVESTMENT OF EDUCATION?

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Abstract: Education is an important issue in every country, including Hungary. Regular PISA surveys show that Hungary is lagging significantly behind in all competences compared to developed European countries. This study is not intended to find a solution to this problem, but it is well known that the capital and time invested in education pay off, albeit slowly. It pays off for both the individual and the national economy. The educational achievements of Roma children, many of whom live in disadvantaged settlements, lag further behind those of average Hungarian children. This study provides an example of how disadvantaged pupils can be specially motivated and how their learning can be promoted with the help of robots.

Keywords: *robotics, competence development, disadvantaged children, motivation*

Return on education

In a globalised economy, the basis of competitiveness is knowledge, which is also the most important asset of companies, intellectual capital, based on the competences of individuals (Farkas et al., 2009). The human capital theory is that human knowledge has economic value. Continued investment in human capital is a necessary condition for operating and maintaining a knowledge-based economy and society. Learning can be seen as an investment in human capital that pays off for both the individual and society. The most important indicators of return are economic welfare, higher employment and social cohesion (Sándor Kriszt, 2016). According to (Thurow, 1970), human capital is defined as the productive capacity, talent and knowledge of an individual, measured in terms of the value of goods and services produced directly or indirectly by human capital. Thurow approached human capital primarily from the perspective of production as a relevant factor of production.

According to Szűcs (1999), the fundamental goal of knowledge management is to achieve the best business results, which he focuses on five strategic points:

1. Knowledge strategy: knowledge management, acquiring, exploiting and sharing the best knowledge.
2. Intellectual property management strategy: exploiting patents, creating an innovative climate, incentives.

3. Personal knowledge strategy: importance, exploitation, responsibility of individual characteristics.
4. Knowledge creation strategy: importance of organisational learning.
5. Knowledge transfer strategy: targeted, optimal knowledge transfer at the right point, with the right tools.

In the process of education and training, in addition to imparting knowledge, it is important to transmit values and behaviours that include the transmission of norms and rules and learning how to apply them, which help individuals to participate in social life and economic activity (Halász, 2001). It is important to clarify that it is worth distinguishing between different life stages in terms of the subsequent return on investment in education. The rate of return is highest in the early childhood phase and decreases over time. The rate of return is much higher for children from disadvantaged socio-cultural backgrounds, but the decline is much steeper, i.e. the probability of return declines more rapidly over time (Heckman, 2003). However, the benefits of education are not limited to improving economic productivity, as a good quality education contributes to social welfare in a number of ways. For example, people with higher educational attainment may have higher health, interpersonal trust and political efficacy, and may be more active citizens, for example, more likely to volunteer. The better educated take better care of their environment and consume culture more intensively (Csapó, 2011). In recent decades, the nature of workplaces has also changed. People with higher skill levels have an advantage in the labour market. Technology, mechanization and robotics are increasingly taking over work areas that can be performed with lower qualifications (Molnár et al., 2019).

Disadvantaged children in education

In Hungary, the social, economic and political changes that have taken place since the regime change have significantly transformed the structure of society, and the impact of increased social inequalities can be felt in all areas of education (K. Nagy, 2019). The socio-economic benefits that can be realised through education are most beneficial for children from disadvantaged social groups. If students from disadvantaged family backgrounds do not have the skills to enter the labour market when they leave the education system, they are unable to contribute to the public purse, or only to a limited extent, while generating costs for society, including unemployment, social and health care, and also the costs of the prison system (Fejes et al., 2020). However, due to the hierarchical stratification of society, schools today are not able to offer all children the opportunities and chances they need to develop optimally. There is the social group at the bottom of society, and there are schools where the children of this group study (Kertesi & Kézdi, 2016).

A significant proportion of Roma pupils have unsuccessful school careers. To explain the reasons for their failures, it would seem obvious to refer to cultural differences and the school's failure to take them into account (Fejes, 2005).

Motivation for disadvantaged children

According to the (Mourshed et al., 2007), the success of the education system is driven primarily by three factors. First and foremost is the talent of teachers in the joint

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task of education and training. The second is that teachers use teaching methods that are able to hold the attention of students and capture their interest. The third is to ensure that the education system is able to reduce and approximate the inequalities that arise from family backgrounds.

The acquisition motives may be linked to direct learning at the beginning of school, possibly in kindergarten. If children do not experience the experience of acquisition, of gaining knowledge, during their first learning experiences - which is assumed in the case of Roma children - then untapped inherited drives, motives not reinforced by success, may be pushed into the background, replaced by motives not related to learning, and their function in school situations may cease (Józsa, 2002). In Gypsy families, doing well by children means giving them immediately what they want. Children are not forced to do anything, but rather they are lovingly waited until they are told, but then their needs are met immediately. In this way, they do not develop the skills of delay and self-control that are essential for good school performance (Fejes, 2005). The most sensitive measure of a society's openness is the opportunities it can provide for such children. (Kertesi & Kézdi, 2016) point out that today the disadvantages arising from segregation are consistent with a simple model of school choice, a model based on differences in the perceived quality of schools and selection by ability and family background. Experts agree that in Hungary, the problem of disadvantaged children who are lagging behind in learning and the compensation of their backwardness in school can only be achieved by a radical change and reform of education, and therefore, teaching methods that are suitable for children of all social groups should be sought (Ostorics et al., 2016).

The prolonged childhood of Roma children is not followed by normal adolescence, but by a sudden "miniaturisation" of adulthood between the ages of about 10 and 13. Instead of adolescent crises, they have adult problems. They expect help with family maintenance earlier than average. At home, they are treated as adults from adolescence, but at the same time they are treated as children in the eyes of the school. In particular, children who are over-age at school have problems with the role of the small adult, who cannot even communicate with classmates who are two or three years younger. This earlier adulthood is also linked to the fact that Roma children of secondary school age are traditionally considered to be ready to start a family (Liskó, 2002). According to (Fejes, 2005), the language socialisation of Roma pupils is an issue that deserves particular attention, as it can affect motivation to learn from two angles. On the one hand, the inadequate acquisition of the majority language and, on the other hand, the use of a language other than that of the middle class can separately hinder success in school, mainly through the self-image of learning. This may be particularly true in traditionalist schools where verbal intelligence is the basis for school success. These differences and difficulties cannot be overcome, or are very difficult to overcome, using traditional pedagogical methods and school tools.

The term robot was coined by Karel Capek in the science fiction drama R.U.R. (Rossum's Universal Robots) in 1921. The original meaning of the Czech word 'robot' was forced labour, slave labour, although at the dawn of human civilisation, in the 18th canto of the Iliad, there were also fantasies of talking, self-operating structures made of gold in

ancient times. Yet it is primarily through Asimov (1942) that its modern interpretation has come into the public consciousness. A robot is defined in (Szabó et al., 2014) as an electromechanical device that can perform various tasks based on prior programming. It can be under direct human control, but can also perform its work autonomously under the supervision of a computer.

Thanks to the rapid development of science and technology in most fields, it is not yet known what knowledge students will need in 10-20 years to succeed in life. As a consequence, young school students need to be equipped with the skills to create new knowledge from existing knowledge and to support the application of previously acquired knowledge in new and different contexts (Molnár, 2006). The development of technology also affects the learning landscape from kindergarten to higher education (Molnár, 2021). Technology-enhanced educational processes, including educational robotics, can be used to change the processes of learning and teaching. The use of educational robots is a new and interesting answer to the questions posed by the 21st century and the information society (Majzik, 2020). The rapid technological development and changes of the 21st century have a significant impact on our daily lives, our communication, our communication opportunities, our shopping and entertainment habits (Molnár et al., 2020).

Playful teaching is a primary aspect of the development of children with special educational needs. Special Education Needs (SEN): a child or pupil with special educational needs who, according to the expert opinion of the expert committee, has a motor, sensory, intellectual or speech disability, or, in the case of a combination of several disabilities, a cumulative disability, an autism spectrum disorder or other mental development disorder (severe learning, attention or behavioural disorder). Act CXC of 2011 on National Public Education.

When a robot tool is presented to children, it can activate an intrinsic motivational base that is difficult to mobilise with traditional tools. We can easily motivate children with any kind of disability with a nice, perhaps talking, floor robot. With the help of robots, children can learn the basics of robotics and coding through gamification by doing different tasks. They learn different subject content through active, action-based activities with robots and develop different skills through developmental tasks with robots (Aknai, 2020). Educational robotics refers to the pedagogical development of hands-on, programmable tools, physical objects, and technologies (such as programmable LEGO or EDISON) that can be used to support understanding and concept formation in learning (Mező & Szabóné Burik, 2021). The robots help children develop their attention, memory, and thinking functions in a playful way. Emotion-based child-robot interaction helps to focus attention, improve information perception during learning, and verbalisation. This process has a positive impact on children's educational rehabilitation and develops their emotional culture when interacting with robots (Aknai, 2020).

Development, motivation and robotics activities

At the beginning of the school year, we always start the tuning process with BeeBots, which develops algorithmic thinking and helps children to anticipate (Figure 1). BeeBot's memory can be programmed up to 40 steps and BlueBot's up to 200 steps. BlueBot can be controlled from a smart device or PC. Unlike BeeBot, BlueBot can turn 45 degrees when

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controlled from a smart device. The code generated on the device can be sent to the robotic bee via a direct Bluetooth connection. Of course, BlueBot can also be used in BeeBot mode (Aknai, 2020).

Figure 1 Children working with BeeBot and BlueBot

Source: taken in the classroom

Besides BeeBot, other popular floor robots are Edison and Ozobot. Edison robots are motivating tools for playful learning. The advantage of this robot is that it can be programmed in several languages, from small ones with built-in barcode through block and icon programming to ED-Phyton, which is "understandable" for users with a more advanced background. It develops problem-based problem solving and algorithmic thinking (Mező & Szabóné Burik, 2021). The colour codes tell the Ozobots what to do. The colour codes teach basic coding principles such as cause and effect, critical thinking and debugging. The bots use sensors to follow the lines and read the colour codes made with markers (or stickers). For "colour" programming, we use a colour-coded board" (Aknai, 2020).

In many cases, school deficits mean that some computer literacy training is needed such as, how to copy, save and open applications and how to shut down the computer properly. To develop mouse use and dexterity, we get students to edit 3D designs for the 3D printer. Using one of the software programmes, students design items such as small keychains or a name coin for a shopping trolley. They then ‘slice’ their design and print them using the 3D printer. These items are also a big hit in the run-up to various holidays. For Christmas, we 3D print small pine ornaments, and for Easter, we 3D print colourful egg holders. The children are delighted to take these small objects home as gifts for their parents.

To promote programming skills, we create a simple, fun, funny few-step program in Scratch. Here, students can practise block programming. Scratch does not require any tools or robots. All you need is a computer or laptop. Most students write the first program

of their lives in this program, which they can try out immediately. Scratch is loaded with many visual elements to make sure that the result is really spectacular and appealing to children. The first, and perhaps simplest, task involves a fish swimming in a fish tank, which, when it reaches the wall of the tank, turns around and then does the same thing again at the other wall, so that you see the fish swimming back and forth in the tank. It is a simple task, yet the screen shows a spectacular, moving picture where children can choose the aquarium itself, the plants in it, the other animals and the fish itself to move. The task is very simple yet requires some programming elements. The other big hit is when children draw a maze using a paintbrush. Then they have to move the chosen figure (costume) from the start to the finish using the down, up, right, left keys. In case the figure reaches the wall of the maze, it jumps back to the starting point.

The microbit is a great success in all cases, as it is now a device that has been brought to life with programs written by the students and that children can actually use. microbit A printed circuit board with two micro switches 25 LEDs, with a built-in gyroscope, with a motion sensor. This tiny device, the size of a simple matchbox, can be expanded with countless devices, starting with simple texts in smileys, but gradually deepening the knowledge, even a compass, protractor, pedometer can be programmed. Later, microbit accessories will be added to the sessions. For example, building and programming an automatic irrigation system, with the help of which the humidity sensor, when it detects that the potting soil is dry, sends a signal to the microbit, which starts the mini-pump and the plant is watered through a pipe. This is where the various variables appear, the operation of the motors and, not negligibly, environmental education are all part of the task. Every year, the compass is a great success, where, in addition to the cardinal points, the repetition of the degrees is practised, thus helping to develop mathematical competences.

Many of us would think that all children like LEGO, but I was surprised to find that these disadvantaged children do not. The reason is that they do not have the skills, they don't have the dexterity, they do not have the creativity. In many cases, putting together a building block causes problems. This is why LEGO Spike is a great way to develop dexterity. It develops their dexterity and creativity when they have to build a tiny car, for example. Later, we bring this tiny car to life and program it. During the program, the different motor control operations, angles, occurrences and different conditions are displayed again. For example, if you show the car a green card, the colour sensor detects this and the robot starts and then drives until it detects a red colour. With this knowledge, children can easily program robots they have built themselves, such as a robot vacuum cleaner or a sumo robot, and the game Codycolor, which they know from the Internet, is repeatedly adapted to Spikes, which is always a great success and the children enjoy it, as well as the fact that their digital competence has been improved, along with their mathematical and other skills. In the case of the Spikes, it is definitely worth mentioning the development of foreign language competences, where the commands are available in English, but this only initially comes as a surprise to the children. They will soon realise that they have to match the different programming instructions in the same way as in the English programs used before. In this case, the pupils are working with English words,

both wittingly and unwittingly, and building the program from English words, so they learn them by playing.

Table 1 illustrates how robotics education can help children to develop different skills that can be useful not only in science and technology, but also in other areas of life.

Skill	Area it develops
Critical thinking	Problem solving, logical thinking, analytical skills
Creativity	Innovation, idea generation, design skills
Programming skills	Knowledge of basic programming languages, algorithmic thinking, software development
Teamwork	Working together, communication skills, division of roles
Technical knowledge	Mechanical knowledge, electronics basics, engineering approach
Autonomy	Working independently, solving problems on your own, taking responsibility
Project management	Time management, planning, setting goals, prioritizing tasks
Mathematical skills	Calculations, measuring, geometry, data management
Patience and perseverance	Recognizing and correcting errors, following long-term projects, perseverance in overcoming difficulties
Communication	Technical writing, making presentations, clear expression of ideas and results

Table 1 Skill development with robotics

Source: edited by author

To investigate the effectiveness of the sessions (the research)

To find out whether the robotics sessions had a demonstrable impact, whether the students acquired useful knowledge, whether the knowledge acquired contributed to the development of any of their competences, the students completed an online quiz (questionnaire) with graphical elements on two occasions during the school year. This was part of the experiment, which I will describe below.

Methodology

To assess robotics knowledge, an online 10-question questionnaire was created in both semesters, which followed the lessons learned during the semester, closely related to the topic, but still playful and illustrated with pictures to make the children think. You can see some of these questions as you read further into the study. The quiz was created on quizziz.com. In addition, a 10-question questionnaire was used to ask the children if they liked going to classes, if they had learned anything they hadn't learned at school, and if they were learning English at school. The answers have been exported from quizziz.com to

a spreadsheet and the statistical results can be found here. Descriptive statistics, namely means, modes and medians, were used to explore the relationships.

There were some factors that could not be clearly identified through the questionnaire, such as things related to children's behaviour, socialisation, or what and how they actually learn at school. These questions were answered by teachers who knew and taught the children, in order to get more accurate and objective results (qualitative).

The question given to the children was "Do you like to go to robotics class? It should be remembered that the aim of play sessions is learning and they are always held in the afternoon, after school, when most students are tired.

Results

Out of the 40 students who responded, only four said they didn't like it, while 36 students answered yes to the question, so 90% of students like robotics. When asked the question "Have you learned anything that you did not learn in school before?", without exception, all students answered yes, so in all cases the robotics sessions showed and taught something new to the participating students. Did they gain an understanding of concepts that they had previously struggled with at school, but which they successfully mastered during the robotics sessions? For example, they learned about the analogue clock. They got to know the clock and its hands by assigning angles to them, which they calculated using microbits. The students' deficiency was highlighted by the fact that they often asked what time it was because they had to catch the bus. This showed that they were not familiar with analogue clocks. So when they were asked if they had understood something during the sessions that they had not previously understood at school, thirty-two children said that yes, they had.

In addition to the general questions, they were also asked whether the children understood what they had learned in the session and how it related to their everyday knowledge at school, using the programs and programming languages they had learned. The figure below illustrates one of the tasks of the online quiz. The question was: Which block rotates the Lego robot?

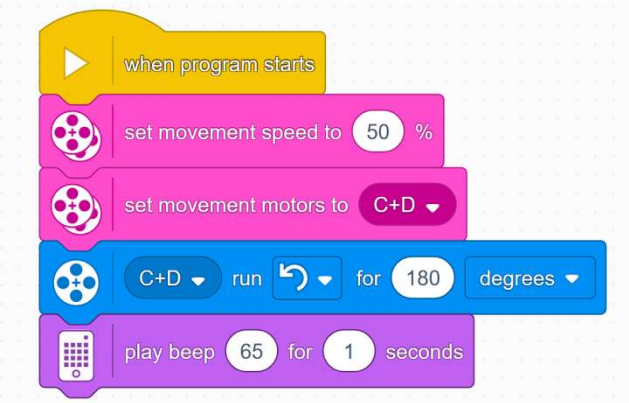

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Figure 2 The format of the question in the programme.

Source: own editing

Out of the 40 children who replied, 37 correctly answered that block 4 rotates the robot. It can be seen that not only knowledge of the program, but also basic foreign language vocabulary is needed to solve the task correctly. In this short block programme, degrees, percent and time are also shown as necessary knowledge. Similar playful questions helped me to get a relevant picture of whether the students had mastered all or part of what they had learned in the sessions, whether they understood it and could apply it correctly.

Some sample questions from the questionnaire are the following (Figures 3–5):

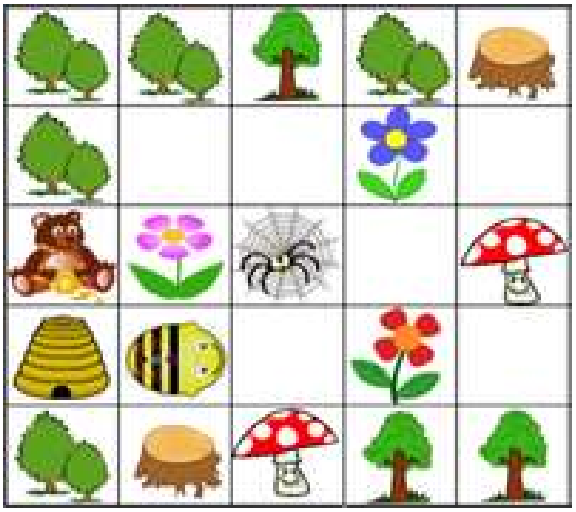
What animal does this robot imitate?

a. mouse
b. beetle
c. cat
d. bee

Figure 3 The format of the question in the programme.

Source: own editing

Where does the Bee-bot go when it receives these commands: forward, forward, left, forward, forward?

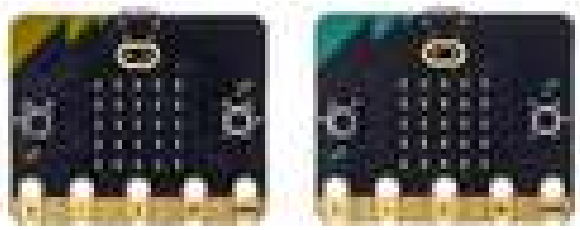


a. blue flower,
b. mushroom,
c. red flower,
d. spider

Figure 4 The format of the question in the programme.

Source: own editing

Is it true that a microbit can send information to another microbit even if they are not connected by a cable?



a. true

b. false

Figure 5 The format of the question in the programme.

Source: own editing

It may be fair to ask whether this knowledge was really acquired during the sessions or whether the children already knew it before? In this case, the testimonies of their teachers were taken into consideration, who stated that the children were almost without exception poor learners, with learning difficulties, and their knowledge was therefore very incomplete. The majority of the students did not have these basic competences. There are no robotics sessions in school, no robotics or programming in IT lessons, so the knowledge of programming languages, the commands learnt there and the correct linking with school knowledge are all the results of the robotics sessions. In several cases, teachers reported that students reported having acquired knowledge that they had not previously learned at school and explained that they had learned it in robotics lessons.

Conclusion

Based on the questions answered by the 40 students in the two locations, it is clear that the children like to attend robotics sessions, and they themselves appreciate, see and feel that they have gained new knowledge and understanding of school curricula that they could not learn at school before. The results of the questionnaires showed that children develop other competences in addition to programming. It can be seen that they are skillful at linking fractions with coding or, equally, that they can see through the coordinate system by means of a sequence of instructions. The surveys showed that children have become familiar with different IT tools. They are confident and aware of using different smart devices such as laptops, tablets, and smartphones.

In addition to quantitative research, it is important to mention what the teachers say, that the children are happy to come to the sessions, and that they themselves see and feel the benefits. So, the answer to the question of whether it makes sense to provide playful sessions with robots for disadvantaged children, many of whom have learning difficulties, to develop their digital competence and other basic skills, is yes, it makes sense, it is

worthwhile, the children acquire usable knowledge during the sessions. As to the question of whether all this pays off - referring back to the introductory section where we said that knowledge generates a return - it is clear that these children are more likely to go on to further education, gain a profession, and find a place in the world of work with the knowledge they gain here. The income they earn supports their own families, and the taxes they pay on that income add to the national economy. One of the most effective ways of reducing poverty and alleviating many social tensions is to promote education among the most marginalised. Equitable education can contribute to a more economically advantaged, healthier, more democratic, more inclusive society with lower levels of social tension.

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ISSUES OF GENERAL PRACTITIONER FINANCING IN HUNGARY AND AUSTRIA

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Abstract: Healthcare, and within that, general practitioner care, has traditions. The goal is to provide for members of society. In Europe, this goes more along the lines of joint burden bearing. The histories of Austria and Hungary are intertwined. However, their financing systems differ. There are differences in the sources of funding between the two countries' systems. The role of state funding is more important in Hungary, while in Austria, local funding is more important. The Austrian population is increasing slightly, whereas the Hungarian population is decreasing. This was followed by an increase in the number of general practitioners in Austria and decreasing in Hungary. In patient care in the Austrian system, the doctor is interested in performing the diagnostic tests locally, whereas in the Hungarian system, due to funding, the doctor is not interested in having them performed but rather sends the patient to central laboratories, which overloads the system. Both systems have advantages and disadvantages. There is no absolutely good solution for financing.

Keywords: *general practitioner, health financing, health care system, Hungary, Austria*

Introduction

The World Health Organization (WHO) drafted a constitution on the functioning of the health system in 1946, to which 170 countries have so far adhered. It contains the following points: health is more than the absence of disease. It includes a state of complete physical, mental, and social well-being; health is not the absence of disease or infirmity. This is because it is limited to the physical level. Health is defined as a right, that is, the presence of the highest attainable state of health would be defined as one's own (WHO, 2024).

It is one of the fundamental rights of all people, regardless of race, religion, political belief, and economic or social status. According to this, it is the basic property and right of the members of humanity. On the level of individuals, to have peace on Earth, it is necessary to satisfy basic needs. The health of all people is fundamental to achieving peace and security. To achieve this, cooperation at the individual level is required on the one hand, and cooperation between states on the other. There is also a connection between the states. If a state moves forward in this area, it helps other states achieve their goals. A state's performance in promoting and protecting health is valuable to all other individuals and states. The inequality of different countries, especially at the level of health, is a risk that comes with the fact that in the case of infections, the danger appears for everyone, that is, health must be ensured for everyone in order not to pose a danger for everyone. The

healthy development of a child is of prime importance for everyone. This also means physical, spiritual, and mental health. Developing the ability to live harmoniously in a changing environment is essential. Sharing, disseminating, and passing on the benefits of medical, psychological, and related knowledge is essential for all people to achieve and maintain a healthy state. Providing the population with adequate knowledge and active cooperation is extremely important for improving people's health (WHO, 2024).

They accepted the basic principles that correspond to the healing ethics maintained over the centuries, but they also tried to consider the requirements of the operation of modern medicine (Baráth, 2008). It is important to highlight some of these central points:

- within the framework of the mandatory solidarity principle insurance, everyone contributes to the basic and guaranteed quality healthcare service,
- the service structure meets real health needs and "consumer" needs, it handles morbidity and demographic changes flexibly,
- the effectiveness and efficiency of the procedures are adequate,
- the system of services, the possibility of using them and the fate of public money spent in the health sector are transparent,
- health care operates in a financeable system, and the efficiency of the resources devoted to health care increases.

The informed opinion and active cooperation of the public are of paramount importance for people’s health. The financing and burden-sharing of healthcare is based on several types of models. The first important objective is to create a socially based, solidarity-based risk-sharing community to ensure that the insured, regardless of their current income situation, can access the quantity and quality of healthcare they need and can afford on a social scale. This system has been in use for decades and should continue to work. This is based on an important principle. And that is solidarity. The rationale for the need for solidarity is still present. There is an inverse relationship between the personal income of the population and their personal health needs. The costs of healthcare are such that only a solidarity community on a societal scale can spread them. Changes in health status cannot be planned in advance and can only be partly influenced by the individual (Kincses, 1994).

Hungarian general practitioner financing

A historical review

The General Workers' Sickness and Disability Fund (General Fund) was founded on 3 April 1870 in the capital city of Budapest with 19 members. It was initially a subdivision of the Pest-Buda Workers' Training Association but became independent in 1871. The aim was to create a sickness and invalidity benefit fund. Needy workers received life insurance, which provided compensation in case of illness and disability. Unfortunately, this was unnecessary. It also provides support in the event of unemployment. The aim was to enable workers to maintain this funding. Its income was the contributions paid by the members, and the Minister of the Interior also contributed to the costs when it was founded. The amounts paid by low-wage workers could not be used to fulfil the tasks of the disability fund, so this function had to be deleted from the statute.

The General Treasury strove to become a national organisation as soon as possible, so branch cash registers were established in rural settlements. Despite several reorganisations carried out over more than 120 years, it can be said to be the predecessor of the National Directorate General of Social Insurance (Kiss, 1991).

Hungary introduced a compulsory social security system in 1891. It was third in Europe, the first two being Germany and Austria. Hungary was a member of the Austro-Hungarian Monarchy. From then on, we can discuss a compulsory health insurance system. Law XIV of 1891 helped workers in the industry in cases of illness. This was a novel finding at that time. The scope of the act was extended to Europe. It provides sickness and health insurance. Workers covered by the 1884 Industrial Act were obliged to take out insurance regardless of sex, age, or nationality. Employees of state institutions, legislative bodies, municipalities, and public enterprises were not obliged to join, but employees in agriculture were not obliged to do so either. Entry was voluntary. Funds operating in the spirit of the law are municipal bodies that were managed, supervised, and controlled by the competent industry authority according to their seat, and were under the supervision of the Minister of Internal Trade. The funds' sources of income were the contributions of members who were required to join, one-third of whom the employer was obliged to cover from its own funds, and two-thirds were deducted from the member's salary (Besze, 1998).

Under social security legislation, health services may be provided by a doctor or health service provider who is licenced to do so and has a contract with the National Health Insurance Fund. This also requires that he/she carry out an activity which is included in the activities defined by the Health Insurance Fund and is eligible for financing. It is important to point out that it is not the patient who pays the provider, but the health insurer. The payment is based on the financing report reported by the doctor. Funding is settled by contract in accordance with legal requirements. A financed service is defined in the financing contract as a health service actually provided under the compulsory health insurance scheme, for which no other person is or may be obliged to reimburse. The purpose of the system for receiving and processing performance reports is not only to support the financing of the healthcare provided, but also to facilitate the retrieval of patient life histories and to allow systemic risk analysis (NEAK, 2018).

Health care system in Hungary

It provides general medical care for those entitled to health insurance. This is based on the residence and being viewed by a general practitioner. The aim of the scheme is to ensure continuity of healthcare. The primary health care service is organised as a general practitioner (GP) and general paediatrician (GP). It is important to note that everyone has the right to choose a general practitioner or general paediatrician (GP), including persons with full capacity to act, minors with limited or no capacity to act, and adults with partial or full legal capacity to exercise rights relating to healthcare through their legal representatives. It is the responsibility of the local authority to create conditions for the provision of general medical care and define the area to be covered (street directory). The GP performs his/her duties based on an agreement with the municipality. However, the requirements for doctors are not set by the municipality but by law. It describes the

content, professional, personnel, and equipment requirements. The activity of general practitioners is subject to an operating licence issued by the district (metropolitan district) office of the Metropolitan and County Government Office in the field of public health. The operation of the general practitioner service is financed by the National Health Insurance Fund Management through the Health Insurance Fund (NEAK, 2021).

The financing of primary health care provided by general practitioners, general paediatricians, and dentists under the Regulation on the activities of general practitioners, general paediatricians, and dentists is carried out by the statutory body. This is a contractual obligation. To conclude the contract, the funder declares that the doctor undertakes to provide care on an ongoing basis under the conditions laid down. If the number of persons registered with a general practitioner who is not subject to a territorial obligation to provide care is less than 1,200 in the case of an adult or mixed population, or 600 in the case of children, the amount of funding is paid on a pro rata basis. NEAK concludes a financing contract with a doctor to finance the GP service with a territorial coverage obligation.

A financing contract may be concluded for a new general medical service with a territorial coverage obligation if the provider

(a) a population of between 1,200 and 1,500 persons aged 14 years and over (hereinafter referred to as an adult district), or

(b) 1,200 to 1,500 inhabitants without age limit (hereinafter referred to as 'mixed district'), or

(c) 600-800 inhabitants aged 0-14 years (hereinafter referred to as 'children's district') (43/1999. (III. 3.)

The financing is based on the contract between the healthcare provider and NEAK, and the data provision (performance report) submitted to the health insurance company containing the services provided by the healthcare provider within the framework of the relevant legal provisions. The healthcare provider may be entitled to maximum monthly financing for the number of months for which it has provided services based on its current contract. Based on Government Decree 43/1999 (III. 3.) on detailed rules for financing health services from the Health Insurance Fund and NM Decree 9/1993 (IV. 2.) on certain issues of social security financing of specialised health care financing of health services takes place (1) on the basis of expenditure, (2) on the tasks to be performed, (3) on the count of cases served, (4) per head quota, (5) on the performance ratios of the services provided, (6) with respect to certain services, on the quantity of its performance unit, and (7) on the combination of the previous point-based system.

The elements of financing are (1) fixed fee (determined by taking into account the population of the district to be served, the number of dispensaries, and the disadvantaged situation of the settlement), (2) regional additional fee (remuneration to be paid based on the type of settlement served by the family doctor service, taking into account the characteristics of the location of the population living in the area of the family doctor, additional fee to cover the costs of visiting patients by a doctor), (3) performance-based fee (calculated by taking into account the number (age) of insured persons registered for the

family medicine service, the qualification multiplier of the doctor providing the family medicine service, and the degression factor, (4) outpatient remuneration (remuneration to be paid for emergency treatment of insured persons who have not registered for the service) additional compensation for skilled workers (in the case of a skilled worker employed for at least 20 hours per week, with the fact that the additional skilled worker fee must be used to supplement the salary and income directly due to the skilled worker), (5) equipment and real estate subsidy fee (overhead subsidy for operators of general practitioner services with regional care obligations), and (6) remuneration based on the results achieved in the indicator system legal relationship verification fee (NEAK, 2018).

Austrian general practitioner financing

The GPs' income consists of two parts: the fee for the services and the fee based on the number of cases. Individual services make up a significant part of the total fee. Each service has a separate fee. When patients visit the office, they usually provide several unique services. A person treated in a given quarter is considered a case, regardless of how often they come to the particular contracted clinic. If a patient visits the office several times per quarter, it remains a case. If a person returns in the next quarter, they become a case again. The number of cases (case number) and the fee per case (case value) are important comparative values for many doctors on the basis of which they evaluate their economic performance. The basic service fee (per-case flat rate) is a per-case flat-rate amount settled when the patient's e-card is inserted for the first time in the quarter, regardless of other treatment services (Gesundheitskasse, 2024).

Figure 1 shows a comprehensive picture of the Austrian supply system. A significant part of expenses is financed from tax revenues, which represent the second largest source. According to the system, this accounted for 30.8% of all expenditures and 40% of public expenditures (Statistics Austria, 2017).

It is equal to the sum of the contributions of the federal government, provinces or municipalities to the costs of inpatient care and LTC, public health and prevention, and contributions to the SHI funds for unemployment and maternity benefits. The other leg of the funding is related to health care. The health tax is managed and distributed at the federal level by the Federal Health Agency (Bundesgesundheitsagentur, BGA) and at the state level by the nine state health funds (LGF). Private contributions also reach a significant amount. They represent the third largest source of income, representing a total of 25% of all expenses according to known statistics. The OOP is the measure of healthcare expenses out of all expenses of approx. They represent 20%. This is higher than the EU average. On the other hand, the level of voluntary health insurance can be said to be small. They represent about 5% of the whole (Statistics Austria, 2017).

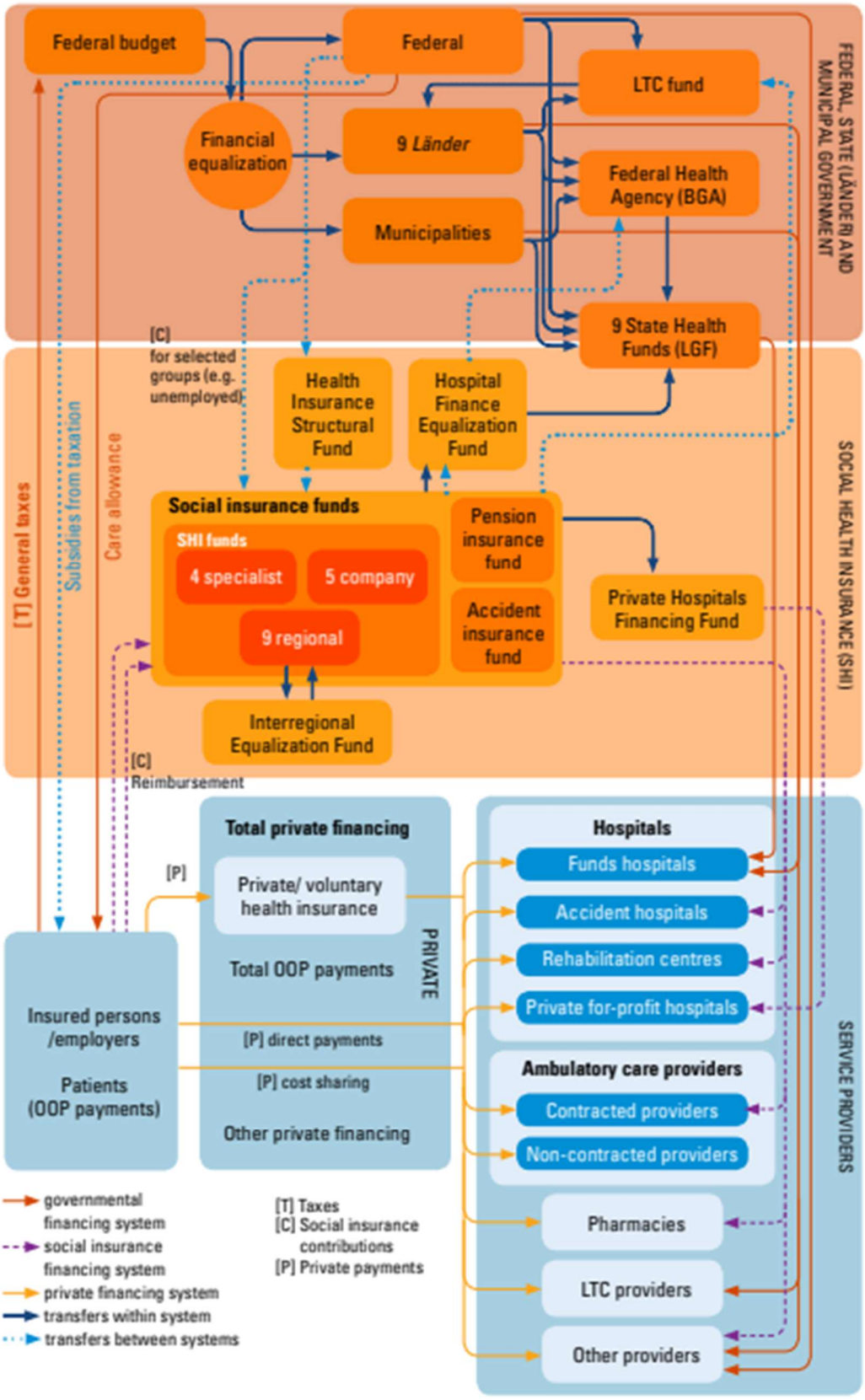

Figure 1 Financial flows in Austrian health care system

Source: Statistics Austria 2017

Based on Figure 2, it can be seen that general practitioner care is financed by the 18 sickness insurance (SHI) funds. Furthermore, long-term care (LTC) services are mostly funded by provinces and local governments. The contribution of the federal government is independent of the number of cases; they contribute a fixed amount to the costs on a monthly basis. Rehabilitation after accidents is also supported by pension insurance, accident insurance and health insurance, among others. All other remaining parts are covered by health insurance (Health System Review, 2018).

	1980	1990	2000	2005	2010	2015
Current health expenditure (in € million)	5 417.9	10 615.9	19 659.7	24 243.1	29 793.6	35 076.9
Government/compulsory schemes	67.2%	74.4%	75.5%	75,1%	76.1%	75.6%
Government schemes	–	–	–	29.2%	31.7%	30,8%
Compulsory contributory health insurance schemes/CMSA	–	–	–	45.9%	44.5%	44.8%
Voluntary schemes/household out-of-pocket payments[1]	32.8%	25.6%	24.5%	24.9%	23.9%	24.4%
Voluntary health insurance schemes	–	–	5.3%	5.0%	4.7%	4.9%
Household out-of-pocket payments	–	–	17.8%	18.6%	17.7%	17.9%
NPISH financing schemes	–	–	1.2%	1.2%	1.3%	1.4%
Enterprise financing schemes	–	–	0.2%	0.2%	0.2%	0.2%

Figure 2 Sources of revenues as percentage of current expenditure on health (current prices), 1980-2015

Source: OECD database, 2024

Austrian healthcare spending has grown steadily in recent years and continues to grow today. The role of the government is stable and significant. Voluntary funding also shows a stable and slight decrease. The various sources of income (SHI contributions, taxes, OOP and VHI) have remained relatively stable in the past period. The role of SHI contributions is the largest. In the observed period, they accounted for 44.8% of all healthcare expenditures and 60% of public expenditures. The payments are collected by the General Association of Austrian Social Insurance Institutions (HVB) and then transferred to SHI funds to cover the costs of healthcare providers (OECD, 2024b).

Comparison of Hungary and Austria

Looking at health spending in 2022 reveals significant differences between countries. The average for the 38 OECD countries was 9.2%. The Hungarian share of spending was 6.7% at that time, whereas Austria's share was 11.2%,, which is a positive deviation from the average (OECD, 2024b). These data are shown in Figure 3.

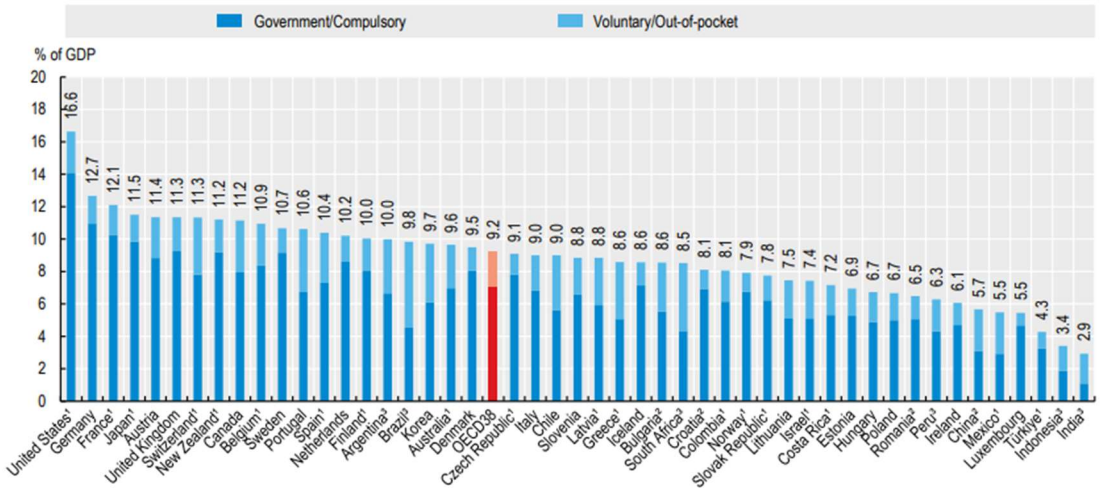

Figure 3 Health expenditure as a share of GDP, 2022 (or nearest year)

Source: (OECD Health Statistics, 2024b)

Figures 4 and 5 show health expenditure in millions of euros in the two countries. Between 2010 and 2015, the order of magnitude in Hungary did not change significantly. From 2016 onwards, however, we observe a more significant increase in expenditure. Unfortunately, data for 2022 is unavailable, which would have revealed the impact of significant inflation on expenditure.

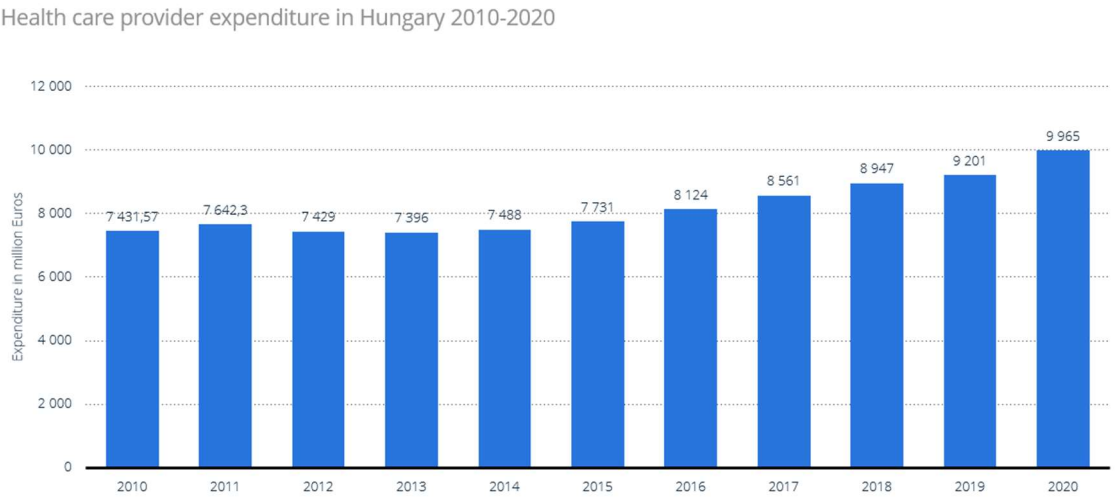

Figure 4 Health care provider expenditure in Hungary 2010-2020

Source: Statista (2024a)

In Austria, on the other hand, we are not talking about stagnation, but a steady increase year on year, with 4 times as much being spent on healthcare as in Hungary.

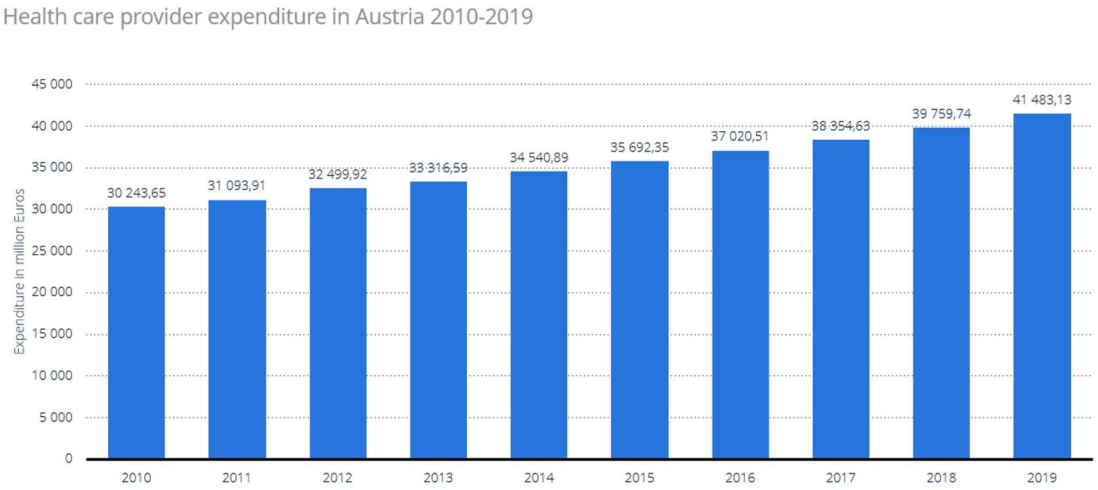

Figure 5 Health care provider expenditure in Austria 2010-2019

Source: Statista (2024b)

Surprisingly, Cuba has the highest number of doctors per 1,000 inhabitants of any country in the world. This is clearly a priority area for the Cuban system. This is followed by welfare states and developing states. So, in many cases it is not a financial issue, but rather a tradition or health policy. It could be an interesting study to look at the number of doctors per capita and other health parameters for a given country. Whether there is a correlation between the number of doctors and the quality of health. Austria is ranked 9th in the world with almost 55 doctors per 10,000 inhabitants, with people reporting a shortage of doctors. See Figure 6 for details.

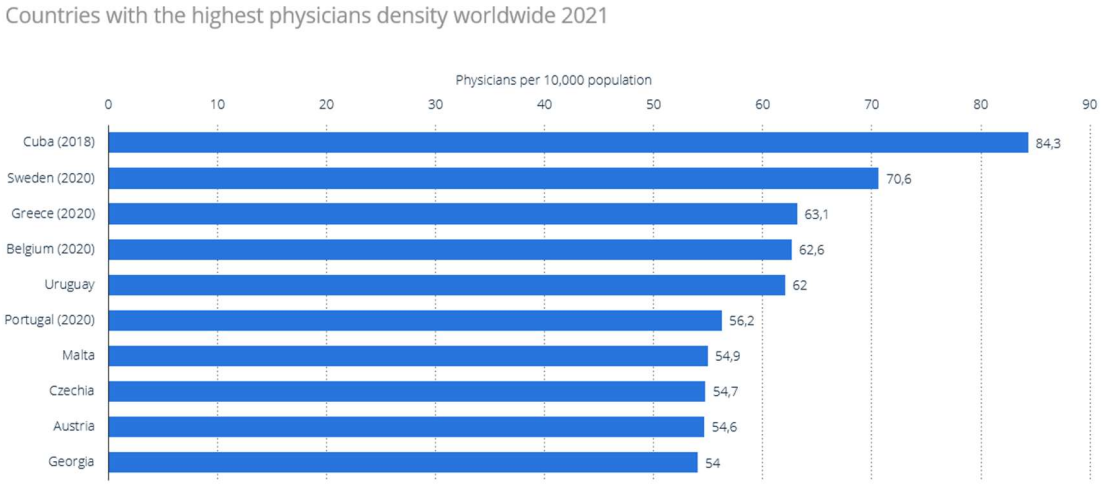

Figure 6 Countries with the highest physicians density worldwide 2021

Source: Statista (2024c)

Figures 8, 9, and 10 show the number of GPs. In Austria, adult and paediatric general practitioners are counted separately, whereas in Hungary they are shown together.

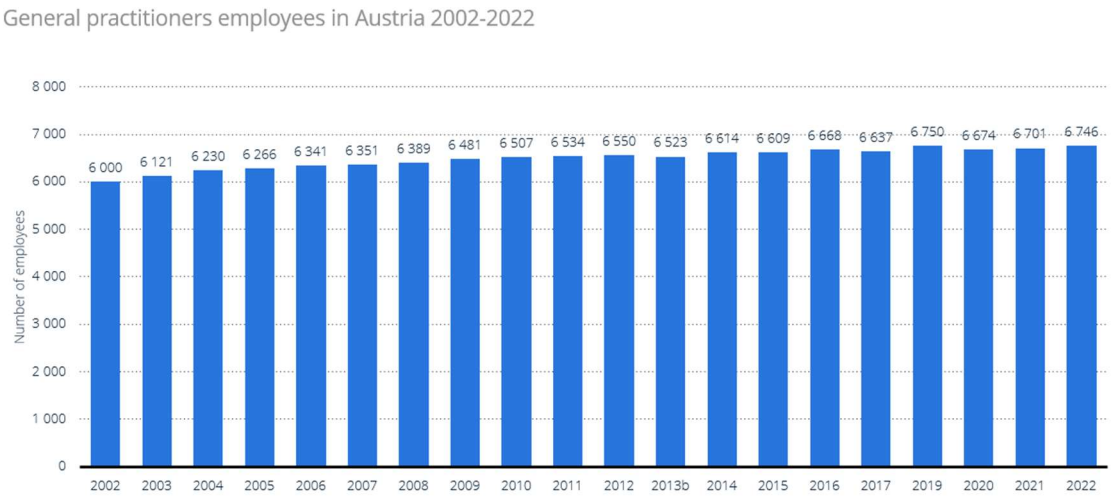

Figure 7 General practitioners employees in Austria 2002-2022

Source: Statista (2024d)

The number of general practitioners in Austria has been increasing year on year, reaching 6700. In Hungary, the total number of general practitioners, including paediatricians, is 5,700, and this figure is steadily decreasing. It should be added that Austria has a population of 9.1 million, and due to immigrants, the number of general practitioners is increasing year on year. In contrast, Hungary's population is decreasing, as is the number of general practitioners. The number of paediatric general practitioners is estimated to be around 2000 in Hungary.

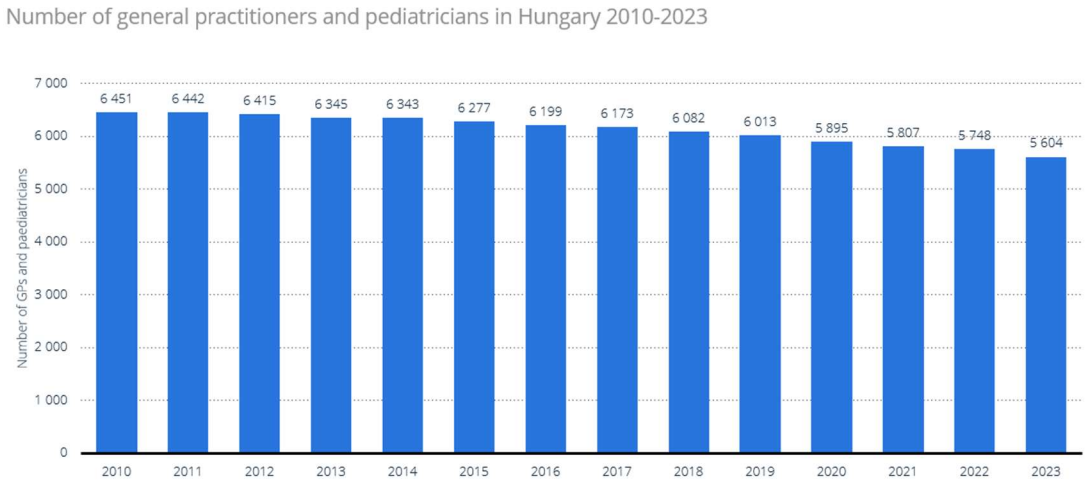

Figure 8 Number of general practitioners and paediatricians in Hungary 2010-2023

Source: Statista (2024e)

The number of paediatricians in general practice in Austria was 1628 in 2022. This figure has been steadily increasing.

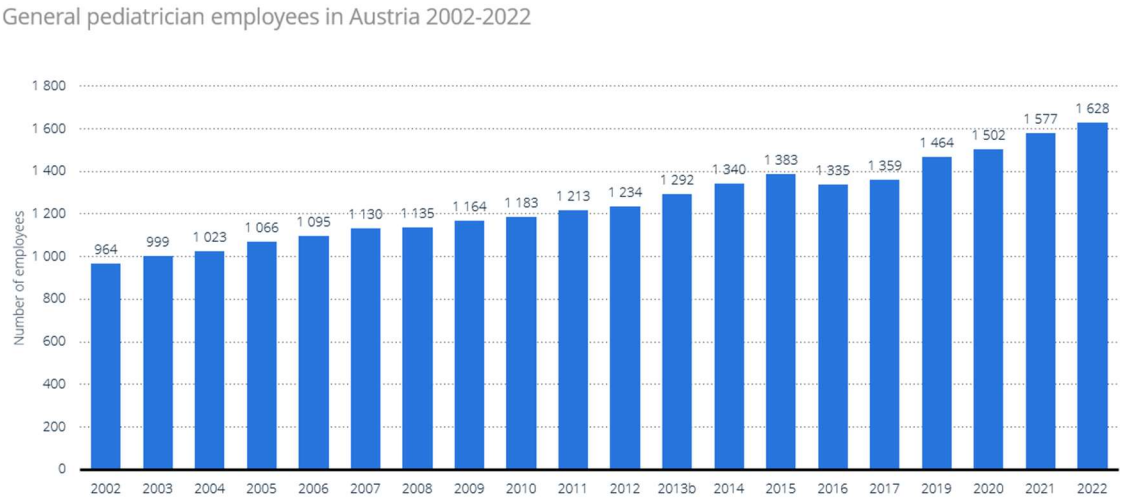

Figure 9 General paediatrician employees in Austria 2002-2022

Source: Statista (2024f)

Conclusion

There are differences in the source of funding between the two countries' systems. The role of state funding is more important in Hungary, whereas in Austria local funding is more important. The Austrian population is increasing slightly, while the Hungarian population is decreasing. The number of general practitioners is increasing in Austria and decreasing in Hungary. In patient care in the Austrian system, doctors are interested in performing the diagnostic tests locally. In the Hungarian system, however, due to funding issues, doctors are not interested in performing tests locally and instead send patients to central laboratories, which overloads the system. Both systems have their advantages and disadvantages. There is absolutely no good solution for financing.

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GREEN SUPPLY CHAIN MANAGEMENT PRACTICES IN SOME SECTORS

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Abstract: Green Supply Chain Management (GSCM) integrates sustainable practices throughout supply chains, addressing environmental, economic, and social concerns. This study examines the implementation of GSCM across various industries, including lumber, steel, electronics, automotive, construction, and food. It analyses key frameworks such as the triple bottom line, cradle-to-cradle, and circular economy. Industry case studies reveal common themes, such as waste reduction, eco-friendly sourcing, and process optimization. However, differences also emerge due to sector-specific challenges, including resource constraints and unique operational needs. The lessons learned emphasize the importance of stakeholder collaboration, innovative solutions, and targeted strategies to overcome barriers like high costs and limited infrastructure. These insights provide best practices for aligning GSCM with sustainability goals, fostering both economic resilience and environmental stewardship.

Keywords: *green supply chain management, cradle-to-cradle, triple bottom line, circular economy.*

Introduction

Green supply chain management (GSC) has gained significant attention recently as businesses strive to address growing environmental concerns and meet sustainability demands. GSC integrates environmentally conscious practices throughout the supply chain, from sourcing materials to production, distribution, and end-of-life disposal. As climate change, resource scarcity, and consumer awareness intensify, industries are pressured to adopt sustainable practices that minimise their environmental impact while maintaining efficiency and profitability.

This comprehensive review explores the evolution of GSCM, its underlying principles, and the unique challenges associated with its implementation. It delves into green design, operations, and logistics concepts, highlighting their relevance in diverse industries, including electronics, automotive, construction, and food. Additionally, the study examines frameworks like the triple bottom line, cradle-to-cradle design, and circular economy, which underpin the theoretical and practical aspects of GSCM.

While the growing body of literature underscores the transformative potential of GSCM, significant barriers persist, ranging from high implementation costs to regulatory and infrastructural constraints. This paper aims to synthesise key insights into these challenges, outline best practices across industries, and identify gaps in existing research. By addressing these gaps, it seeks to provide actionable directions for advancing the field of GSCM and contributing to the broader sustainability agenda.

Defining Green Supply Chain Management

Undoubtedly, a bird on the tree is not valuable compared to a bird at hand. This analogy is accurate for business enterprises where there is no value created unless the enterprise is able to not only source but transform inputs and make them available and accessible to its customers. This interplay may be summed up as a discipline: supply chain management.

Supply Chain Management (SCM) has long been understood as the coordination of processes that span from the supplier's supplier to the customer's customer, with the goal of delivering products efficiently and effectively (Kranz, 1996; Larson & Rogers, 1998). Traditionally, SCM has focused on managing the flow of goods, information, and finances across a network of entities, emphasising customer satisfaction and operational efficiency (Mentzer et al., 2001). However, as environmental concerns have grown, SCM has significantly transformed into Green Supply Chain Management (GSCM), which integrates environmental considerations into every aspect of the supply chain (Srivastava, 2007).

The transition to GSCM is characterised by a shift from focusing solely on economic factors to embracing a broader set of objectives that include environmental sustainability. This change has been driven by regulatory pressures and consumer demand for environmentally friendly products (Beamon, 1999). GSCM encompasses practices that minimise ecological impact at every stage, from product design to disposal, through green design and green operations (Srivastava, 2007). Green design involves developing products with environmental considerations, ensuring health and safety throughout their lifecycle, while green operations aim to reduce ecological defects in manufacturing processes (Srivastava, 2007).

Recent literature highlights how digital transformation, including artificial intelligence and big data, has reshaped SCM by enhancing visibility and responsiveness—key elements for implementing sustainable practices (Chopra & Meindl, 2016). Furthermore, integrating sustainability into SCM aligns with broader economic, environmental, and social goals, with studies indicating that GSCM practices significantly impact sustainability performance (Touboulic & Walker, 2015).

Government subsidies and public pressure have further accelerated this shift, with research demonstrating their influence on green practices in closed-loop supply chains (Mondal & Giri, 2022). In regions like China, external pressures have played a crucial role in the adoption of GSCM, affecting both practices and performance outcomes (Zhu & Sarkis, 2016). Similarly, in India, the implementation of GSCM faces distinct barriers that have been analysed to provide insights for overcoming these challenges (Govindan et al., 2014).

The convergence of supply chain management (SCM) with environmental management is not only about minimising negative impacts; it also involves creating strategic business advantages. For instance, practices such as green procurement, green design, and green logistics can lead to cost savings, enhance brand reputation, and open up new markets (Hervani et al., 2005). Furthermore, green supply chain management (GSCM)

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enables organisations to build resilience, helping them navigate turbulence or unforeseen events. This resilience is largely achieved through digitisation and the use of intelligent systems. As a result, there are integrated human and IT systems that create digital twins, fostering environmental sustainability and promoting resilient business processes (Singh et al., 2024).

The journey from traditional SCM to GSCM reflects a wider societal shift towards sustainability. This evolution has been fuelled by a combination of technological advancements, regulatory frameworks, and increasing awareness among consumers and businesses regarding the environmental impact of their activities. As SCM continues to evolve, its integration with green practices will likely strengthen, driven by the need to balance profitability with planetary health.

As per Figure 1, GSCM involves a number of processes that require intricate involvement by enterprises. These processes involve green supplier selection, eco-design, green manufacturing, green inventory management, green transportation, and reverse logistics. Gurel et al. (2015) identify cost, delivery, quality, service, strategic alliance, pollution control, green product and environmental management as crucial criteria for green supplier selection.

Figure 1 Aspects in green supply chain management (Puglieri et al., 2021, p. 286)

Eco-design primarily focuses on a holistic approach towards the product life cycle and transformation process considering environmental impact, health and safety considerations. It focuses on transformation activities and how to reduce their impact on the environment. Some key dimensions of ecodesign include raw material design, where there is reduced use of hazardous or complete replacement of hazardous raw materials. Clean production, where the emphasis is on green technology, waste reduction, and environmental friendliness through reduced to no pollution. Green packaging is another dimension where reusable packaging is used through reverse logistics. Transportation and distribution design is primarily concerned with effectively improving product movement routes, reducing distance for moving products and controlling variation in transportation.

Product deployment focuses on extending the usability of products by optimising product attributes like reduced size, weight, maintenance and lower power consumption. Lastly, reverse logistics involves the activities of receiving and managing products after their usability runs out (Thamsatitdej et al., 2017).

Green manufacturing involves adopting fast, reliable and energy-efficient manufacturing processes and equipment to minimise waste and increase productivity. In mechanised processes, this involves reducing emissions, energy usage and input consumption while using eco-friendly energy sources (Afum et al., 2020). Green inventory management is characterised by the traditional economic cost focus with environmental considerations in inventory management and practices (Marklund & Berling, 2016).

Green transportation, which aims to counter high carbon emissions, has been adopted globally. Using alternative energy sources in distribution reduces the amount of carbon emissions and offers enterprises opportunities for reduced production costs where alternative energy sources are available (Saada, 2020). Lastly, reverse Logistics involves the reverse flow of goods to the enterprise. It requires planning, implementing and controlling how remnants of finished products return back to the enterprise and are reused or re-made as fresh inputs for new products or remade for consumption yet again (Agrawal et al., 2015).

Relevant concepts of green supply chain management

Green supply chain management (GSCM) is an integrative approach to designing and managing supply chain activities to minimise environmental impact while promoting economic and social sustainability. This concept reflects a growing recognition of balancing business success with environmental stewardship and social responsibility. Central to GSCM are principles like the triple bottom line, cradle-to-cradle design, and circular economy, each offering frameworks for achieving sustainability within supply chain operations. By aligning organisational practices with these principles, businesses can address critical challenges such as resource scarcity, waste management, and carbon emissions while fostering innovation and long-term profitability. This introduction highlights the interplay of economic, social, and environmental considerations as integral to modern supply chain management and lays the foundation for exploring these concepts in detail.

Triple bottom line and sustainability

Coined by Elkington in 1997, the triple bottom line looks at business success through the lens of three parameters: profit, people, and the planet. Organisations, therefore, set up their business success metrics on these three fronts. The triple bottom line is seen as a practical guide towards sustainability as organisations do not only focus on one of the three aspects but aim to maximise all three (Alhaddi, 2015).

Sustainability, on the other hand, is an overarching framework that encompasses harmony between human activity and its impact on the environment through appropriate policies and best practices and a rallying future vision that appeals to everyone, including

businesses and individual communities (Brundtland, 1987; Arowoshegbe & Emmanuel, 2016).

However, we must add that Corporate Social Responsibility (CSR) and Environmental Social and Governance (ESG) concepts are very close to the triple bottom-line framework. Corporate social responsibility gives businesses, particularly corporations, an extended aim of maximising profit and generating benefits for different stakeholders and related communities. The main dimensions of CSR in businesses are economic considerations, legal considerations, and legal and discretionary responsibilities, which The Organisation of Economic Cooperation and Development considers 'making a positive contribution to economic, environmental and social progress' which in extension are at the core of the triple bottom line perspective (Bansal, 2005: Mendes et al, 2021).

Environmental, social, and governance (ESG) factors, which are seen as businesses' contributions to environmental and societal concerns, stem from the need to promote greater good and benefits to stakeholders while striving towards profitability. ESG factors are seen as crucial for businesses considering their roles in environmental pollution. They are seen as a compliance exercise and a strategic decision essential for long-term success, especially with the need to reduce carbon emissions globally (Suzan et al., 2024).

CSR and ESG are largely interrelated but distinct. CSR, which focuses on activities an enterprise engages in, closely relates to social obligations resulting from its use of natural resources and affects how it interacts with external and internal environments. In contrast, ESG is more quantitative and measures an enterprise's CSR activities and initiatives (Lew et al., 2024).

Automation of large-scale production by manufacturers like Coca-Cola has reduced production, reducing production costs. Integrated real-time monitoring and visual inspection technologies allow the manufacturer to trace defective output. These, among other process improvements, have resulted in increased profits for the beverage manufacturer. Further inclusivity programs have created a harmonious working environment for not just disabled employees and women; inclusivity networks link different communities around the globe in their areas of operation and leverage ideas generated from these networks into business practices. From the planet perspective, Coca-Cola has proactively reduced waste with innovative technologies like paper bottles and planet bottles, among others (Jia & Ma, 2022).

Cradle to Cradle and sustainability

Motivated by scarce resources, engineers strive to reduce the impact of lifecycles and their wastages by utilising the fewest resources while maximising output. Braungart and McDonough introduced the cradle-to-cradle concept in their 2002 book as an ideological shift from 'less bad' to 'more good' by reducing eco-footprint and damage.

The cradle-to-cradle concept relies on three tenets that enterprises need to strive towards: waste equals food, where wastes from one process are treated as inputs for the next process; use of current solar income or sustainable energy sources is applied in

production; and thirdly, diversity is celebrated to reduce reliance on one criterion in production (Toxopeus et al., 2015).

McDonough et al. (2003) stipulate that the C2C approach focuses on what to do and not necessarily how to make the approach. As such, they suggest 12 principles that provide a guiding compass to employ the C2C approach in the business model. This approach is, however, not foolproof as it requires a completely closed-loop recycling system, whereas organisational activities rely on externalities like external energy sources and waste management infrastructure (Bjørn & Strandesen, 2011).

These principles include the use of non-hazardous inputs and outputs, prevention of waste production, minimising energy consumption, efficiency in terms of products, processes and systems, an output pull use of energy and materials, embedded entropy, targeted durability in design goals, utilisation of excess capacity and capabilities, reduction of material diversity for value retention, interconnectivity with available energy sources.

A compostable diaper manufactured by Diapers is a case of Cradle to Cradle in practice. With their eco-friendly diapers, the use of more than 75% cellulose material is more compostable than the industry standard of polypropylene or polyethene plastics, as they break down within 3 months of disposal. They are also considered user-friendly, especially for babies, as alternative diapers impact babies' health, limiting breathability and causing diaper rash. Its manufacturer is also credited for using 100% renewable energy (Lumsden, 2014)

Circular economics

Seen as a comprehensive multidimensional approach, circular economy falls into 6 main theories; economic and environmental theory, theory of resource efficiency, waste hierarchy theory, environmental impact theory, green growth theory and sustainable development theory. What is common about these theories is their emphasis on keeping materials and products in a closed cycle as long as it can take and making recyclable material flow efficiently through the loop. Economic and environmental theories emphasise trading in recycled raw materials and keeping them in a closed loop. Resource efficiency theories place emphasis on recycling infrastructure and technologies; waste hierarchies theory also places hierarchy on waste management strategies by focusing on the best solution for waste prevention and reduction coupled with appropriate management and recycling and reuse strategies; environmental impact theory focuses on impact to the environment and giving priority to reducing the unfavourable impact of economic activity on the environment; green growth strategies state environmentally friendly practices can achieve sustainable growth; lastly, sustainable development combines social, economic and environmental goals through sustainable practices (Lingaitiene & Burinskiene, 2024).

From a circular economic perspective, Paghal et al. (2024) identify several barriers to adopting and implementing green practices like green logistics. For example, a lack of commitment by management translates to poor adoption of green logistics activities. Lower-level management may also fail to cooperate among departments, coupled with a lack of understanding or adequate training in green logistics practices.

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Battery production plays a vital role in the circular economy through Battery Second Use (B2U) systems, which repurpose batteries from Battery Electric Vehicles (BEVs) for stationary energy storage applications, such as grid storage and home energy optimization. This approach significantly lowers the environmental impact, saving approximately 100 kg of CO2 per kWh and delaying energy-intensive recycling processes, in line with the principles of reduce, reuse, and recycle, as well as EU Battery Regulations.

Second-life batteries are also economically advantageous, offering savings of 8-25% compared to new batteries. Successful implementation of B2U systems requires modular designs, thorough safety testing, and innovative business models, including leasing or pay-per-use options, to foster customer trust. In summary, B2U systems represent a sustainable strategy for advancing a circular economy (Meyer et al., 2024).

Summary of relevant models and frameworks

As Figure 2 shows various models and theories relate the term of green supply chain management. The similarities and differences between the triple bottom line, CSR and ESG models have been explained above. These models focus on the management vision and the success factors. The Cradle to Cradle and Circular economics approaches share a complex vision, i.e. they look at the whole supply chain. Of course, both the implementation of modern management and the analysis and development of the supply chain as a whole are necessary; thus, neither model is mutually exclusive, but rather complementary.

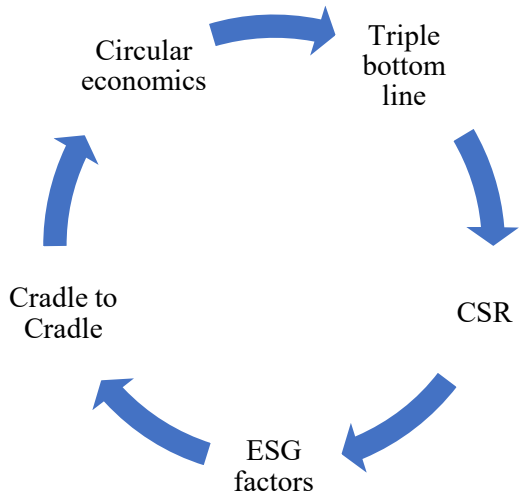

Figure 2 Some models and frameworks concerning green supply chain management

Source: Own editing based on literature

Barriers to implementing green supply chain management solutions

So far, we have seen the multi-faceted nature of the green supply chain. Enterprises may recognise the importance and competitive advantage GSCM offers but may fail to implement it into their processes. It is important to recognise these barriers to develop appropriate implementation strategies. Dhull & Narwal (2016) categorise these barriers and may fall into one of the following categories: internal, external, customers, competition, society, suppliers and uniquely industry-specific barriers (Table 1).

Category	Examples of barriers	Impact
Internal	High investment costs, lack of expertise, organisational inertia, inappropriate business models	High investment costs, lack of expertise, organisational inertia, inappropriate business models
External	Limited infrastructure, regulatory constraints, minimal government support, low public awareness	Impedes the broader ecosystem needed for GSCM success
Customer	Price sensitivity, lack of demand and awareness of green products	Discourages market adoption and demand for green initiatives
Competition	Undercutting on costs, reluctance to adopt long-term sustainability goals	Discourages collaborative approaches to sustainable practices
Supplier	Lack of knowledge, commitment, or resources to implement green initiatives	Disrupts alignment within the supply chain
Industry-specific	Manufacturing: energy costs; Food: sustainable packaging, perishability; Logistics: green infrastructure	Creates unique challenges that require tailored strategies for green practice adoption

Table 1 Barriers to implementation of green supply chain practices (own edit)

Among internal barriers include factors like high investment costs required to implement green practices from design, transformation of inputs, logistical costs etc., organisational deficiency in understanding green practices and associated benefits, inappropriate business models and business structure hindering implementation, a lack of commitment to implementation, inaccessibility of green technology due to associated costs or a reluctance to implement, nature of industry and its complexity among others.

External drivers outside the enterprise's scope range from the high cost of acquiring green inputs to a lack of infrastructure to support green practices, as discussed earlier. Some practices involve the whole value chain and not individual players. There are cases of limited manpower with appropriate expertise, heavy regulation minimal government support, and a general lack of environmental concern, ethical support, and CSR.

Customer drivers include, but are not limited to, pressure to have competitive prices. In cases where green practices are expensive, the high costs translate to high practices, which may be seen as unattractive to price-sensitive markets. A lack of demand

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and awareness about green products and practices may limit the support organisations with green practices get from customers.

Competition barriers may hinder green practice adoption through unnecessary competition where companies undercut each other to dominate or acquire market share. This may not be feasible to maintain, especially where green practices involve a high cost of acquiring green inputs and a high cost of transformation.

Supplier commitment or lack thereof, has a direct impact on the extent of the adoption of green practices. A lack of knowledge or understanding of green practices may also hinder the adoption of green supply chain management.

Some barriers are also industry-specific and may fall in any implementation stage due to either failing to have green design, green inputs due to the nature of operations, or infrastructural limitations in distribution.

To overcome these barriers, as tabulated but not limited to in Table 1, enterprises and policymakers must collaborate to create enabling environments through incentives, awareness campaigns, capacity-building initiatives, and supportive infrastructure. Solutions must be industry-specific, addressing each sector's unique challenges while fostering alignment across the supply chain. Through such targeted approaches, businesses can successfully navigate these barriers and fully realise the potential of green supply chain management.

Green supply chain management in some sectors

Understanding how green supply chain management practices emanate in different industries is important, as each industry offers unique challenges. Distinct challenges in value chains require a level of ingenuity and engineering, which usually results in new ways and business models. Though inconclusive, Let us explore how green supply chain practices in a few industries.

Lumber Industry

The implementation of a green supply chain in the lumber industry emphasizes sustainability by integrating economic, environmental, and social dimensions at every stage, from forests to lumber production and distribution. Sustainable forest management practices focus on optimizing resource use and minimizing environmental impacts through techniques like life cycle assessment, carbon sequestration analysis, and multi-objective programming. These methods aim to balance profitability with ecological objectives, such as reducing greenhouse gas emissions and preserving biodiversity. For example, decision-support systems, such as GIS-based tools and dynamic programming models, are used to optimize harvesting and transportation logistics, leading to lower costs and reduced emissions.

In sawmill operations, green supply chains benefit from innovations in manufacturing systems, material flow analysis, and sustainable procurement models. Techniques like mixed-integer programming and discrete event simulation are employed to improve production efficiency, minimize waste, and enhance resource circularity.

Additionally, social metrics are applied to ensure fair labour practices and community involvement. These approaches represent a shift towards a low-impact, high-value system in the lumber industry, promoting environmental stewardship and economic resilience while addressing societal expectations for sustainability (Jorge et al., 2024).

Steel Industry

The steel and iron manufacturing industry has numerous specific issues to address, from greenhouse gas emissions to various pollutants, as it is a sector that consumes a significant amount of energy and resources. Hunan province in China, which is predominantly dominated by this industry, faces considerable environmental challenges.

Pang et al. (2011) propose two strategies for establishing a green supply chain in the steel and iron industry: forward supply chain and reverse supply chain. The forward supply chain focuses on green purchasing, strengthening cooperation with suppliers. For instance, Xiang Gang factory fully implemented green purchasing by establishing qualified supplier files and conducting annual assessments of suppliers to evaluate quality, pricing, delivery times, and, importantly, environmental protection considerations.

In terms of green production, Xiang Gang has optimised its processes by implementing ERP information technologies, enhancing production efficiency. Hunan Valin Xiangtan Iron and Steel Ltd has adopted green production methods using Six Sigma management and optimised Total Productive Maintenance (TPM).

Green marketing is directed at downstream industries and customers through marketing networks that incorporate centralised distribution, resource consumption control, and route optimisation. Additionally, green product marketing involves collaboration between the manufacturer, Xiang Gang, and its customers to develop new products that meet emerging needs.

Finally, the reverse supply chain has been implemented to create a closed-loop system in the steel industry by recycling waste products. Xiang Gang constructed a recycling centre and waste gas disposal facility to address environmental issues effectively.

Electronics manufacturers

In their definition of green procurement, Ninlawan et al. (2010) describe it as purchase activities that aim at reducing, reusing, and recycling inputs. They found that supplier selection has strict adherence to environmental quality and standards requiring suppliers to meet certain thresholds and certifications, creating “green partnerships” or “green partners.”

The Thai electrical manufacturing green supply chain is defined as the use of inputs with a low environmental impact during the production process and tends towards little to no waste or pollution. With this, manufacturers replace the use of chemicals with water to allow re-use while cleaning parts. There are also energy efficiency measures in place ensuring the use of fewer resources to produce output, the use of bio-based plastic components and hence an elevated level of fire resistance.

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Green distribution, which involves efficient packaging and logistics, has seen manufacturers optimise space in warehousing and shipping through packaging characteristics like the use of unique sizes and correcting typing mistakes! shapes, and materials. This has resulted in better arrangement of load patterns, reduced packaging material usage, and use of space. Therefore, transporting has been optimised by carrying more finished output and using alternative energy sources, and an increase in returnable packaging methods has been adopted just as much.

Automobile manufacturers

Initially, the industry was mostly focused on the domestic market, but there have been instances of partnerships with external players and car brands. This has resulted in both the assembly of global household car brands in China and the export of Chinese car brands to other markets. Such expansion has economic and environmental influences on the Chinese automotive supply chain.

The rapid growth in automotive manufacture has had an impact affecting not just environmental sustainability but also resource shortages. Air pollution is a grim reality in big cities with automotive manufacturing being one of the major culprits. Such environmental burdens influence how players in the industry do business; hence, there have been attempts at having more environmentally friendly supply chains and products through eco-design practices by learning with and learning through supply chain partners.

Construction Industry

Green construction has been embraced by construction firms as a means of environmental consciousness, and it entails ensuring quality, safety, and other scientific management practices in engineering construction to maximize resource conservation and reduce unnecessary activities that result in wastage.

The dimensions involved in GSCM and construction practices include green initiation and green design, where firms come up with eco-friendly designs that are in harmony with the environment; green material management, which involves such processes as raw material planning, storage, handling, green material selection and sourcing and compliance to government regulations and legislations on environmentally friendly construction practices; green construction and green operation and maintenance which focus on transportation, onsite management and environmental safety and green building practices; reverse logistics which pushes for recycling and reuse of residual resources on other related projects (Wibowo & Handayani, 2018).

These industry examples highlight both the diversity of GSC implementation and common themes, such as waste reduction and eco-friendly sourcing, underscoring the adaptability of GSC principles across sectors.

Food Sector

Though ambiguous on its parameters, sustainable agriculture has gained considerable traction as an environmentally conscious approach to food production. It may

be seen as an approach allowing the production of high-quality produce while protecting resources; this heavily relies on the use and re-use of the farms' own resources instead of purchasing fertilisers or other purchased materials (Reganold et al., 1990; Velten et al., 2015).

With ICT solutions comes the need for intensive capital employment as these technologies do not become cheap. This may be too expensive for small unit farms. These technologies require technical know-how or the employment of experts, which is just as expensive. This may limit the benefits of smart and precision farming to small-time players. Precision agriculture, a form of sustainable farming, is increasingly used to minimise environmental impact through targeted input applications, enhancing productivity and resource use efficiency.

The competitive nature of the food industry, coupled with the need for competitive advantage, is pushing businesses to employ novel strategies like green procurement to remain not just afloat but competitive. Adopting green procurement differentiates businesses with this strategy from those with normal procurement practices without environmental considerations (Beleya et al, 2019).

Other than regulatory requirements, Hauschildt & Schulze-Ehlers (2014) study shows that green procurement is not only driven by moral and legal considerations but also a source of competitive advantage. Dynamic capabilities refer to a firm’s ability to use both external and internal competencies to address emerging environmental changes. Thus, firms may choose green supply chain practices to gain a competitive advantage or first-mover advantage, hoping their customers will take note of their green practices.

Challenges to Implementation of Green Supply Chain Management across various Industries

In the lumber industry, the high initial investment required for technologies like life cycle assessments and decision-support systems poses a significant financial obstacle to adopting sustainable forest management practices. The complexity of multi-objective programming, which requires balancing economic profitability with ecological goals, can lead to indecision and slow adoption rates. Additionally, there may be resistance to change due to entrenched traditional practices and scepticism about the economic viability of green methods (Jorge et al., 2024).

In the steel industry, the primary challenges arise from the sector's high energy consumption and pollution levels. Transitioning to greener practices necessitates substantial technological upgrades and investments, which can be both costly and disruptive. Green purchasing also presents difficulties, as ensuring supplier compliance with environmental standards across a vast network can be logistically complex and expensive. Integrating Enterprise Resource Planning (ERP) systems for green production adds further complexity, requiring workforce retraining and potentially causing operational disruptions during implementation (Pang et al., 2011).

For electronics manufacturers, establishing "green partnerships" hinges on supplier certification and compliance with environmental standards, which can be a significant barrier due to the associated costs and time required for audits. Replacing traditional

materials with eco-friendly alternatives, such as bio-based plastics, may affect product performance or increase costs. Moreover, optimizing green distribution involves revamping packaging and logistics, which may encounter resistance due to existing systems and networks (Ninlawan et al., 2010).

The automobile industry faces barriers related to the complexity of managing a global supply chain while aligning it with green practices. Rapid industrial growth exacerbates resource scarcity and environmental impacts, particularly regarding air pollution, making the shift to sustainable practices more challenging. Implementing eco-design necessitates extensive collaboration with supply chain partners, which can be complicated by competitive or proprietary concerns (Zhu & Sarkis, 2007).

In the construction industry, complying with diverse and changing environmental regulations presents significant hurdles, potentially leading to project delays and increased costs. Green material management requires more expensive and less accessible eco-friendly materials, affecting budgets and timelines. Additionally, effective reverse logistics for recycling construction materials faces challenges due to a lack of infrastructure and economic viability (Wibowo & Handayani, 2018).

In the food sector, the adoption of Information and Communication Technology (ICT) solutions for sustainable agriculture is often hindered by high costs, making it less feasible for small to medium-sized farms. There is also a shortage of technical skills required for precision agriculture, which limits its implementation. Although there is a push for green procurement to gain a competitive advantage, market readiness to pay a premium for sustainably produced goods remains uncertain, impacting the return on investment for green practices (Reganold et al., 1990; Velten et al., 2015; Beleya et al., 2019).

These barriers underscore the need for industry-specific strategies, financial incentives, and educational programs to facilitate the transition to GSCM across these diverse sectors.

Conclusions

The discussed industrial practices exhibit several commonalities in their approaches to green supply chain management (GSCM). A key focus across sectors is waste reduction, which is achieved through practices such as eco-design, green manufacturing, and recycling. Another important aspect is supply chain optimization, where industries utilize green logistics, route optimization, and efficient inventory management to minimize their carbon footprints. Sustainable sourcing is also a shared priority, with green procurement practices emphasizing environmentally friendly materials and careful supplier selection. Furthermore, there is a strong emphasis on lifecycle management across industries. Techniques like reverse logistics and cradle-to-cradle approaches ensure that materials remain within the supply chain loop, thereby minimizing waste and reducing environmental impact.

Despite their similarities, different industries encounter unique challenges that influence their green supply chain management (GSCM) practices. Operational challenges

can vary significantly; for example, manufacturing sectors like steel and automotive deal with issues related to high energy consumption and pollution, while the food industry faces the challenges of perishability and resource-intensive farming. The level of technological integration also differs amongst industries. Advanced sectors like electronics often embrace cutting-edge green manufacturing technologies, whereas industries such as construction and agriculture tend to rely on simpler, resource-efficient practices. Regulatory impacts further distinguish these industries. For instance, steel and automotive sectors adapt their green practices to comply with stringent environmental laws, while the food industry is more swayed by consumer-driven demands for sustainability. Finally, the nature of the outputs produced contributes to variations in GSCM practices. Industries that produce raw materials, such as steel and lumber, emphasize efficient processes to minimize waste. In contrast, sectors like food and electronics prioritize innovations in packaging and distribution.

In conclusion, although industries share foundational GSCM principles, their unique challenges and outputs emphasize the necessity for innovative, collaborative, and sector-specific strategies to achieve sustainability.

Limitations of the study include its scope, which focusses on specific industries in specific geographic areas. While these provide insight into green supply chain management, many areas of application of GSCM with shared and unique challenges and opportunities need examining. The study has limited quantitative analysis, as it relies on existing literature. To ascertain generalisability, empirical analysis and statistical validation are required to prove and disprove the findings across industries and geographical locations.

These limitations offer an opportunity for future research focus and cross-industry studies. Just as important are geographical and cultural cross-examinations. Behavioural and consumer behavioural studies are also needed to gain insights into consumer behaviour and GSCM in different geographical locations across industries.

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CONSUMER TRUST AS A COMPETITIVE ADVANTAGE IN THE RETAIL SECTOR

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Abstract: The issue of consumer trust is a very popular topic in the literature, but its approach from the perspective of competitive advantage is rare. Having a competitive advantage is important because it plays a key role in the long-term success of a company and in strengthening its market position. Competitive advantage models traditionally focus on costs and brand awareness and neglect soft factors. Yet both virtual and physical stores can rely on consumer trust in them. Barney's VRIO analysis explores the relationship between VRIO and competitive advantage. The basic premise of the model is that resources that are valuable, scarce, difficult to replicate and embedded in the organisation are closely linked to a company's competitive advantage. In our study, we use qualitative methodology and VRIO analysis to show how consumer trust can help small retail firms to operate. We find that high consumer trust contributes to strengthen a business in an almost invisible way. After all, the right level of consumer trust can give any organisation a significant competitive advantage and boost its results.

Keywords: *consumer trust, retail, VRIO analysis*

Introduction

According to KSH (Hungarian Central Statistical Office), there were 99,200 retail shops in Hungary on December 31st of 2023 (KSH, 2024a). In 2023, the value of retail sales at current prices was HUF 18.4 thousand million, which, with a 17 percent increase in retail prices, represented a 7.9 percent decrease in volume compared to the previous year, based on preliminary data adjusted for calendar effects. In the past year, the volume of sales in food and grocery retail stores declined by 4.7 percent. At the end of June 2023, the number of retail outlets was 6.4 percent down on a year earlier, at around 7,000 (KSH, 2024b). These data highlight the importance of the retail sector, both for the macro-economy and for individual consumers. We can also see that the number of shops and their turnover has declined in recent years. There are many reasons for these declines, but this is not the focus of our study. In any case, it is clear that retail businesses have to cope with a deteriorating and challenging economic and social environment and ensure stable operations.

In the case of shop retailing, either the customer goes to pick up the goods (in which case the retailing takes place at a fixed location) or orders them online. In category, location (choice of site), choice of product range, service (e.g. traditional, partially or fully self-service), price level and ownership are important. We believe that the companies

concerned should therefore strengthen not only the traditionally hard factors (Kelemen-Erdős et al., 2024; Tick, 2023), but also the - often looked down upon - soft elements. They may be the very things that might save a retail business – especially a small retail shop –, which is important not only for its customers but also for the jobs saved.

So our study focuses on a soft element, consumer trust, but not in a traditional approach, but from a competitiveness perspective. Our research question is:

How, in what way, does consumer trust give a retail business a competitive advantage?

To answer our research question, we conducted a systematic literature review on consumer trust and its relationship with competitiveness. The focus of our qualitative research is a micro-sized, mixed-profile retail company. For our analysis we used the VRIO method. The VRIO concept seeks to answer fundamental questions such as: 1. How valuable is the resource? 2. How available, rare in the market? 3. How easily can it be copied by competitors; and 4. How well does the possession of the resource fit into the organisation?

Relevant literature review

This section first briefly introduces the concept of competitive advantage and its typical sources. Then we describe how we conducted a systematic literature review on consumer trust. We looked at how popular a topic consumer trust is, and which research topics are most often linked to it. We then looked at the literature on consumer trust from a retail perspective and then from a competitive advantage angle.

Competitive advantage is any characteristic of a company, country or person that distinguishes it from others and puts it in a relatively higher competitive position. That is, any characteristic that makes it more competitive than the others. Although competition has long been a central concept in market-based economies, its importance only increased in the second half of the 19th century and the first half of the 20th century, mainly as a result of the work of A. Smith, J. Schumpeter and J. B. Clark. The attributes that contribute to comparative advantage are innumerable. But examples include privileged access to natural resources (such as high quality minerals or cheap energy), a highly skilled workforce, geographic location or high barriers to entry. However, these features and conditions are often difficult to maintain in the long term. Companies therefore seek to find new competitive advantages and improve on those they already have.

Competitiveness is related to the development and acquisition of a competitive advantage. However, competitive advantage is not synonymous with performance although it can contribute to superior performance, but is a much more complex concept. In essence, it is a comparison between a focal company and its competitor(s) according to a given aspect(s). Competitive advantage is also context-dependent. It is not a universal, generic characterisation of a particular company or particular parts of a company, but the positional relationship between the company and its rival(s) in a given competitive situation (Ma, 2000).

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Competitive advantage differentiates a company from its competitors. It contributes to better pricing, generates more sales and strengthens brand loyalty. Creating such an advantage is an important goal for any company. Competitive advantage refers to the factors or attributes that enable a company to produce services or products that are more affordable or of higher quality than those of its competitors. Competitive advantage can help a firm to differentiate itself from its competitors. Maintaining a competitive advantage is a challenge, as competitors are constantly trying to gain or copy it. A sustainable competitive advantage means having characteristics that are difficult for competitors to imitate (Kaukab et al., 2024).

There are many opportunities for organisations to maintain a competitive advantage, and successful companies are taking advantage of them, recognising which solutions are best for them. Companies must constantly develop new products, services or technologies to maintain their competitive edge (Kyatmaja et al., 2023). This may be technological development or continuous improvement of products and services. Strong brand loyalty is also vital because loyal customers are less sensitive to competitors' pricing and offers (Ebele et al., 2024). Cost efficiency is key to maintaining competitive advantage, especially for companies with a low-cost strategy. Firms need to continuously optimise their production processes and reduce costs to maintain their price competitive advantage (Mugoni et al., 2023). Maintaining customer satisfaction contributes to a firm's competitiveness by enabling it to respond quickly to changes in customer needs, strengthen customer loyalty and generate repeat business. To ensure a long-term competitive advantage, firms should enter into strategic partnerships that give them access to new markets, technologies or resources (Agustian et al., 2023). Sustainability plays an increasingly important role in maintaining competitive advantage. Firms that build a sustainable value chain remain competitive in the long term because they are more attractive to conscious consumers (Sharma & Gupta, 2024). To maintain their existing market position, companies are strengthening their presence in key markets.

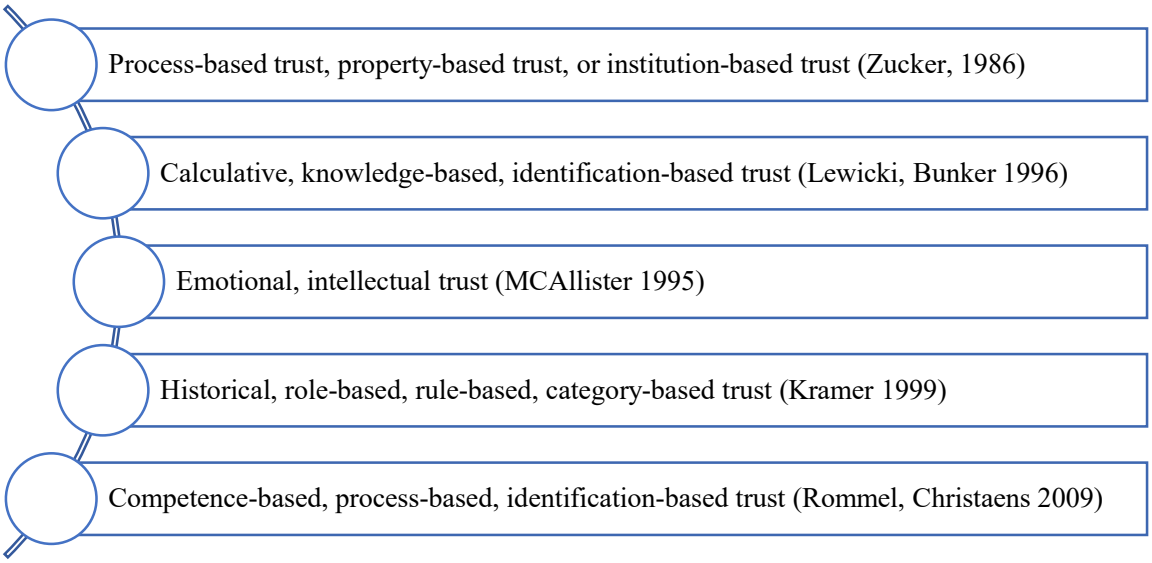

Figure 1 Categorisation by type of trust

The issue of trust between people has always been a major phenomenon. Not only is trust between people essential, but also for organisations, therefore business trust has been a hot topic that is addressed by many disciplines. Research on the topic has the longest history in social psychology (Larzelere-Huston, 1980) and sociology (Cook & Santana, 2020). In connection with the results of these fields, the first authors in the field of management science to publish independent research results were the authors of the theory of organisational behaviour (Mayer et al. 1995) and inter-organisational or business marketing (Doney-Cannon, 1997). In this case, the focus is not primarily on trust between individuals, but on trust between organisations. Whether the typification of trust is based on the incentive structure or on the internal norms of the partner, reciprocity is an essential characteristic of inter-organisational trust (e.g. Holm et al., 1999, Walter et al., 2001).

According to the dominant trends in the international literature, some authors interpret trust primarily as a resource (Tsai-Ghoshal, 1998), as faith in others (Kumar, 1996), a management strategy (Uzzi, 1997), or as a management mechanism (Jarvenpaa et al., 2000). In another categorisation Zucker (1986), Rommel (2009) and Christaens (2009) argue that trust is process-based (see Figure 1). Zucker (1986) further distinguishes between attribute-based and institution-based trust. Lewicki (1996), Bunker (1995), Rommel (2009) and Christaens (2009) agree that trust is based on identification. However, Lewicki and Bunker added that trust is also calculative and knowledge-based. According to Christaens and Rommel, trust is competence-based. McAllister (1995) formulated that when we talk about trust, there is intellectual and emotional trust. Finally, Kramer (1999) thought that trust can be historical, role-based, rule-based and finally category-based. One critique of the faith-based interpretation of trust interprets trust itself as a willingness to act. What the two conceptions have in common, however, is that they both see trust as closely related to vulnerability and risk, and self-interested behaviour. It is thus generally accepted that trust presupposes the existence of a risky situation (Luhmann 1979).

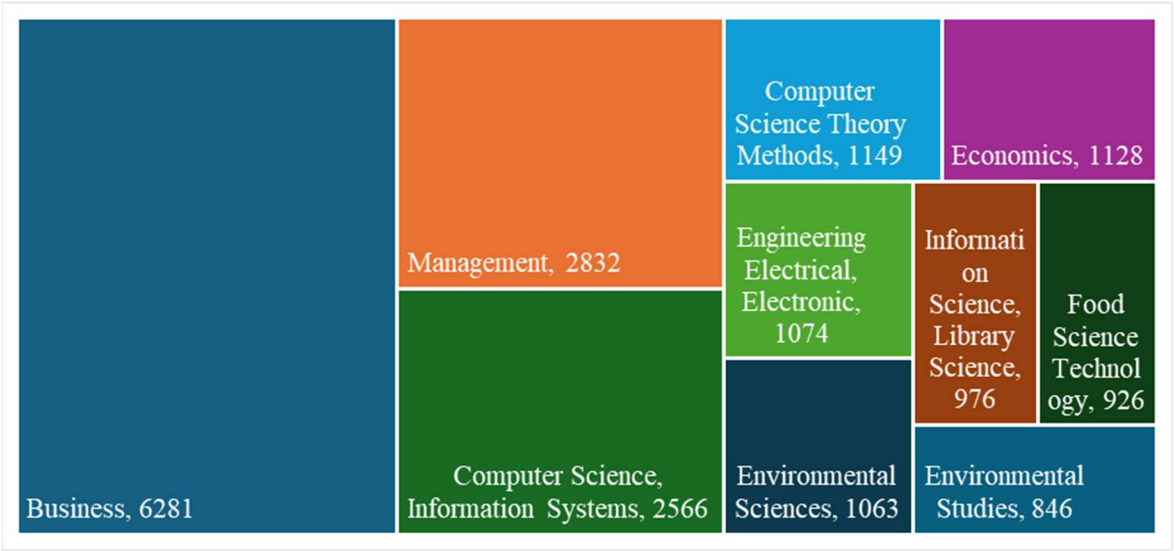

Table 1 Distribution of the 21891 publications on consumer trust by category (Own editing)

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A systematic literature review is a transparent and explicit process that reviews, evaluates and interprets the available literature based on different search criteria (Fink, 2019; Tranfield, et al., 2003; Davis et al., 2014). We used the well-known and reliable Web of Science (WoS) database, without year restrictions, using the topic mode. The general term 'consumer trust' resulted in 21891 publications (see summarizing Table 1). This was narrowed down to social science topics (9113 results), more concretely 6281 publications on Business (29%), and 2832 publications on Management (13%), and this is the set of publications that we examined further. These data suggest that consumer trust is a very popular and researched topic.

As shown in Figure 2, the number of publications (on consumer trust in the two social science topics) included increased steadily until 2020 and then remained roughly at the same level. This figure also demonstrates the popularity of the topic, but it is interesting to note that the growth stopped around 2020. It seems there is still interest, but it is no longer a rising trend.

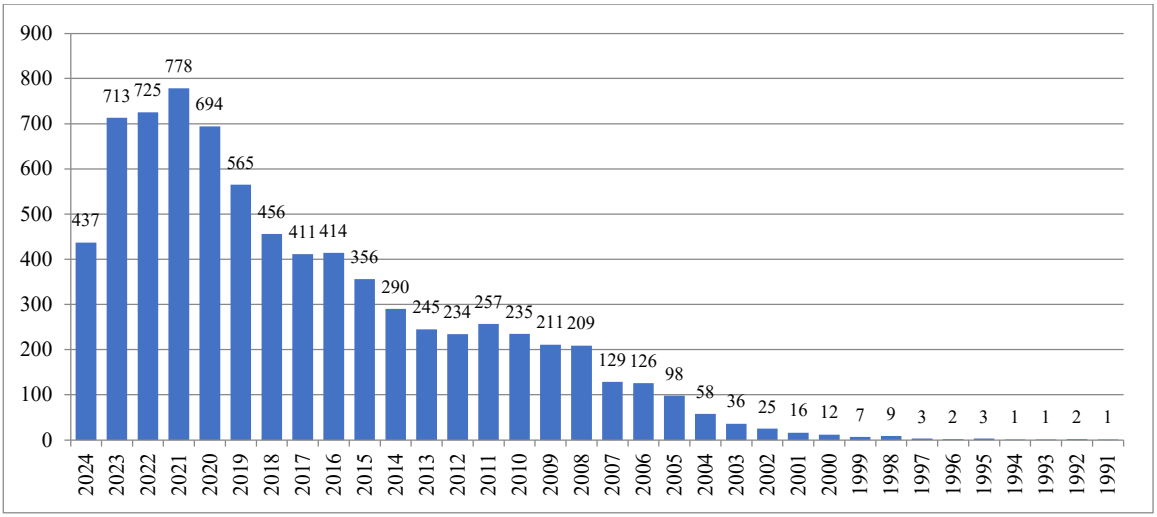

Figure 2 Chronological variation in the number of 9113 publications examined (Own ed.)

According to Micro-topics (algorithmically labelled with their most significant keyword) of publications on consumer trust (see Table 2) consumer satisfaction – as the largest group if Micro-topics – is closely linked to trust, although it is difficult to say which factor develops first, a dynamic interaction is more likely. However, the 2nd place of the Technology Acceptance Model (TAM) is surprising. The foundations of TAM were laid by Davis (1989) based on the book by Ajzen and Fishbein (1975). The study of technology acceptance investigates how people psychologically relate to the use of a given technology voluntarily and willingly. Its core area is information technologies and systems (computer use, software use and adoption in work environments). It is assumed that the rapidly growing technology, IT and knowledge in consumer products is the cause of this. Although we should add that since TAM, many similar models have appeared. We see that the increasing IT content in products is linked to Privacy (5th) and Knowledge Management (7th) is linked to the greater knowledge embodied in the product.

Social responsibility, or corporate social responsibility (CSR), is a business concept whereby companies take into account the interests of society by considering the impact of their activities on their customers, suppliers, employees, shareholders and the environment. This is the 3rd most common topic (see Table 2), but the 4th, Environmental Concern, is also logically closely related. CSR is considered to be important in terms of competitiveness and has been shown to bring benefits in terms of risk management, cost savings, access to capital, customer relations, human resource management and innovation capacity (Garai-Fodor et al., 2023).

The sharing economy (6th) is based on the principle that we do not use all the tools we own every hour of the day, and we do not want to buy everything we want to use. In the sharing economy, we create an exchange pool that we can put at each other's disposal for a reasonable fee. The Internet and social rating have thus opened the way to various community solutions. This has led to online marketplaces, housing and accommodation booking systems, car-sharing and community finance portals etc. In this model, social rating itself has become a risk factor. In today's world, customers are increasingly reliant on each other's opinions, so one bad review can damage the image of a business. This new form of buying/renting is both heavily reliant on trust and can have a major impact on retailing and the way it is conducted.

	Micro-topics	The number of publications
1.	Customer Satisfaction	4817
2.	Technology Acceptance Model (TAM)	506
3.	Corporate Social responsibility	336
4.	Environmental Concern	269
5.	Privacy	200
6.	Sharing Economy	159
7.	Knowledge Management	113
8.	Persuasion	72

Table 2 Most frequent Micro-topics covered by the 9113 publications examined (Own ed.)

Persuasion (8th) is a complex concept, and is most closely related to marketing psychology. At the intersection of marketing and psychology, marketing psychology is an expanded field that explores how to influence consumer behaviour and decision-making. Marketing psychology aims to understand consumers' motivations, tastes and needs so that we can create more effective, targeted marketing strategies. Knowledge of advertising techniques and manipulation methods is essential for both consumers and marketing professionals. Respecting ethical boundaries and transparent communication can help maintain consumer trust and achieve long-term business success.

A combined search for the two terms *consumer trust and retail* resulted in 13 hits in the WoS database. Of the 13 articles, 7 were related to on-line retailing. Consumer trust in retailing as a research topic seems to be most often raised in the case of online retailing. Gender (Amin et al., 2015) as well as generational differences (ElSayad et al., 2024) in the relationship with consumer trust in retailing was also examined. In their empirical research,

Kokthi et al. (2022) shows how consumer confidence is influenced by the retail purchase of daily consumer goods such as mineral water.

As our study examines consumer trust in terms of its contribution to competitiveness, we have also looked at the literature on this relationship. The search for the two terms (*consumer trust and competitive advantage*) yielded 197 results, which is not a very high number. The following Micro-topics were the most frequently mentioned in this search: 1) Customer Satisfaction 121; 2) Corporate Social Responsibility 25; 3) Knowledge Management 13; 4) Technology Acceptance Model 8; and 5) Privacy 5. So this means that more or less the same topics emerged in the search for consumer trust as the only subject word.

Empirical research

Research aim This research focuses on customer trust and its relationship with the competitive advantage. We applied the case study method and within this methodology we asked some buyers of the focal firm and the shop's sales staff, about their experiences.

Applied methodology A case study is a method in which we examine and study a phenomenon that has already happened (Yin 2002). From this, we decipher the individual components, the factors affecting the results, and the hidden connections. This provides an opportunity to systematically examine the data, collect data, analyse the information and finally record the results. As a result, the researcher can gain a more complete picture of why things happened the way they did, and what would be worth examining more closely in the future. In contrast to questionnaires, interviews or observation, several methods are actually used simultaneously during the preparation of a case study. When selecting a case, researchers often prefer samples that focus on the information that can be obtained (Flyvbjerg, 2006). The two essential features of the case study are complexity and contextuality. Complexity means that the examined case is presented in its entirety. In accordance with contextuality, we examine and present the case not only by itself, concentrating on its specific characteristics, but in connection with the environment in which it operates and acts (Yin, 2018).

The data were collected after the COVID-19 pandemic. In addition to its tragic effects, this event brought about a number of changes in economic processes and sectors. It also had an impact on the psychology, behaviour and purchasing habits of consumers in terms of retail sales (Gupta et al., 2023). These aspects have also been taken into account, thus increasing the generalisability of our results.

The selection of the case is therefore of particular importance, and can usually be chosen according to the following: The average case means the processing of a case whose essential properties, in the opinion of the researcher, also characterize the other units of the population. In an extreme case, the presentation of the case is considered exceptional in some way, often an "outlier". Our case is one of the first, average cases. With this, our goal was to research how an organization copes with the creation and maintenance of consumer trust.

Although we are now looked at a single case, we had to work with many data sources for an objective result. The sources used for our case study were the following: a. Statistical data on the investigated case, its type and environment; b. Public documents: newspaper articles, legal documents, publications, etc.; c. Personal documents: e.g. reports showing the specific business processes of the company; d. In-depth interviews with people familiar with the chosen case (colleagues, consumers, business partners, etc.); and e. Multiple visits to the selected organization.

During the depth-interviews the aim of our research was to get the interviewees to be honest about their own opinions. This is mainly achieved by sitting down with each subject one by one, as this makes everyone more open and honest. For example, in the focus group, it would have been a problem if those who were a bit braver had spoken up, thus suppressing the more timid. But we wanted to hear everyone's views, which is why we chose to conduct in-depth interviews within the case study.

Before the in-depth interview, we prepared a guide to help us explore the topic in depth. The expert interviews took place on the company's business premises. During the interviews, we were able to interview a total of six sales representatives and six individual buyers. These interviews were carried out one by one, in order to allow each person to express their thoughts and opinions.

The qualitative research process is very time-consuming. The number of subjects targeted/interviewed is relatively small, so it is necessary to draw a conclusion from the small number of subjects and to shed light on the problem. It also has the disadvantage of high subjectivity and low reliability. It provides less data, which may reduce the individual conviction of the researcher. The central organisation of the case study was based on familiarity. These are all limitations of the research and our conclusions should be treated in conjunction with them.

The *focal company* where our research was carried out is a small enterprise located in a village in Pest county. The retail business has been operating for about 15 years and has been growing and developing ever since. This company has 4 different shops. Its main activity is grocery retailing, which includes household goods. The shop sells a wide range of products to all its customers and has partnerships with a number of suppliers. During our research, we found that the goods are always fresh from the suppliers. This small business currently employs 10 people.

The method of analysis The theoretical background of VRIO is the resource-based theory (Wernerfelt, 1984, Barney, 1991). VRIO analysis (Astawa, 2022; Logan et al., 2017) is a tool used in the strategic analysis of a company. It allows us to determine which resources and capabilities can generate a competitive advantage for the firm. Basically, it is a tool that is very useful for companies because it allows them to spot what resources and capabilities they have. The letters of the VRIO analysis display the following:

a) *Valuable*: A company's resources must have value. A valuable resource can help your business better cope with threats and help you better leverage and exploit your opportunities.

b) *Rare*: Generally speaking, a resource is rare if it is difficult to access in the market. It can be a special purpose resource for the company.

c) *Inimitable*: This characteristic means that competitors have little ability to copy or replicate the company's resources or capabilities. Furthermore, if a competitor wanted to copy the resource or capacity, it would incur very high costs. It is therefore practically impossible to imitate.

d) *Organized:* Organisation, the final element of the model, refers to the ability of the company to optimise the use of its resources and capabilities. It is the right organisation that allows it to generate sufficient revenue to define its strategies.

If the first point is met (Valuable), we cannot talk about a competitive advantage, only a good opportunity that other competitors can often use. If the competitive advantage is valuable and even rare, it is a temporary competitive advantage, but it becomes long-lasting if it is difficult to imitate, but the organisation is able to do so. Table 3 illustrates visually the logic of VRIO, how a valuable resource, attribute or any organisational factor becomes a source of organisational competitive advantage in its market. By evaluating the resources in the table, we can answer the question of which resources are important for our competitive advantage. The VRIO analysis may still be relevant for make-or-buy decisions and outsourcing issues, but in this case the logic is reversed, as we are looking at resources that the company owns, but that do not create value.

Is a resource or capability…					
Valuable?	Rare?	Costly to Imitate?	Exploited by Organisation?	Competitive Implications	Economic Performance
No	---	---	No	Competitive Disadvantage	Below Normal
Yes	No	---	↕	Competitive Parity	Normal
Yes	Yes	No		Temporary Competitive Advantage	Above Normal
Yes	Yes	Yes	Yes	Sustained Competitive Advantage	Above Normal

Table 3 The VRIO framework (Barney, 2002)

Discussion with VRIO model

Consumer trust has been defined by more interviewees as the satisfaction of customers with a product or service. "Personally, I think consumer trust means that a customer will return to the business that they have confidence and loyalty in. Consumer trust, in my opinion, is a constant and high level of customer satisfaction. "- said one buyer. Our analysis of the literature also shows that consumer trust and consumer satisfaction go hand in hand. For some sales persons, consumer trust is not only about

satisfaction with a product or service, but also about satisfaction with the staff and management of the company. As a salesperson said, "To gain trust, you need to pay attention not only to the quality of the products or services, but also to the image of the business."

The opinions also reflect a belief-based approach to trust. For example, in this opinion: “To me, consumer trust is a belief that the seller or manager can perform their obligations fairly, have the right expertise and act in the consumer's best interests.” According to the next buyer, "I, as a consumer, as a buyer, trust that what I buy is of the quality and expiry date that it says it is, or for example that the fruit and vegetables are as fresh as the seller said and that they are not just trying to sell the product". This points to a common feature of services such as dependence on the person. In the case of traditional - not online - retailing, this is even more appreciated.

As another interviewee put it, "For me, consumer trust is a reassurance that I can be sure that the staff and management are acting in a way that ensures that consumers receive the freshest and best quality products and maximum quality service." The interviewees are probably not familiar with the different approaches to trust, but this view illustrates an approach to trust that assumes that the other party will not behave opportunistically (Lado et al., 2008).

"The company manager has won the trust of many consumers, as it is characteristic of him that he communicates personally and directly with his consumers. He pays close attention to the individual wishes of consumers and often inquires whether they are satisfied with the products. I think this gives customers a very positive feeling," said one of the sellers.

"Several consumers have come to me with how satisfied they are with their sellers with atmosphere. There was a consumer who said that it was very important to him that help him with his shopping and be respectful towards him. He said in the other shop of the settlement the salespeople didn't even bother to greet him when he entered the store." - said one of the salespersons, which proves their good judgment against the competitor. The following quote summarizes the focal firm's organizational policy well: "Based on my experience, I think that at any time if there is a problem with the goods or if a conflict arises a between the consumer and the seller (the store or the management), we immediately look for a solution to restore this." Niewczas-Dobrowolska et al. (2024) also found that after the COVID-19 outbreak, shoppers' behaviour changed, especially when buying food.

Based on the case study, let's look at the VRIO analysis of the organisation (see Table 4). By evaluating the resources listed in the table, we can get an answer to the question of which resources are important for the researched firm’s competitive advantage. The first question is whether we see a valuable competitive advantage in what the organisation does. We see that the activity of a retail store offering mixed category products is supported by consumer trust in the organisation and its individual consumers. The next question is rarity, i.e. how rare is the competitive advantage of the examined organization and whether there is any demand at all for what it offers. A shop with a mixed profile is really not that special, but its geographical location - it is in a village, easily

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accessible - increases this "rarity" factor, which is enhanced by the trust that has been established. Imitability refers to how quickly, easily and especially cheaply competitors can copy the organization.

In principle, consumer trust is easy to copy, but it takes a long time to build it, and they cannot make mistakes in the meantime, since it's a fragile resource that can easily be damaged by a comment or negative opinion. The strong consumer trust developed in the examined organization is therefore rare, as it cannot be easily and quickly imitated. Based on experience in our research, we see that the conflict management for both the supplier and the consumer is advanced. They conduct open communication; the management is visible and available to employees and customers. Therefore, the development and maintenance of consumer trust is not surprising.

Elements of VRIO	The relevant characteristics of the focal firm
Value	The retail store in the village offers mixed-category products, which is strengthened by consumer trust in it
Rarity	Good geographical location (very few shops in the village) and good consumer trust toward this specific retail firm; consumers can go to this shop frequently
Imitability	Stable consumer trust which was developed over long period of time that's why it is difficult to imitate
Organization	Part of the organization's corporate culture is trust towards employees, suppliers and customers; it has good relationships with its stakeholders

Table 4 The VRIO analysis of the focal organisation (Own ed.)

Looking at global retail trends (Zeller, 2024), the focal company researched differs from some these trends in some respects. For example, it does not use AI in its operations and is dominated by traditional, in-store shopping. However, they are trying to make this personal shopping as efficient and harmonious as possible, paying more attention to the needs of their customers (Tinonetsana and Msosa, 2023). This is in line with the global strategy, as a significant proportion of retailers aim to remain memorable for their customers (Zeller, 2024), as competition between retail chains and stores is very strong.

The impact of social media is also increasing on the retail side (Raniya et al., 2023), but there are differences between e.g. China and the US (Statista, 2024), but this area was not found in our research, nor do special, high-priced brands play a significant role in the small rural shop. The phrase 'retail apocalypse' was used even before the pandemic (Thompson, 2017), with e-commerce becoming increasingly popular, resulting in large numbers of shop closures. This global trend continued after the epidemic (Müller-Pérez et al., 2023), but our empirical results show that shoppers in a well-known store in a small town still opt for traditional on-site shopping. Consumer demand is growing towards sustainability (Wilson, 2024), but this demand has not yet been reflected among the store stakeholders included in the research.

Conclusions

VRIO is basically a tool that is very useful for companies because it allows them to see what resources and capabilities they have. Then, knowing how valuable, rare, inimitable and organized resources and capabilities the company has, it can create a sustainable competitive advantage over time.

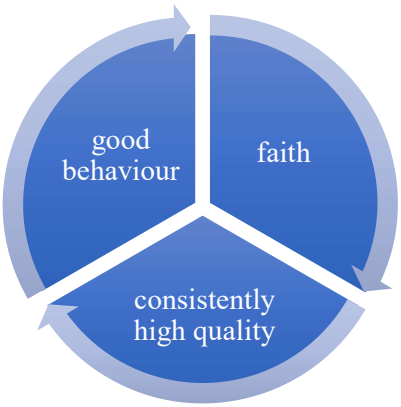

Figure 3 Visualisation of the main results of the research (Own ed.)

The investigated small business offers a wide range of products in order to provide all its customers and seemingly could develop strong consumer trust over the long years. For the small-scale retailer at the heart of the case study, the consumer trust that has been established now provides a competitive advantage that is difficult to replicate (due to the long time span) and unique (specific to the organisation). In response to our research question, consumer trust in the organisation can therefore function as a competitive advantage, firstly towards its employees and then towards the products it offers. The right behaviour on the part of the organisation, which is part of the corporate culture, has created trust and faith in consumers (see Figure 3). This consumer trust was maintained and further strengthened when it was found that the products offered were of consistently high quality.

Based on the results of the research, it would be worthwhile to conduct quantitative research how consumer trust leads to increased competitiveness. It would be also interesting to examine how this works in the case of large multinational retail chains, which have different relationships with their individual customers because of their size and other characteristics.

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SHARING ECONOMY AND MOBILE APPLICATIONS – ACCEPTANCE AND USAGE

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Abstract: This study investigates the impact of mobile applications on the sharing economy and consumer attitudes towards environmentally conscious practices. Utilising a structured questionnaire distributed via Google Forms, data was collected from 160 respondents between October and November 2023. The findings reveal a significant awareness of various mobile applications aimed at promoting sustainability, with Vinted, MOL Bubi, and Munch being the most recognised amongst users. Despite a self-reported inclination towards environmental consciousness, the study indicates a disconnect between awareness and actual usage of these applications. The results suggest that factors such as limited availability, lack of promotion, and personal preferences significantly influence the adoption of sharing economy services. Future research is recommended to expand the dataset and explore additional applications to gain a more nuanced understanding of consumer behaviour in this evolving economic landscape. This paper contributes to the discourse on the sharing economy by highlighting the challenges and opportunities presented by mobile technology in fostering sustainable practices.

Keywords: *sharing economy, collaborative consumption, mobile applications, generations*

Introduction

The majority of countries now have social, political, and economic frameworks that include the sharing economy idea. Its growth is driven by the growth of the digital platforms that enable it, and it happens in a way that frequently outpaces the relevant legal frameworks and scholarly research. Mobile applications, due to their widespread use and accessibility, have become a powerful tool for promoting environmentally conscious practices. This paper examines the sharing economy as a novel economic structure as it is used in everyday life through mobile applications, and the attitudes of consumers toward it.

The sharing economy, characterised by collaborative consumption facilitated through online platforms, has revolutionised various industries such as tourism and accommodation (Morandeira-Arca et al., 2023). It provides access to goods and services without ownership burdens, and facilitates product exchange and wayfinding strategies (Moresi et al., 2018; Ku et al., 2022). Sharing economy and the business models based on it started to explode at the end of the first decade of the new millennium. Airbnb, now a household name, was launched in 2008 and Uber in 2009.

Platforms like Airbnb and Uber have disrupted traditional markets by enabling peer-to-peer interactions and encouraging the sharing of goods and services, leading to cost savings and increased efficiency (Simic & Liem, 2023). The sharing economy's success hinges on building trust, reducing uncertainty, and maximizing product utilization through digital peer-to-peer platforms, ultimately reshaping consumption patterns and economic interactions (Acosta et al., 2022). Furthermore, the sharing economy's disruptive nature challenges traditional business models, emphasizing the role of startups in creating value through horizontal networks and community participation, especially in the food industry (Toivola, 2018; Mucelin & Durante, 2018). These studies collectively underscore the significant impact of mobile applications on reshaping consumer behaviours, enhancing sustainability, and fostering innovative business models in the sharing economy.

In this study we set out to introduce usage and attitudes of Hungarian consumers of various collaborative online platforms. In the next sections, after a brief literature review, followed by a Materials and Methods section, we present results and discussion, and the paper is finalized by conclusions and recommendations.

Literature Review

The demand for environmentally conscious behaviour has become increasingly important due to the alarming environmental consequences of traditional consumption-production attitudes. As a result, there is a growing interest in exploring alternative approaches to promote sustainability. One such approach is the intersection of the sharing economy and the circular economy, which represents a promising way to explore environmentally conscious consumption and production practices.

The aim of the circular economy is to minimize the generation and emission of waste, as well as to reduce the consumption of raw materials and energy. This is achieved by designing products with a focus on circulation, where materials are used for as long as possible and waste is transformed into new resources. On the other hand, the sharing economy emphasizes access over ownership, allowing individuals to share underutilized goods with others. By combining these two concepts, we can create a more sustainable system that encourages the sharing of resources and reduces the need for new production (Hoffman et al., 2022).

Economic models based on sharing can also offer a solution to the ecosystem problems of big cities. The services cooperate with many local actors, such as local government companies, local residents and other economic and social actors and institutions. Partnerships take many forms, for example the bicycle sharing company MOL BUBI, has a direct relationship with MOL and the state-owned Budapest Transport Center (BKK), as well as indirectly with the district municipalities. GyőrBike has a direct partnership with István Széchenyi University in Győr. In the case of transport sharing services, partnerships are important, as users must provide parking spaces at pick-up and drop-off points (Czakó at al., 2019).

The sharing economy based on social consumption has many concrete forms, but they generally have in common that the emphasis is on demand-based access instead of

ownership, and that they use (P2P) solutions based on the direct connection of users, the creation of which uses Internet-based platforms (Frenken & Schor, 2017). Social media, mobile technology, and digital devices are extremely important to people's daily lives everywhere. Information technology and digitalization have revolutionized the market of goods and services alike (Mai & Tick, 2021). Hungary's digital infrastructure, which includes reliable broadband networks and cutting-edge mobile connectivity, has rapidly expanded, allowing its citizens to access information and communicate digitally with ease (Tick, 2023).

Mobile applications have become a powerful tool for promoting sustainable practices, especially in the areas of travel, waste management and the circular economy. Eco-friendly travel is one area where mobile apps can have a significant impact. Apps can promote sustainable travel behaviour and accessibility by encouraging people to use alternative modes of transport such as walking, cycling, public transport or carsharing – to reduce carbon emissions and traffic congestion (Cimsir & Uzunboylu, 2019). E-scooters are still relatively new in the field of transportation. This new vehicle type was first introduced in California, USA, in 2017 and is currently offered globally. In Europe alone, e-scooter sharing has about 20 million users, and its uptake rate is four times higher than that of bike sharing (Szemere & Nemeslaki, 2023).

Waste management is another area where mobile apps can motivate sustainable behaviour. They can contribute to the practice of reuse, they give objects a new life, thereby reducing the amount of garbage that ends up in landfills (Martín & Calvo Martínez, 2022). Food waste is a global problem today, with significant economic, environmental and social consequences. According to the Food and Agriculture Organization of the United Nations, around one-third of the food produced for human consumption worldwide is lost and wasted every year (Dwyer, 2023). Consumers play a significant role in the generation of food waste, especially in high-income countries (Ahmed at al., 2021). Some mobile applications can also help reduce household food waste. Restaurants, bakeries, supermarkets, hotels, and other businesses can save money by selling unsold but intact, fresh food at a set time or by the end of the business day, at the same time helping out their consumers. For example, in Hungary people can order food at a 40-70% discount through the Munch platform from a browser or APP (Wu & Takács, 2023).

Materials and Methods

The questionnaire required for my research was distributed using Google Forms and the answers were collected on various internet platforms. The fillings took place between October and November of 2023. In this time interval, 160 replies were collected. The questionnaire was completely anonymous and the data was only used for research purposes. The questionnaire was structured as follows:

- demographic questions, where I also asked about sensitive data such as monthly net income per capita, this is justified by the idea that the level of earnings affects people's willingness to be environmentally conscious (the demographic characteristics of the data can be found in Table 1),

- 7 questions that assess the attitude of the interviewees towards sustainability, in this part I would also like to highlight how consistent people's opinions and actions are,
- 6 questions that ask the respondents about specific environmentally conscious mobile applications, among them are lesser-known ones, but also include the most well-known ones in Hungary:
  - Vinted – sale of new and used clothes at favourable prices
  - Munch – discounted sales of still good quality food packages
  - MolBubi – community bicycle rental
  - MolLimo – community carpooling, car sharing
  - Lime – e-scooter rental
  - Rakun – returnable food packaging for home delivery

Designation	Frequency (%)	Designation	Frequency (%)
Generation		Main activity	
Silent/Great	3.8%	Work	55.0%
Baby Boomer	16.9%	Education	16.3%
GenX	20.6%	Entrepreneur	15.0%
GenY	18.1%	Retired	12.5%
Genz	40.6%	Unemployed	1.3%
Gender			
Male	29.4%		
Female	70.6%		
Education		Domicile	
Less than lower secondary	3.8%	Capital and suburbs	45.0%
Secondary	43.1%	City	39.4%
University	53.1%	Village	10.6%
Subjective Income		Abroad	5.0%
We live in deprivation	10.0%	Household members	
We get by	35.6%	alone	14.4%
We can set aside some money	41.3%	2	48.1%
Have substantial savings	10.6%	3-4	31.3%
No answer	2.5%	5 or more	6.3%

Table 1 Demographic data (N=160)

Examining the ratio of women to men, the number of women's responses is clearly higher. It was filled out by twice as many women (111 people) as men (49 people). Also, about half the respondents live in the capital city and its suburbs and have a university education. Additionally, the older generations (especially the Veterans) are underrepresented. Due to the low number of responses, and the skewed data, the survey is not representative. The survey also did not include psychographic aspects, such as values and lifestyles.

My research questions were the following:

• How important do each generation consider sustainability, and how responsible do they feel for the deterioration of the environment?

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• To what extent are the different generations receptive to alternative solutions and environmentally conscious applications that help them?

In this paper, due to the depth of the study, not all possible correlations will be presented; the primary focus will be on generations.

After the initial descriptive statistics, ANOVA test was run followed up by Tukey post hoc testing. Additionally, chi square test was utilized to analyze categorical variables and assess the independence or association between them (McHugh, 2013). For the statistical analysis SPSS was used.

Results and Discussion

3.1. Sense of responsibility for the environment

In the first part questions were relating to sustainability (on a scale from 1 = not important at all to 7 = extremely important):

• How important is sustainability to you?

• To what extent do you feel that you are also responsible for the deterioration of the environment?

On average, the respondents rated the importance of sustainability at a level of 5.50 (SD = 1.25), whereas their own responsibility for the deterioration of the environment only at a level of 4.58 (SD = 1.59) (Table 2).

		Importance		Responsibility	
	N	Mean	Std. Deviation	Mean	Std. Deviation
Veterans	6	3.83	1.33	3.67	0.82
Boomers	27	5.70	1.44	4.37	1.86
GenX	33	5.24	1.17	4.52	1.75
GenY	29	5.59	1.24	5.00	1.54
GenZ	65	5.66	1.11	4.58	1.45
Total	160	5.50	1.25	4.58	1.59

Table 2 Importance of sustainability and sense of responsibility and generations

Source: Own figures, SPSS

An analysis of variance (ANOVA) revealed that there was a significant difference between generational groups in the importance of sustainability (p=0.006). Based on the between subjects Tukey test, Veterans found sustainability significantly less important versus all other generations, except GenXers ($p < 0.05$). However, no significant difference could be found among the different generations in sense of responsibility (Table 3). Nevertheless, since the number of veteran responders was very low, these results might not be reliable.

	Sum of Squares	df	Mean Square	F	Sig.
Importance	21.888	4	5.472	3.718	0.006
Responsibility	11.443	4	2.861	1.132	0.343

		Mean Difference (I-J)	Std. Error	Sig.
Veterans	Boomers	-1.870*	0.548	0.007
	GenX	-1.409	0.538	0.072
	GenY	-1.753*	0.544	0.013
	GenZ	-1.828*	0.518	0.005

Table 3 Relationship between Importance of sustainability and sense of responsibility and generations, results of ANOVA and Tukey post hoc test

Source: Own figures, SPSS

Personal responsibility was also addressed in the later questions that inquired about who do they think pollutes the environment the most (Figure 3), and who should be responsible for protecting the environment (Figure 4). In both of these question individual responsibility (or the responsibility of the consumers) was ranked very low.

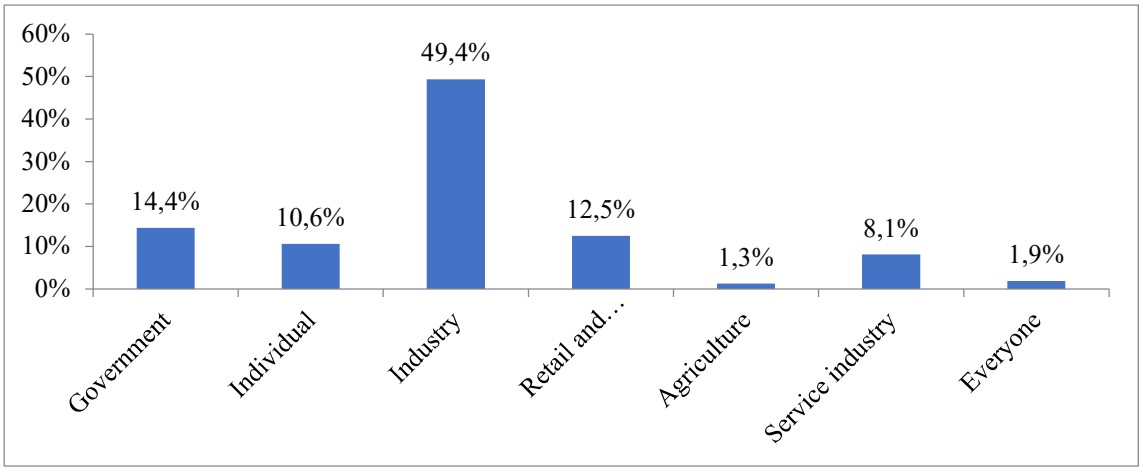

Figure 2 Who pollutes the environment the most

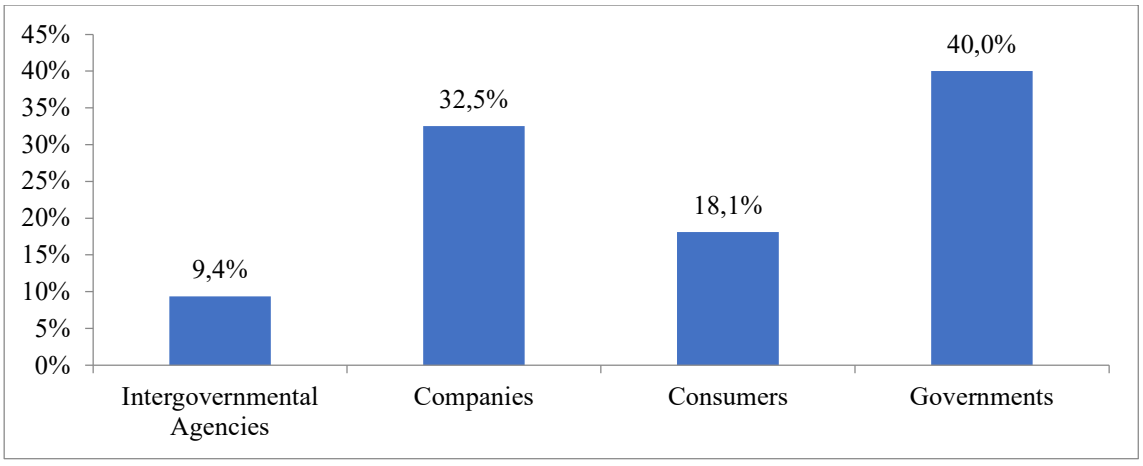

Figure 3 Who is the most responsible to act in defence of the environment

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Only 18 percent of the respondents believe that the individual should do the most to improve the situation of the environment. 40 percent of those surveyed hold the government, 33 percent the companies, and 9 percent the international bodies (EU, UN) responsible. Thus, the majority believes that the government should first introduce regulations and decrees within the country in order to achieve a more environmentally conscious behaviour, and second it is the duty of companies to ensure that their products and services are environmentally friendly, or at least to support such initiatives.

Running chi squares test on either of these questions reveals that there are no significant differences between generations (Table 4).

	Assigned Responsibility for Pollution			Assigned Responsibility for Protection		
	Value	df	Asymptotic Significance (2-sided)	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.798[a]	20	0.841	13.973[a]	12	0.302
Likelihood Ratio	14.605	20	0.799	15.735	12	0.204
Linear-by-Linear Association	0.352	1	0.553	2.019	1	0.155
N of Valid Cases	157			160		

Table 4 Relationship between assigned responsibility for pollution and protection of environment and generations, results of Chi square tests

Source: Own figures, SPSS

Note: Expected value of cells should be 5 or greater in at least 80% of cells. Since this assumption is violated the Likelihood ratio numbers should be used

3.2. Knowledge and usage of green mobile applications

Vinted is clearly the best-known mobile application among those listed (Figure 5). This can be attributed to the fact that the ads of the company that sells used clothes could be found everywhere - TV, newspapers, online advertising, influencer recommendations, in fact even those for whom this would otherwise not be relevant know about its activities. About 88 percent of the respondents know it.

Vinted is followed by MOL Bubi and lime on the familiarity list. 77 percent of the respondents stated that they know Bubi. The high rate of choice may be the result of the fact that the bike sharing app has the longest history of the listed applications in Hungary, but due to the lack of promotion and its availability only in Budapest, it slipped to second place.

60 percent of the respondents have already heard of MOL Limo as a car sharing service, so lack of knowledge is not the reason why they do not use it. Further research is needed to reveal the real reason behind this. Limo is followed by Munch, more than half of the respondents, 54 % recognized it. The least known application is Rakun, only 16 people have heard of it.

The result suggests that the respondents are not necessarily receptive to mobile applications created to protect the state of the environment, despite the fact that they described themselves as environmentally friendly in the first part of the questionnaire.

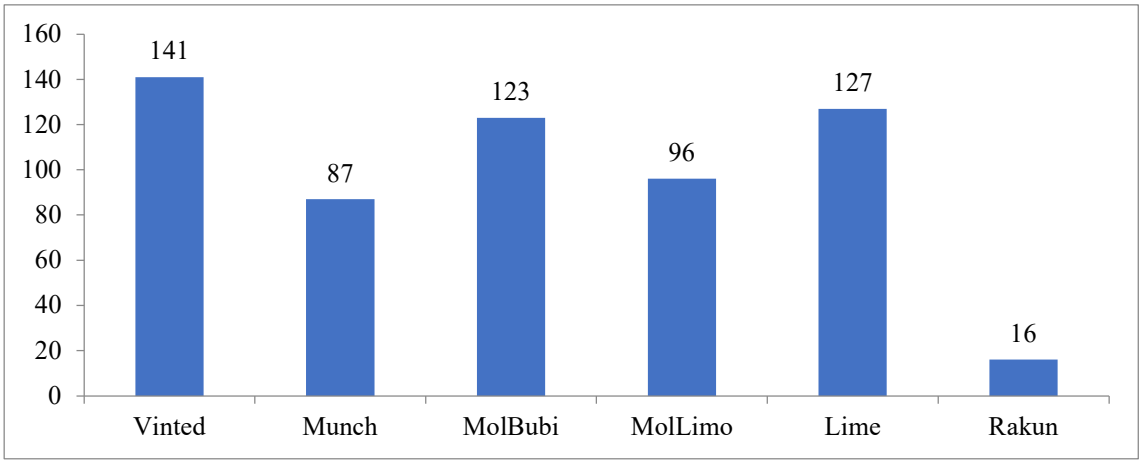

Figure 4 Which of these applications have you already heard about (number of people)

Vinted is the application that is used even on a daily basis by those filling out the questionnaire (Figure 6). Overall, 35% stated that they actually use it. Despite the fact that the Munch application is the second least known (only 54%), a reasonable proportion of the respondents, 21 percent, use the service.

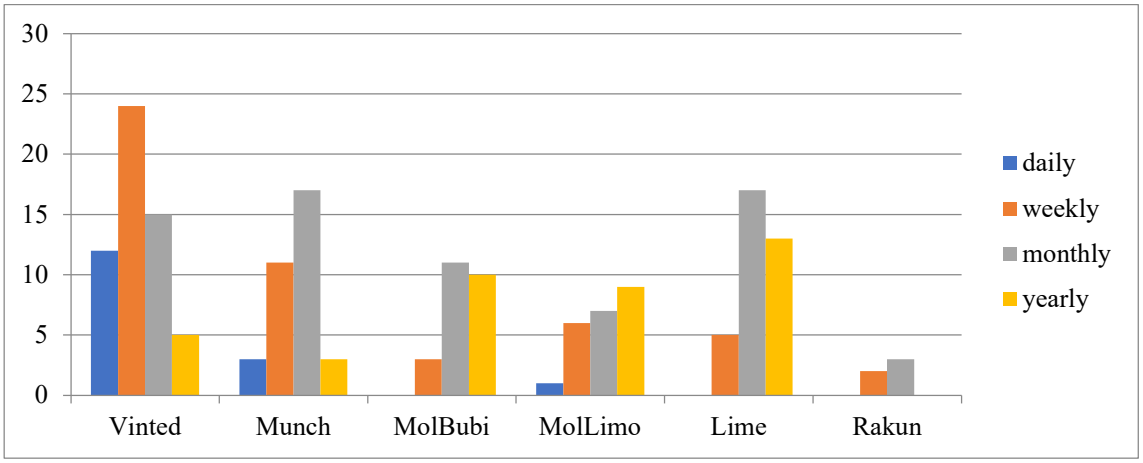

Figure 5 How often do you use these applications (number of people)

Although each subsequent generation was familiar with an increasing number of applications, there were no significant variances between the groups (Table 5).

	Mean	Std. Deviation
Veteran	3.17	1.72
Boomer	3.19	1.66
GenX	3.64	1.58
GenY	3.83	1.42
Genz	3.91	1.53
Total	3.69	1.55

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	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.247	4	3.062	1.275	0.282
Within Groups	372.128	155	2.401		
Total	384.375	159			

Table 5 Number of applications recognized by respondents and relationship with generations, results of ANOVA test

Source: Own figures, SPSS

In the next section, I aimed to find out, what could be the reason why people do not use mobile applications made in the name of sustainability, even though they acknowledge them (Survey question: If you don't use it, why not?). The field was not required to be filled in and an answer had to be entered in one's own words, thus a little more than a third of the respondents did not even want to answer (Table 6).

I examined the received answers, grouped them and came to the following conclusion - 106 of the 160 respondents expressed an opinion. The most common reasons being "I don't need it / I'm not interested/ I do not know them/ Not relevant". In the second group we can find the answers "I have my own car/bicycle/I cannot drive/ I use public transport". Some of these replies are closely related, since for the group that has their own car/bicycle or use the public transport it is not relevant to use MOL Limo or Bubi. Additionally, 45 percent of the respondents do not live in the capital, so it is understandable that they remarked that the service is not available in their place of residence.

Grouped answers	**Number of respondents**
Not available where I live	14
I do not need them	24
I do not know them	9
Not relevant/not useful	6
Not interested	5
I use my own vehicle/bike	12
I walk/use public transport	5
Can't drive/bicycle	5
Too complicated	7
Don't like apps	2
Not safe	5
Only buy new products	2
Didn't have good products	2
Don't have time	2
Use GreenGo	2
I cook for myself	2

Table 6 Reasons for not using these applications

Among the responses, some mentioned that it is too complicated for them to use the application, or that they do not like mobile applications. Some considered either the service not safe (it is not safe to travel by bicycle/roller in Budapest), or the mobile application themselves. In addition, two respondents specifically stated that they prefer to use the GreenGo, instead of MOL Limo, because of the more favourable price. Price and quality are still the main factors that influence brand switching, but social media plays a crucial

role in presenting new options and guiding consumers in their purchasing decisions (Tladinyane et. al., 2024).

Conclusion

Based on the responses to the online questionnaire, it can be stated that the respondents clearly consider sustainability important, however, they feel less responsible personally for the deterioration of the environment. Furthermore, most of the respondents assign responsibility both for environmental degradation and protection, not to the individual, but to governments and companies. This is in line with prior research (Piscitelli & D'Uggento, 2022; Adamczyk & Adamczyk-Kowalczuk, 2022).) Although, Veterans found sustainability less important, as far as personal responsibility, there were no significant differences between generations. Similarly, while younger generations are more familiar with these new green applications, no significant differences could be found in awareness.

The topic needs further research to find out what motivating factors can influence people to use environmentally conscious mobile applications. In my opinion, a greater degree of promotion would be necessary. Research has indicated that active participation in social media can result in increased levels of brand advocacy and loyalty among customers (Tladinyane et. al., 2024). Furthermore, I think it would be a good marketing tool for these companies to announce different challenges for their users, who after completing them can receive discounts, thereby encouraging a more frequent use. Additionally, many responses were received that indicated that they do not use these options because it is not available at their place of residence. If the companies were to extend their services to the entire country, the utilization of these applications would show an increasing trend.

Future research could focus on collecting a larger, more representative dataset (with a broader geographical reach and including psychographic data) and incorporating additional mobile applications for a better, more nuanced understating of the topic.

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LEADERSHIP DEVELOPMENT WITH MINDFULNESS

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Abstract: Mindfulness refers to focusing on the present moment and non-judgemental awareness. It has become popular in Western society in recent decades, particularly under the influence of positive psychology, as it has been shown to reduce stress, anxiety and depression. Nowadays, we hear more and more about the importance of mindfulness in more and more areas. The world of business is no exception. Numerous international studies show the benefits of mindful presence at the level of individuals, groups, organisations and markets. Mindfulness training in the workplace promotes emotional intelligence and team dynamics. The practice of mindfulness is not just a stress management tool, but a way of life that improves managers' self-awareness, sense of responsibility and quality of relationships. In this paper, I would like to provide insights on how this method can be applied in leadership development to increase effectiveness.

Keywords: *mindfulness, leader, leadership development*

Mindfulness

The concept of mindfulness

„The awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, 145 p.). Mindfulness, or conscious presence, is defined in various ways in the literature. Kabat-Zinn (2003) was the first to study this topic with scientific rigor, and his work remains fundamental to this day. Mindfulness is a psychological state characterized by a focus on the present moment and non-judgmental awareness in every moment. It is a special practice of attention that exclusively concentrates on the present moment. According to Brown and Ryan (2003), the essence of mindfulness is setting aside personal filters to establish direct contact with experiences and responding to them in a less automated and more flexible manner.

Lengyel (2018) provides the following comprehensive definition of mindfulness in his dissertation: "A specific form of perceiving reality and relating to it. It is a highly alert yet deeply relaxed state of consciousness, where the individual mind allows and non-judgmentally observes whatever arises from external or internal stimuli, letting these sensations, thoughts, and feelings dissipate on their own, allowing the mind to quiet down in the here-and-now." (Lengyel, 2018, p. 34)

Szabó (2018) summarizes the most essential elements of mindfulness in the following five points:

6. Focus on and experience the present moment. Fully living the present experience without being disturbed by memories of the past or worries about the future.
7. Non-judgmental attitude. Openness to the present moment and clear reception without labelling, suspending constant correction and mental commentary.
8. Letting go of automatic responses. This means not yielding to immediate, instinctive reactions.
9. Opportunity to avoid game situations. Instead of acting according to usual patterns, we approach the present situation with curiosity, recognizing its uniqueness and novelty.
10. The ability to distinguish between the inner reality coloured by thoughts and feelings and the external, actual reality. Recognizing what exists only in our own thinking versus what is the actual, real situation. This allows us to break away from past patterns and respond in a new, situation-appropriate way.

In recent years, research on mindfulness has flourished, with increasing empirical evidence supporting its beneficial effects on many important aspects of human life (Baer, 2003).

The place of mindfulness in Western society

Mindfulness has its roots in Eastern Buddhism, where the ultimate goal of meditation practices is liberation and enlightenment from a spiritual perspective. The mindfulness techniques prevalent in Western culture have more mundane goals. In recent decades, attitudes to meditation in Western society have changed fundamentally. Practices that used to serve exclusively mystical and spiritual purposes have now been brought to the level of the everyday by modern psychology. They are often used in conjunction with other therapeutic techniques and have been shown to be effective in treating a variety of mental and health problems. Mindfulness and other meditation practices have become increasingly popular areas of scientific research, and this trend continues today (Schlosser, 2012).

The positive psychology movement, which started in the 2000s, aimed to explore the conditions of human well-being, led by notable figures such as Csíkszentmihályi and Seligman. One of the main fields of positive psychology is happiness research, well-being research, resilience, flow, emotional intelligence, and scientific research on mindfulness (Oláh, 2022). Mindfulness is a specific state that helps an individual to achieve a higher level of psychological well-being (Creswell, 2017). Empirical research has shown that mindfulness is excellent for the prevention of various mental or psychosomatic illnesses (Schlosser, 2012).

The primary effect of mindfulness is to reduce stress levels. According to Jain and colleagues (2007), mindfulness reduces the negative impact of internal dialogue and thoughts that quieten down, thereby reducing self-generated stress. Goyal and colleagues (2014) have shown that mindfulness meditation reduces symptoms of anxiety and depression, with beneficial effects on psychological well-being. Sanada and colleagues

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(2016) showed in their study that mindfulness reduces levels of cortisol, the stress hormone. These meditation methods also have long-term stress-reducing effects (Koncz, 2020).

Davidson and colleges (2003), examining the effects of 8 weeks of mindfulness-based stress reduction training, concluded that even such a short training had a positive effect on immune function, and that a significant difference between the two groups was observed over several months.

Achieving a state of mindfulness

Mindfulness is a specific quality of alertness and attention that aims to experience the present moment, while meditation is a means of practicing it (Verdes, 2019). Achieving a state of mindfulness is part of a meditation process that goes beyond a simple technical toolkit. Kabat-Zinn (2003) emphasises that mindful presence is not just a tool to be used in times of increased stress but a way of life that needs to be continuously invested in developing throughout the daily routine.

Mindfulness is learned through regular meditation practices. Meditation can take different forms. Classically, many people think of sitting meditation with closed eyes, but there are many other dynamic methods to achieve the desired mental state (Lengyel, 2018). What these methods have in common is that they focus attention on a specific object. This may be observing a physical sensation, watching the breath, looking at an external image, or even repeating a passage of text. The attention is consciously directed to the chosen object. Eventually we drift towards the thoughts and feelings that arise. We then observe them without judgement and return our attention to the original object. In this way, maintaining a focused state becomes easier with practice (Bishop et al., 2004). This practice can also be seen as training the mind.

As a result of regular practice, this psychological attitude is also reflected in everyday situations. We then recognise our automatic thought and emotional reactions to the situation and learn not to identify them with ourselves, but to treat them as events in the mind, thus maintaining our inner balance (Unoka, 2015). This allows us to manage our emotions and thoughts, as well as our behaviour, more consciously and to communicate on that basis. These skills can be valuable opportunities and sources of change for everyday and organisational collaboration.

Mindfulness and leadership

Mindfulness in organisations

How does mindfulness fit into the life of organisations? This question can be approached from several perspectives: at the employee level or for the organisation as a whole, considering mindfulness as part of the organisational culture.

The potential to transcend our psychological conditioning is one of the most significant effects, enabling new responses and behaviours, thus bringing positive changes in the behaviour of all organisational members.

Even just observing and noticing how easily we get distracted can be helpful. This can help us to recognise how much time we are wasting by not focusing on the present (Weick and Putnam, 2006). We can also apply this awareness to our work by focusing our attention back on the work process. The ability to practice mindfulness is particularly important for work as it is linked to employee well-being and performance (Brown and Ryan, 2003; Hülsheger et al., 2013). Research by Indrianti et al. (2024) suggests that entrepreneurial mindfulness provides startup leaders with a solid emotional foundation and cognitive awareness, which is an essential resource for effective business management.

For the positive effects of mindfulness and conscious presence in organisations to take hold, the contribution of leaders is essential (Verdes, 2019). According to Chia (2005), the most important task of a leader is to operate with mindfulness, which has an exemplary effect on the attitudes and behaviours of the people he or she leads. Given the benefits of mindfulness, organisations can be encouraged to apply it at all hierarchical levels. Leaders can be the driving force for employees to take advantage of mindfulness. To achieve this, organisations should be vigilant to assess their capacity for mindfulness in advance when recruiting new leaders, and implement leadership development programmes that help to achieve a state of mindfulness and improve leadership quality (Lange, 2018). A further opportunity for the organisational development of mindfulness is for leaders to implement mindfulness-based operations and communication transparently in their daily routines and in challenging situations, especially for senior leaders who serve as role models for others (Richardson and Rothstein, 2008). Leadership awareness opens the way for individuals within the organisation to be non-judgmental, self-aware and present in the moment (Lange, 2018).

Mindfulness and the leader

In the following, I will focus on the leader, analysing the importance of mindfulness, its applications and benefits. According to Chia (2005), the leader's task is to identify and prioritise the needs within and outside the organisation. This highlights the importance of managerial attention and awareness in organisations. Research by Lange (2018) and colleagues has shown that leaders with higher mindfulness skills are less destructive and more transformative. Their results support the importance of mindfulness in the leadership process and suggest that organisations should invest in mindfulness-based development programmes (Lange et al., 2018).

The work of managers often involves parallel tasks or dealing with unexpected events that can compromise the quality of work. Work fragmentation can be increased if managers' attention is distracted, for example by checking emails. Mindfulness can help to overcome these and manage them correctly, and to make managers more aware on a spiritual, emotional, mental or physical level. This builds the ability to communicate and connect with others on this level, inspiring their subordinates (Ehrlich, 2017).

Experiential learning plays a large role in the quality of leadership roles that individuals are able to fulfil. One tool for this can be the methodology based on mindfulness, proposed by Ashford and DeFue (2012) as a model of conscious engagement that supports the individual's sense of responsibility and emotional intelligence. Hougaard

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et al (2016) have created a mindfulness leadership framework to help leaders understand and overcome challenges. (Figure 1) The framework builds on the practice of mindfulness and focus to improve our relationships with ourselves and others.

1. Self-awareness and mindfulness: mindfulness is the foundation of effective leadership, allowing the leader to listen to his or her own thoughts and emotions and to guide actions based on values and goals.
2. Empathy and emotional intelligence: as the leader's awareness grows, so does his or her empathy, so that he or she can better understand the challenges and difficulties of others.
3. Effective self-direction: high levels of self-awareness and self-discipline help leaders to focus on the right things and to act with credibility.
4. Leading others: when a leader is able to listen to themselves and others, they can more effectively introduce strategic tools such as visioning and situational leadership, thereby increasing compassion and wisdom in leadership.

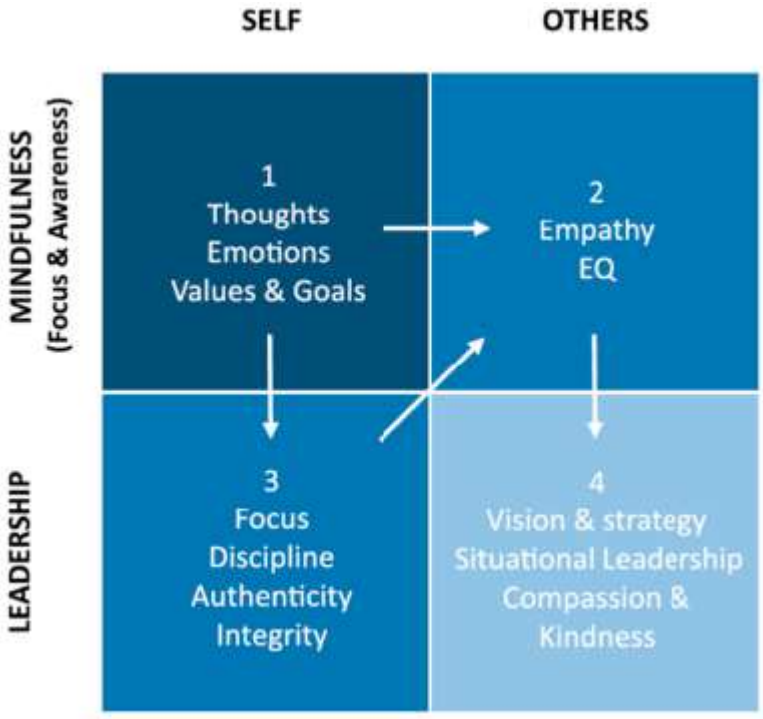

Figure 1 Mindful Leadership Framework.

Source: Hougaard based on Zu, 2019, p. 17.

Empirical research confirms that mindful presence interventions can have a significant impact on the personal and professional lives of managers. Leaders who engage in such practices report increased self-awareness, a greater sense of responsibility and the ability to be present in challenging situations. These practices have a positive impact on leaders' interactions with team members and increase their relationship skills (Urrila, 2024).

Mindfulness leader

The study of Stedham and Skaar (2019) elaborates on how mindfulness aids in self-regulation, emotional management, and social awareness—all of which contribute to a leader's authenticity and reliability.

Doornich and Lynch (2024) sought to offer a theory of the characteristics of mindful leaders. Their proposed theoretical framework consists of three main concepts that explain the characteristics of mindful leaders:

1. attention,
2. awareness, and
3. authenticity.

Inspired by these concepts, they have developed their theoretical framework for mindful leaders as the "three pillars of the mindful leader" - a metaphor that explains the three main concepts and describes the qualities of leaders who regularly practice mindfulness based on existing research. Since neuropsychological research shows that formal meditation as a mindfulness practice can reshape the brain and mind, they believe it is essential to integrate mindfulness meditation into their proposed theoretical framework. Therefore, they propose that the formal practice of meditation should form the basis of "the three pillars of the mindful leader". In Figure 2, they summarize and model their proposed theoretical framework on the qualities of mindful leaders.

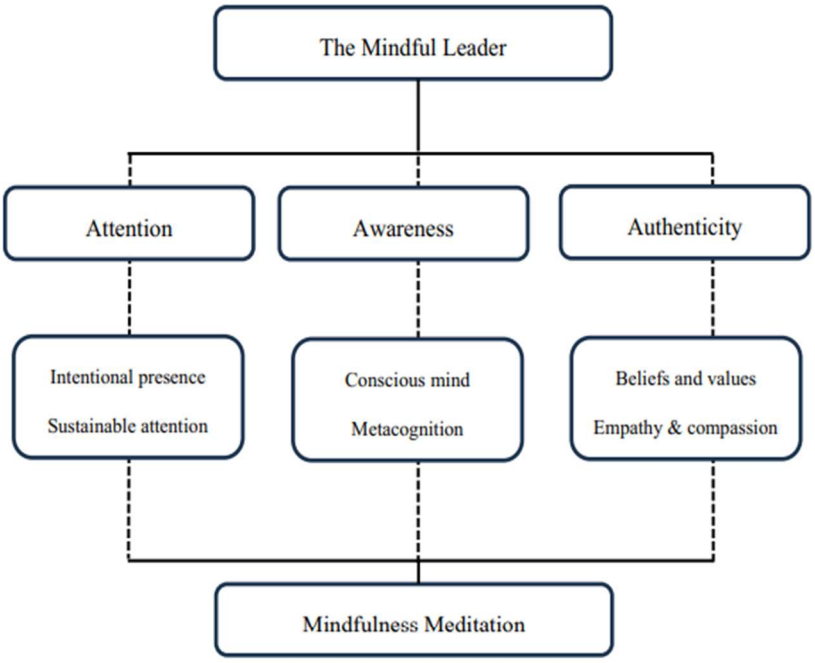

Figure 2 The three pillars of the mindful leader.

Source: Doornich and Lynch, 2024, p. 12.

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Mindfulness training

Managers can increase their awareness by regularly practising mindfulness, which includes both formal meditation and informal mindful activities such as mindful walking. These practices are offered as an 8-10 week training course (Rupprecht et al, 2019)

Two methodologies have also been proposed: mindfulness-based stress reduction programmes (MBSR) and cognitive-behavioural therapy programmes (MBCT). These can be complemented by the development of ideal levels of work-related stress (Chiesa and Serretti, 2009).

King and Badham (2018) distinguished between first and second generation mindfulness programmes. First-generation mindfulness programmes, such as MBSR and MBCT, were developed primarily to alleviate symptoms of stress and depression and can be used in both clinical and non-clinical settings. Evidence on the effectiveness of these types of programmes mainly relates to the reduction of psychiatric disorders and stress among healthy adults. In contrast, second-generation mindfulness training is gaining ground in workplace and management settings. These trainings, while secular, make more explicit reference to Buddhist philosophy with the aim of bringing about significant changes in participants by reintegrating the ethical dimension of Buddhist consciousness.

Developing leadership skills with mindfulness

Urrila (2022) developed a comprehensive framework to organize the outcomes of mindfulness interventions and practices, structured into 28 developmental outcomes across four thematic clusters: personal wellbeing, work productivity, relationships, and inner growth. These clusters were further divided into two dimensions: essential and transformative outcomes. Essential outcomes refer to mindfulness practices' impact on managing stress and demanding work situations, thereby improving leader wellbeing and work productivity. Transformative outcomes highlight the deeper impact of mindfulness practices on leaders' self-reflection and interaction with others. Transformative change signifies a lasting shift that fundamentally alters one's way of being and leading. This structure is illustrated in Figure 3.

The empirical research of Rupprecht et al (2019) suggests that mindfulness training can be a valuable tool for self-directed leadership development, promoting emotional intelligence, self-regulation, and improved interaction styles. The study identified several key impacts of mindfulness training on leaders:

1. Self-Leadership Capacities:
    a. Mindful Task Management: Improved focus and efficiency in handling tasks.
    b. Self-Care: Increased awareness and practices related to personal well-being.
    c. Self-Reflection: Enhanced ability to reflect on actions and decisions.
2. Leadership Capacities:

a. Relating to Others: Better communication and relationships with team members.

b. Adapting to Change: Increased flexibility and adaptability in dynamic environments.

3. Broader Impacts

a. Participants reported that the benefits of mindfulness training influence team dynamics and organizational culture positively

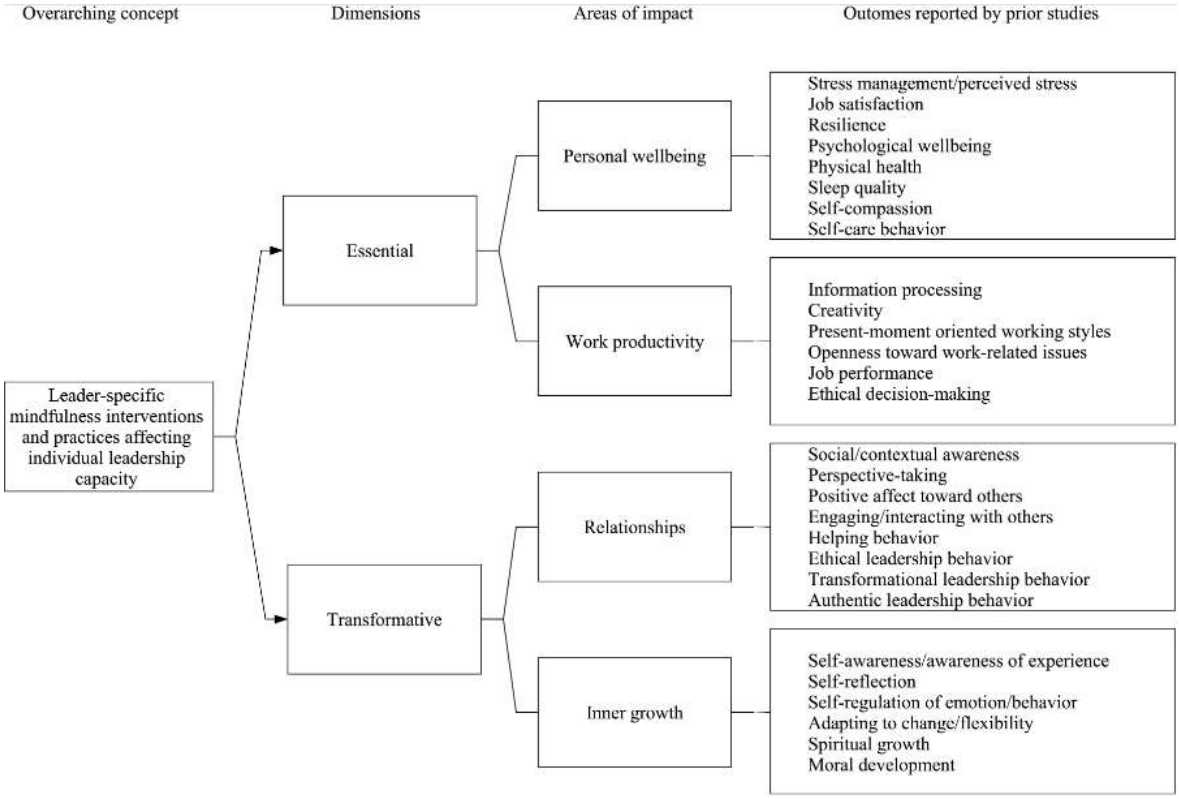

Figure 3 Impact of mindfulness interventions and practices on leaders.

Source: Urrila, 2022, 4.pp

The impact of mindfulness leadership on followers

Arendt et al (2019) hypothesize that leaders' mindfulness positively affects followers' satisfaction, primarily through a mindful communication style. Mindful leaders are more attentive, open, and non-judgmental, helping followers feel valued and appreciated. Additionally, mindful leaders exhibit better emotion regulation, allowing them to manage stressful situations and serve as positive examples for followers. (Figure 4).

The study included 34 leaders and 98 followers from various industries, and findings indicate that mindful communication significantly mediates the relationship between a leader's mindfulness and follower satisfaction. Leaders with higher levels of mindfulness tend to enhance followers' satisfaction both in communication and in general.

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This research contributes to understanding the role of mindfulness in leadership, suggesting that mindfulness is not just a personal resource but also enhances interpersonal skills. Practically, the findings suggest that mindfulness-based training could be beneficial in leadership development programs, potentially leading to positive organizational outcomes (Arendt et al, 2019).

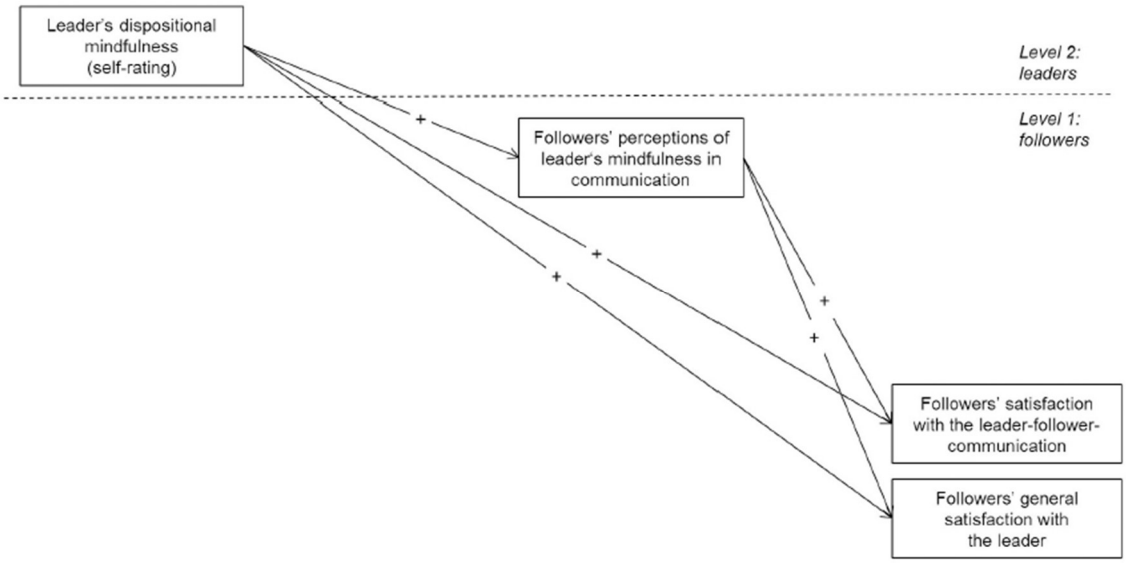

Figure 4. Model of the impact of mindfulness leadership on followers

Source: Arendt et al, 2019, 6.pp

Stedham and Skaar (2019) suggest that mindfulness develops leader qualities and behaviours that foster trust-based relationships between leaders and followers. A mindful leader becomes more open and accepting, which increases followers' trust and commitment. Mindful leaders experience improved cognitive flexibility and empathy, enabling them to handle stress effectively and support their followers, who, in turn, feel safe and more willing to follow them. Empirical data indicate that mindful leaders positively influence employee performance and satisfaction.

The study of Zang et al (2020) examines how follower mindfulness and leader mindfulness impact followers' well-being through the mediating role of perceived authentic leadership. The researchers hypothesize that follower mindfulness is directly linked to followers' perceptions of authentic leadership behaviour, which positively influences their well-being. Leader mindfulness plays a moderating role in this process: when leaders display high levels of mindfulness, it strengthens the relationship between follower mindfulness and perceived authentic leadership, thereby enhancing followers' well-being. The findings suggest that high leader mindfulness positively affects follower well-being via followers' perception of authentic leadership. The study highlights that workplace mindfulness training could benefit both leaders and followers by improving psychological well-being, particularly in environments where the leader-follower relationship and authenticity are crucial.

Stedham and Skaar (2019) the following integrated conceptual framework on the relationship between mindfulness, trust and leadership has been developed based on the research:

Mindfulness → Leadership

Trust → Leadership

In addition to the direct influence of mindfulness on leadership, they suggest that mindfulness impacts leadership indirectly by fostering trust. This results in the following extended relationship:

Mindfulness → Trust → Leadership

They propose that mindful leaders cultivate attitudes and behaviours that build trust-based relationships, which enhance their ability to effectively influence others. This conceptual framework, illustrated below (Figure 5), positions trust as a key link between mindfulness-driven leadership qualities and overall leadership effectiveness. Beyond these indirect effects of mindfulness on trust and leadership effectiveness, they also anticipate that mindfulness may directly enhance both trust and leadership outcomes.

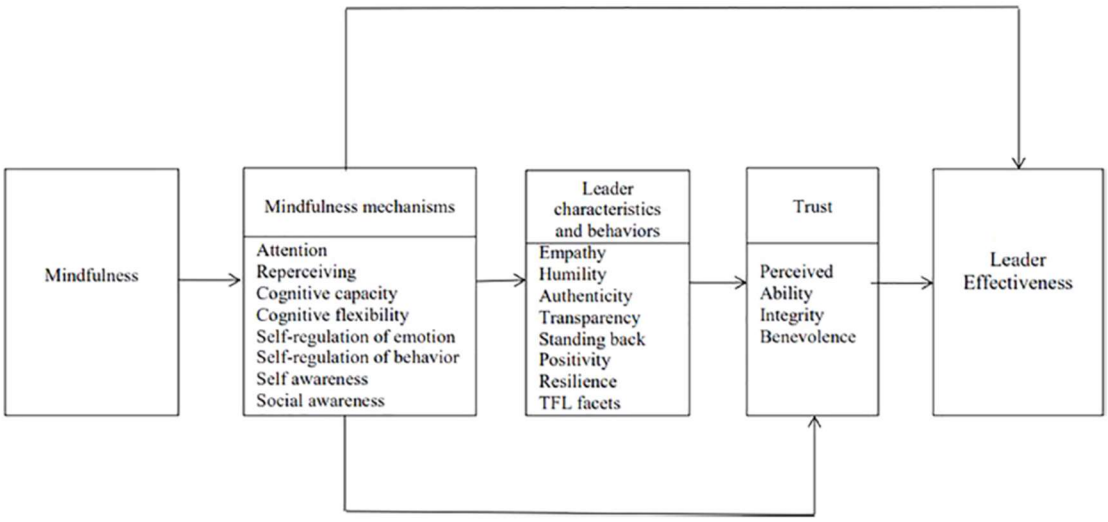

Figure 5 Proposed conceptual framework relating mindfulness to leader effectiveness.

Source: Stedham and Skaar, 2019, p. 7.

The cumulative impact of mindfulness on the leader and through them on the organisation as a whole

We can see that integrating mindfulness into leadership development offers transformative potential in fostering effective, compassionate, and self-aware leaders. As organizations increasingly face complex challenges, mindfulness stands out as a tool that not only aids in stress management but also supports personal growth, interpersonal dynamics, and organizational resilience. Grounded in mindfulness, leaders cultivate greater self-awareness, emotional regulation, and empathy—all of which are essential traits for adaptive leadership in today's dynamic environment.

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Empirical research supports that leaders who practice mindfulness experience not only personal well-being but also improvements in leadership effectiveness. Studies have demonstrated that mindfulness training enhances emotional intelligence, particularly in areas such as empathy, which allows leaders to understand the challenges faced by their team members. Empathetic leaders, attuned to the emotions and needs of others, create a supportive and psychologically safe work environment, where employees feel valued and motivated. In this setting, trust grows organically, leading to increased engagement, collaboration, and overall job satisfaction. The positive effects of mindfulness extend beyond individual leaders, reaching team members and influencing the broader organizational culture.

The transformative power of mindfulness is not confined to the individual leader but radiates outward, influencing teams and entire organizations. By fostering key traits such as self-awareness, emotional regulation, and empathy, mindfulness enhances leadership effectiveness and strengthens organizational dynamics. This interconnectedness underscores how the integration of mindfulness practices shapes not only personal development but also organizational culture and resilience. This is illustrated in Table 1. This table shows the structure of the framework and the importance of each layer in contributing to effective leadership and organisational results.

Layer	Key Concept	Description	Impact on Leadership
Core Layer (Foundation)	Self-Awareness	Awareness of one's own thoughts, emotions, and values, grounding decisions in authenticity.	Enhances decision-making, fosters authenticity, and strengthens alignment with personal and organizational goals.
Second Layer	Empathy and Emotional Intelligence	Understanding and responding to the emotions and challenges of others, fostering positive interactions.	Builds trust and rapport, improves team collaboration, and enhances conflict resolution.
Third Layer	Self-Regulation	Maintaining focus, composure, and credibility under stress.	Promotes adaptive responses, strengthens resilience, and enables leaders to maintain consistent integrity.
Outer Layer	Strategic Leadership	Applying mindful strategies such as vision-setting, situational leadership, and organizational wisdom.	Drives innovation, cultivates compassion in decision-making, and aligns short-term actions with long-term organizational values.

Table 1 Key layers and their impact of the mindful leadership

Source: Own editing based on the literature

Mindful leadership development programs, such as Mindfulness-Based Stress Reduction (MBSR) and other training methodologies, offer structured paths for leaders to cultivate and strengthen these qualities. These programs not only focus on stress reduction but also help leaders develop skills such as focused attention, emotional resilience, and adaptability. Leaders trained in mindfulness report an increased ability to handle

unexpected situations and a greater flexibility in their leadership styles. By embracing mindfulness as a central tenet of their professional development, leaders build a strong foundation for personal growth and, consequently, the growth of their organizations.

Research further underscores that mindfulness has a positive impact on leadership at the organizational level. When practiced consistently, mindfulness can become an integral part of the organizational culture, fostering an environment that values presence, patience, and open-mindedness. Leaders who model mindfulness influence their teams to adopt similar practices, creating a ripple effect that promotes a culture of mutual respect, psychological safety, and continuous improvement. In turn, this culture strengthens organizational resilience, as employees are better equipped to handle stress, embrace change, and contribute meaningfully to the organization's mission.

Conclusion

The benefits of mindfulness for leaders begin with self-regulation, where they develop an awareness of their own mental and emotional states. By focusing on the present moment and observing experiences without immediate judgment, leaders can achieve mental clarity, a heightened ability to manage stress, and a balanced approach to decision-making. This self-regulation allows leaders to react to situations thoughtfully rather than impulsively, fostering a workplace environment where calm and focused responses become the norm. Mindful leaders bring a non-judgmental openness to their interactions, recognizing each moment as unique and approaching it with curiosity and acceptance. This mindset sets a powerful example for others, encouraging similar behaviours throughout the organization.

Moreover, mindfulness offers leaders a framework for consistent self-reflection, which is key to authentic leadership. Authentic leaders are true to their values and act with integrity, inspiring loyalty and trust among their followers. By regularly engaging in mindfulness practices, leaders enhance their self-awareness, allowing them to remain aligned with their values in challenging situations. This alignment strengthens their credibility and helps them lead with clarity, purpose, and resilience. Mindfulness also supports leaders in navigating complex interpersonal dynamics by helping them remain centred and composed. In doing so, they foster respectful, open communication, which is essential for building high-performing teams.

Mindfulness is not just a stress management technique, but a way of life that has a profound impact on the functioning of the individual and the body. Over the past decades, mindfulness has grown exponentially in popularity in Western societies, particularly as a result of research in the field of positive psychology, which has shown that it significantly reduces stress, anxiety and depression.

Incorporating mindfulness techniques into organisational culture can help reduce workplace stress, increase employee satisfaction and improve organisational effectiveness in the long term. The conscious presence and empathy of leaders is key to motivating and managing teams, and as such, the practice of mindfulness is becoming an essential tool in modern leadership.

In conclusion, mindfulness transcends being merely a stress-management tool; it is a lifestyle and leadership philosophy that deeply enhances leaders' effectiveness and the quality of workplace relationships. Mindful leaders are equipped to meet modern organizational challenges with greater insight, empathy, and authenticity. Overall, mindfulness has significant benefits not only for individuals but also for organisations. The practice of mindful presence contributes to better mental health, emotional intelligence and more effective leadership, thereby creating a more harmonious and productive work environment. Integrating such attitudes and practices into organisational life can lead to long-term positive changes that benefit both individuals and organisations. Given its proven benefits, organizations should consider incorporating mindfulness into their leadership development programs and organizational frameworks. By doing so, they can foster a new generation of leaders who are not only capable and resilient but also compassionate, inspiring, and genuinely committed to the well-being of their teams and the success of their organizations. Embracing mindfulness is thus a strategic investment, one that promises both immediate and lasting positive impacts on individuals and organizations alike.

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