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Paper and packaging industry dynamics during COVID-19 and their strategies for the future

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Abstract
Background: The paper examines the "mysterious case of the disappearing toilet paper" during the COVID-19 pandemic.
Purpose: This paper describes the strategic impacts on paper and packaging supply chains due to the pandemic.
Study design/methodology/approach: Structured interviews and qualitative discussions with organizational and supply chain management leaders.
Findings/conclusions: Several "behind the scenes" and less well-documented supply chain impacts in the paper and packaging, and logistics industries were discovered. The critical effects observed are: (1) Impact on the manufacturing side was mitigated mainly by implementing CDC guidelines and by the willingness of industry leaders to go above and beyond to shield their employees from economic hardships. (2) The transportation sector has experienced a more severe workforce shortage, amplified by government actions before and during the pandemic. (3) Product specialization, a pre-pandemic strategy for industry participants, turned into a weakness during the pandemic due to unprecedented shifts in demand across sectors. (4) Traditional "lean" supply chain thinking is increasingly making way for a more interconnected "risk avoidance" strategic model.
Limitations/future research: The research is limited to organizations in Midwest U.S.A. and one organization in Europe.

Keywords
COVID-19; pandemic; toilet paper; bath tissue; facial tissue; paper towel

Introduction

The COVID-19 pandemic impacted global supply chains, posing severe challenges to the pulp and paper industry. On the other hand, it has created opportunities for manufacturers in the business-to-consumer (B2C) segment (Liu et al., 2020). The United States, like the rest of the world, has been affected by the COVID-19 crisis impacting food safety, healthcare products, and cleanliness in packaging. Efforts are going on to reduce the risk for future outbreaks, and hence, packaging plays a pivotal role in the pandemic crisis. The packaging is designed to protect the product from

contamination and provide impediments against moisture and oxygen transmission to enhance and preserve the quality of the packaged product. COVID-19 has spawned significant changes throughout the various aspects of supply chain management. Supply chains are networks of resource integrators to create value for organizations (Ketchen et al., 2014; Stolze et al., 2016). Further investigation of the pandemic and its effects on supply chains will develop a more comprehensive understanding of the wide range of interconnections.

The pandemic has affected all domains of global supply chains, including distribution, packaging, and sourcing of raw materials (Aldaco et al., 2020; Choudhury, 2020). It has reshaped industry megatrends to have significant short and long-term implications for packaging design (Feber et al., 2020). Lockdowns caused disruptions in the transportation of packaged foods (Choudhury, 2020), while few companies closed their plants for cleaning purposes. Weersink et al. (2020) recognized capacity restrictions due to the pandemic, leading to operational challenges. COVID-19 has impacted many sectors, and business establishments were forced to shut down their operations due to lockdowns which caused supply chain disruptions affecting the packaging industry worth $900 billion (GEP, 2020). Supply chain risk management faces challenges due to economic policies and globalization, which have added more uncertainty and challenges to supply chain networks (Gurtu & Johny, 2021) and globalization (Figus, 2021; Hámori, 2021). Global tissue consumption is rapidly increasing due to the pandemic, which has added more stress to the capacity of the paper and packaging industry. Table 1 describes the tissue consumption worldwide in 2018 by region.

Table 1 Tissue Consumption Worldwide 2018

Region/Country Name	Share %
North America	24.50
China	22.40
Western Europe	17.50
Latin America	11.10
Asia Far East	6.20
Eastern Europe	5.60
Japan	5.10
North & Middle East	4.10
Africa	2.30
Oceania	1.20

Source: the authors according to TAPPI North American Tissue market outlook

The COVID-19 pandemic stress-tested paper and packaging supply chain networks on 3Rs: responsiveness, reliability, and relationship to meet the expectations of customers and stakeholders. The disruptions caused due to COVID-19 forced manufacturers to reassess and realign their supply chain management strategy. Manufacturers encountered several challenges globally due to this crisis, and the paper and packaging industry was no exception.

The demand for packaging in the business-to-business (B2B) sector is associated with GDP and industrial activity. While GDP shrunk, causing a decline in industrial and commercial activities, B2C activities skyrocketed, increasing demand for different products and from various segments. Due to this crisis, the demand for packaging in food distribution, healthcare products and e-commerce sharply increased, while industrial and commercial sectors declined.

The United States constitutes the largest toilet tissue and paper towel market. The consumption for the B2C market has increased, which has impacted the forecast for the top manufacturing companies in this segment. Figure 1 shows that toilet tissue and paper towel sales in the United States have increased over the last four years.

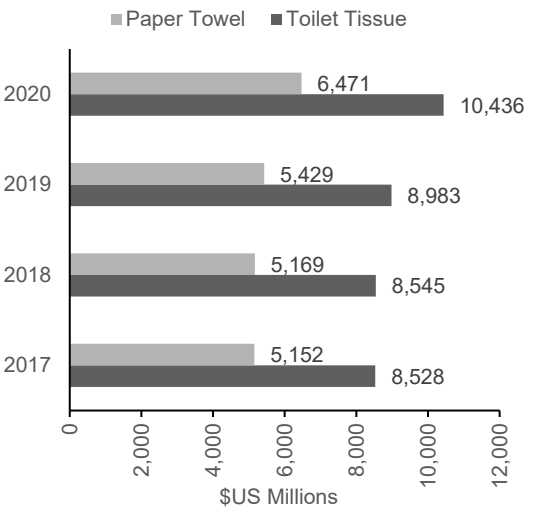

Figure 1 Toilet Tissue and Paper Towel Sales in the USA
Source: Statista, 2021

The remainder of the paper is organized as follows: Section 1 discusses the literature on the paper and packaging industry as well as the timeline of COVID-19. Section 2 explains the methodology deployed in developing this paper. Section 3 presents a discussion and analysis. The last section presents the long-term implications of this pandemic, some limitations of this research, and proposes future research directions.

1. Literature review

This first section of the literature review provides an overview of the paper and packaging industry. All the papers were developed during the COVID-19 pandemic because the world had never experienced it in the past. Toilet paper drew considerable attention from the public and researchers. Many researchers worked on this from different perspectives (Abe et al., 2020; David, Visvalingam, & Norberg, 2021; Décobert, 2020; Dinić & Bodroža, 2020; Engstrom et al., 2021; Garbe, Rau, & Toppe, 2020; Im, Kim, & Lee, 2021; Kirk & Rifkin, 2020; Leung et al., 2021; Miri, Roozbeh, Rad, & Alavian, 2020; Sun & Han, 2021). The disciplines involved were from a wide range, from business and economics to public health.

The global production of paper and cardboard in 2018 was 419.72 million metric tons, and more than half of that was for graphic paper. China, the United States, and Japan are the top three countries in paper production, accounting for more than 50% of the global paper production. Imports and exports from the United States are the highest, followed by Germany (Tiseo, 2021).

Agriculture, biology, chemicals, distribution, forestry, and transportation are parts of the pulp and paper industry, and play a vital role in the world economy (Huang et al., 2019). According to the American Forest and Paper Association, approximately 4% of the total U.S. manufacturing GDP comes from forest products. This industry manufactures products worth approximately $300 billion per year, employs about 950,000 men and women, and is among the top 10 manufacturing sector employers in 45 states of the United States. The major elements of the paper industry are sourcing, making, and converting. Sourcing of raw materials (fiber) can be through virgin growth or recycling of previously used paper/cardboard. The "paper making" process happens in paper mills resulting in a wide range of paper and board types and formats. Finally, the original paper and board are converted into applications, including office products, hygiene products, packaging materials, and specialty papers. The transportation of these products through all stages of the process is a material consideration for the overall economic footprint. Ultimately, the products are being delivered to differentiated markets in customized formats. Supply chains of toilet paper were explored as an example.

The toilet paper industry caters to two major market segments: consumers requiring toilet paper to be used at home and commercial clients stocking restrooms in offices, malls, restaurants, and other public places. Each segment has different product expectations, which has repercussions all the way to the sourcing process. Commercial paper providers may rely primarily on recycled fiber to achieve Eco-Certifications. Their machines are set up accordingly, and the resulting product is rougher toilet paper that would not be well suited for the more demanding consumer segment. Toilet paper demand for the consumer segment increased exponentially during COVID-19, while commercial toilet paper demand decreased due to the shutdowns of business establishments (Moore, 2020). The global revenue in the toilet paper market for the year 2020 is shown in Table 2.

Table 2 Revenue from Toilet Paper Markets

Country name	$U.S. Millions
China	16411
United States	13402
India	7750
Japan	2835
Brazil	2775
Indonesia	2415
Germany	1981
Russia	1945
United Kingdom	1863
Mexico	1711
Philippines	1418
France	1402
Nigeria	1287
Italy	1220
Canada	1130
Turkey	1103
Pakistan	930
South Korea	928
Spain	878
Poland	814
Australia	810
Bangladesh	789
Vietnam	788
Saudi Arabia	785
Argentina	733

Source: Statista, 2021

The tissue & hygiene paper market is worth US$35,535 million in 2021, and the market is anticipated to increase at the rate of 2.29% (CAGR) every year between 2021 and 2025. The paper industry's largest segment is toilet paper, with the market size of US$13,515 million in the U.S.A., followed by China, with the market size of

US$17,602 million in 2021 (Statista, 2021). China was the world leader in toilet paper in terms of revenue in 2020 at 16.4 billion U.S. dollars, followed by the United States at 13.4 billion U.S. dollars in the same year (Statista, 2021).

This second segment of the literature review recaps the known facts and critical timelines related to COVID-19. The Wuhan Municipal Health Commission (China) first reported mysterious cases of pneumonia in Wuhan, which were ultimately attributed to a new form of coronavirus, and the resulting disease was named COVID-19. The pandemic probably started at a wholesale seafood and meat market in Wuhan. These are known as 'Wet Markets' and could be a breeding ground for spreading animal-borne diseases and viruses. As a precautionary measure, the Chinese government is reportedly considering changing meat handling and distribution practices and tighter regulations in the near future (Parker, 2020).

The WHO officially declared the viral disease outbreak to the world on January 5, 2020. The first warnings about the Corona Virus reached the United States on January 3, 2020, and the CDC issued the first public alert on January 8, 2020. The first recorded case outside China was reported in Thailand on January 13, 2020. The first case in the U.S.A. was reported on January 20, 2020, and the Chinese city of Wuhan went into a lockdown on January 23, 2020. WHO announced COVID-19 as a pandemic due to the alarming speed of the spread of the virus, its catastrophic effects, the vulnerability in handling the situation, and the global chaos (WHO, 2021). The first COVID-19 death in the U.S.A. occurred on February 6, which was not identified until April 2020. Previously the first death due to COVID-19 was believed to have occurred on February 29, 2020.

As cases started to rise in early March, individual States declared a state of emergency. By March 11, 2020, the number of cases in the U.S.A. reached over 1,000, with 37 deaths. The NBA announced the cancellation of its season on March 12, 2020, after a player was infected with the Coronavirus (Aschburner, 2020). MLS, NHL, NCAA, and other sports organizations followed suit. President Trump declared the National State of Emergency on March 13, 2020. The various States implemented closures of schools and other restrictions on public life starting March 15, 2020. On March 27, 2020, the first Corona Virus Relief Bill was signed into law. The pandemic is uncertain, and its existence will depend on various scenarios leading to a few months or more than a year (Smit et al., 2020). The impacts along the timeline within the individual case studies will be discussed.

This third section will focus on consumer-driven demand-side changes. Consumers' shopping behavior changed to online purchase/delivery, surpassing the supply chain's agility to cope with the demand (Dunkley, 2020; Smith, 2020). Home delivery logistics services have grown in the past decade (Jara, Vyt, Mevel, Morvan, & Morvan, 2018). This pandemic has given food supply chain companies and startups a sudden jump. Online ordering of food and its home delivery was in development for many years (Cairns, 1996; Heim & Sinha, 2001). However, this pandemic has suddenly increased the demand beyond the capacity of online food retailers (Bhattarai, 2020). Scholars have been documenting the customer's expectations of last-mile logistics services since the early days of e-commerce (Esper, Jensen, Turnipseed, & Burton, 2003; Mentzer, Flint, & Hult, 2001) as well as operational service challenges that increasingly include managing crowdsourced delivery services (Castillo, Bell, Rose, & Rodrigues, 2018).

The price sensitivity among consumers is increasing cost pressures on the packaging industry, forcing packaging converters to get sufficient orders to attain the high operational efficiency of their plants. E-commerce activities and home deliveries are likely to continue to rise worldwide because consumers are increasingly inclined to buy their products through different channels than they used to buy from before the pandemic.

There has been a shift in the demand for the type of packaging, i.e., demand for some packaging declined, and some increased. As an example, e-commerce packaging increased. Many manufacturing and logistics organizations stopped operations during the pandemic to maintain the health and safety of their employees. This has affected the demand for packaging material and operations within the packaging industry. The manufacturing and logistics packaging demand from the B2C segment spiked, leading to stockpiling of bulk containers and drums for the B2B segment in mature markets like the United States and Europe. Moreover, demand for plastic packaging for the B2B segment reduced dramatically in Europe due to halted operations in other industries, leading to a 16% decline in revenues.

The closure of public spaces and lockdowns created a panic demand for packaging for food. Packaging for non-food items and premium goods got negatively affected due to the closures of stores and malls. The market for primary packaging materials like LDPE films from China fell to about $770 per metric ton, which is a 12-year low and translating to an 8% reduction since April 2020 in spot prices. Due to the COVID-19 pandemic, Europe underwent an extensive assessment to replace non-flexible packaging with flexible packaging in the FMCG sector. This change in packaging is likely to reduce up to 21 million tons of waste per year, which is a 70% reduction in the total amount of non-flexible FMCG primary packaging. Thirdly, demand for biodegradable, recyclable, reusable, and non-toxic packaging materials increased. The demand for single-use plastics is high compared to multi-use plastics. However, these are non-biodegradable and pave the way for the globally pressing issue of environmental safety (GEP, 2020; Gurtu & Arendt, 2019).

2. Research methodology

This research started with building a common thread experienced in the markets and summarizing the broader impacts of COVID-19 on the paper and packaging industry. Almost everyone experienced a shortage of bath tissues and paper towels across America. Investigating the reasons behind such a shortage was the starting point.

The initial investigation with known associates confirms the shortage across the nation. Next, various organizations in the paper and packaging industry were approached to dive deeper to understand the reasons for this shortage. Multiple organizations, big and small, virgin and recycled paper producers, and paper products/tissue producers for domestic and commercial applications were contacted. The snapshot of the process steps is illustrated in Figure 2.

A questionnaire was developed for structured interviews of executives. Willing organizations were identified because we reached out to several organizations in the paper and pulp industry. However, every organization was not willing to spend time on this academic research project as they had more pressing issues at hand. At least two researchers interviewed the executive jointly and compared the notes after the interview. An initial draft of findings from each organization was prepared and sent to the executives concerned for validation, endorsement, and corrections, if any. The final consolidated manuscript contained their suggestions and changes while hiding the individual or organizational identifying information.

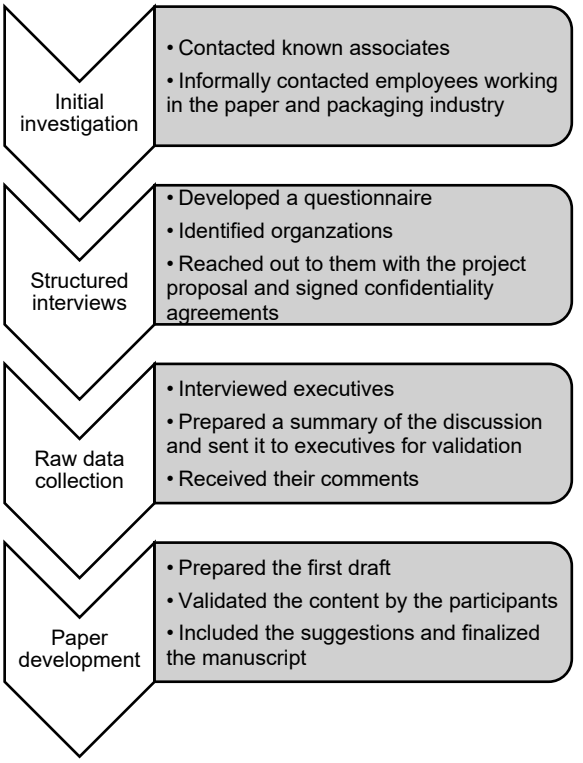

Figure 2 Process steps followed in the research
Source: the authors

Ten senior executives/COOs/CEOs were consulted from five organizations, namely (in alphabetical order) Essity, Green Bay Packaging, Precision Paper Converters, Paper Transport Inc., and Services Plus. Some common themes were expressed by executives, categorized as consumer/market behavior and industry dynamics. The comments about the individual organizations are combined to camouflage the organizations. However, summary profiles of participating organizations are given below.

Essity AB is headquartered in Stockholm, Sweden. It is a global hygiene and health company. The product portfolio contains single-use products such as tissue paper, baby diapers, feminine hygiene care, incontinence products, compression therapy, orthopedics, and wound care. Until 2017, Essity was a part of the hygiene and forest products company SCA. Essity spun off the hygiene operations in 2017 and was listed as a separate company on Nasdaq Stockholm. Essity employs about 46,000 employees. Its net sales in 2019 were

EUR 12.2 billion. The word Essity means "Essentials" and "Necessity" (Essity, 2021).

Services Plus is a privately held company located in Green Bay, Wisconsin, U.S.A. It has 150 employees, and this organization operates 24 hours a day, five days a week, and on weekends when needed. Services Plus focuses on custom manufacturing of consumer tissue and papers for residential and commercial markets. The company also supplies specialty packaging services for branded and private label Consumer Product Goods. Its customers value flexibility and the speed to market the most and rely on them as a partner to increase their brand equity (Services Plus, 2021).

Precision Paper Converters (PPC) was established in 1991 by three individuals working in the packaging industry who had the vision to begin a business in the paper industry. PPC purchased the equipment from a paper manufacturer that had shut down its operations. With five employees in total, PPC began as a small paper converting company renting space in the back of a cheese factory in St. John, Wisconsin, U.S.A. The vision became a reality as the company experienced growth over the years, ultimately leading to land purchase and construction of a new facility in Kaukauna, Wisconsin. PPC has been under the current ownership group since 2002 with over 25 years of paper converting experience. PPC has the expertise and desire to lead facial tissue conversion, including interfolded products such as lens wipes and delicate task wipes. They are the only company in North America that focuses on facial tissue production out of the main tissue product categories. PPC produces facial tissue for other paper companies under their brands. These companies choose not to make their facial tissue or make all the sizes/styles they offer to their consumers. PPC has a significant presence in healthcare, where they produce tissue sizes specific to the needs of the healthcare industry (Precision Paper Converters, 2021).

Green Bay Packaging was founded in 1933 by George F. Kress to offer corrugated shipping containers as an alternative to wooden boxes. The folding carton division was added in 1942. The company continues to grow through innovation and acquisitions and focuses on environmental impact. In 2018 the company broke ground on a state-of-the-art paper mill in Green Bay, Wisconsin, U.S.A. This was the first new paper mill to be built in the U.S.A. in decades. Green Bay Packaging is a full-service packaging company offering corrugated cardboard, folding cartons, and coated label stock. The organization has 35 divisions, 4200 employees, and sales of $1.3bn (Green Bay Packaging, 2021).

Paper Transport Inc. provides freight transportation services. It offers truck-load and intermodal transportation services. The company specializes in regional deliveries and runs lanes from the Midwest to the Southeast. The company was founded in 1990 and is based in Green Bay, Wisconsin, U.S.A. It has service locations in Muskogee, Oklahoma; Dallas, Texas; and Jacksonville, Florida (PTI, 2021).

3. Discussion and analysis

Due to various reasons, the paper and packaging industry and its supply chains were significantly affected during the COVID-19 pandemic at multiple levels. The discussion is divided into three levels, i.e., consumer and market behavior, industry behavior, and organization behavior.

3.1. Consumer and market behavior

General dynamics in March 2020: Many states announced emergency and the closure of education institutes (schools, colleges, universities) and the hospitality industry (restaurants, clubs, pubs); work from home culture increased dramatically due to travel restrictions leading to a massive shift from "out of home" to "in-home," impacting many industries. Consumers started to stockpile (Labad, Gonzalez-Rodriguez, Cobo, Punti, & Farre, 2021; Leung et al., 2021; Prentice, Quach, & Thaichon, 2022), leading to shortages, most notably kitchen towels and toilet paper, sanitizing products, and several other essential categories. Retailers began to implement purchase limits. Business travel was largely replaced with virtual meetings and in-person education with virtual education. Online platforms like Zoom and Microsoft Teams boomed, as did the technology products related to work or learning from home.

Access to talent – a complex dynamic: Initial layoffs in March and April 2020 across industries resulted in unemployment not seen since the Great Depression of the 1930s. Even as workers began to return to work, many companies struggled to attract workers. Some chose to remain at home due to safety concerns. Attractive unemployment subsidies allowed some to have income levels comparable to returning to work, contributing to a "wait and see" strategy. Despite continued elevated unemployment levels, many companies struggle to

attract the workers they need to meet demand, especially in a rebounding market and economy.

3.2. Industry dynamics

Many interconnected supply chains were impacted in the paper and paper converting industries. The following is a list of observations shared by our interview partners about what happened at various stages.

General dynamics in March: Companies were rushing to gather information and implement CDC guidelines on cleaning, social distancing, and reducing human contacts in their facilities. The initial response varied widely, with some companies having to shut down operations for some time while others maintained continuous operations. Fierce competition for resources started, including cleaning/sanitizing supplies, work from home technologies, personal protective equipment (PPE), and items like non-contact screening thermometers. Where possible, companies asked workers to work from home. Others were furloughed. As cases rose, many business areas came to an initial freeze. In light of the growing uncertainty, many companies pared back recruiting and capital investments.

Sourcing raw materials for paper production: one of the key sources of pulp is recycled scrap paper. With the closure of offices and schools, the availability of scrap paper plummeted, forcing many paper companies to switch to a more expensive virgin pulp, which was not as constrained in its availability because lumber operations were able to continue.

This posed a challenge to companies specializing in serving the professional rather than the consumer market. Equipment was not configured to handle most virgin pulp, and a switch could have led to a loss of eco-certification tied to the use of recycled materials. This resulted in fierce competition for the remaining recycled pulp. Specialty product manufacturers have built their entire supply chains to fit the expectations of target markets, from raw materials sourcing, eco certifications, and machine configuration, to product offerings in specialized market segments. Unprecedented shifts across categories – commercial to consumer due to lockdowns, a knock-on effect of the commercial shutdown on recycled raw materials, a surge in domestic rolled paper demand, and a decline in folded commercial paper impacted manufacturing operations. This sudden shift in customer segments or product demand will lead to designing more flexible manufacturing systems and targeting a mix of customer segments in the future.

Significant product shifts within the paper industry: demand for cut paper typically used in offices and schools sharply declined while demand for the rolled products (kitchen towels, toilet paper) in the consumer market skyrocketed. Within the commercial and hospitality markets, demand for all types of products (folded, rolled, napkins, bathroom supplied, among others) dropped significantly. Demand for folded products such as facial tissue reduced in the consumer segment due to reduced social contacts and masks. It eliminated the 2020 regular flu season. Carton demand increased in shipping due to increased B2C activities (the Amazon effect) and take-home/delivery in food sectors. Some companies made substantial capital investments to refocus their paper production capabilities and capacities on high-demand products (e.g., paper boards).

Changes in SKU complexity: Consumer demand routinely emptied shelves in several paper product categories (especially rolled). Historically, a wider range of SKUs provided varying purchase incentives. Manufacturers and retailers were now willing to compromise on fewer options to get the product onto the shelves quicker. This change impacted parts of the supply chain specialized in multi-packing and wrapping.

Transportation industry early dynamics: Many carriers, especially those with a more specialized customer base, had to park their trucks and furlough their drivers because many of their customers were not able to maintain operations. Others were able to shift volumes as certain markets began to boom. Drivers were considered essential workers, so their work did not really change, but they faced substantial obstacles. Rest stops limited food sales, access to bathrooms at loading facilities, and contact avoidance became a prominent theme. Market pressure forced spot rates down initially, which the industry was able to offset due to lower fuel prices. Lower traffic on the roads led to a substantial decline in incidents, bringing run rate safety costs down as much as one-third and providing additional financial lift.

Highlight on driver availability: Driven shortage due to the aging population and less income is a known issue (Gurtu, 2021). The pandemic made it even worse. New rules around drug and alcohol screening (FMCSA Drug and Alcohol Clearinghouse) had already reduced the number of available drivers. Graduation of Commercial Driver's License (CDL) declined by

about 40%, and many drivers exited the profession due to the perceived risk, alternative opportunities, or boost in unemployment programs. The estimated range of truck drivers who retired from the profession is 200K-300K. Recruiting drivers remains one of the biggest industry challenges. Referral programs and sign-up bonuses up to $10K are here to stay for the foreseeable future.

Transportation industry later dynamics: As transportation volumes rebounded and began to boom while truck and driver supply was limited, spot rates started to recover. Since fuel prices remained low deep into 2020, the industry experienced strong profitability with a record Q4/2020. Increasing fuel prices and wages were eating into that profitability in 2021. Talent shortages remain a critical constraint.

3.3. Organizational challenges

Every organization has an emergency plan for incidents like evacuation in case of a fire, chemical leak, or shutting down the plant. Organizations conduct drills routinely to check the efficacy of procedures, train employees, test employees' compliance, and test equipment. However, none of the organizations contacted had a strategy or a plan prepared for a pandemic. All organizations started reacting to the developing situation almost simultaneously towards the end of February-early March. One of the executives said, "We were not at all prepared. I did not think this would be a big deal for us; nobody believed we would have a 48-day shutdown." Another executive said, "In February 2020, we did some disaster testing as part of a longer-term preparedness plan. In March, we had to send 100% of our people home, so reality came much harder. We had not planned for anything of the magnitude of COVID-19."

As the rest of the world was learning about COVID-19 and CDC was updating the guidelines, all organizations followed CDC guidelines for social distancing, masks, and sensitization. Europe (Italy in particular) experienced the harsh effects of COVID-19 before it spread to North America. Europe introduced guidelines for social distancing, temperature checking and sanitizing, among others. Essity being a European organization, started adopting these recommendations a few days before CDC recommended them for American organizations. Sanitization of the entire plant at the end of every shift became a routine. One person wiped every surface and control panel with sanitizer every shift for eight hours. Organizations communicated new guidelines and safety precautions to employees regularly. "We (an organization executive) probably made 40 videos, communicated every week, sometimes twice, when we had a case, or something happened. We believe in informing our people. We put it on a TV in our lunchroom." There were shortages of sanitizing products and preventive items like non-contact thermometers in the beginning. Temperatures measurement for every employee at the start and in some organizations became a new routine during the shift.

A sudden increase in the demand and the closing of some vendors led to sourcing some raw materials from new vendors without the luxury of developing a relationship and trying out the products. Supplier reliance due to capacity limits, the inability of suppliers to source talent or raw materials, and prioritization decisions by suppliers were not favorably identified as the weaknesses by industry players. This situation stabilized after the third quarter, and organizations considered developing a backup plan. The lesson is to move away from the strategy of a single most cost-effective overseas source to develop a network of suppliers from different geographies, some inland and some overseas, to avoid future disruptions. Short-term scramble to mitigate them has to be differentiated from long-term lessons learned that would shape supply chains in the future, including down streaming of key capabilities into supplier base, sustained diversification, greater interconnection between product groups, etc. As a strategy, effective models of crisis management (war rooms, alternative forecasting methods) may be sustained into the future.

Every organization had the capability to remote log in and work while away from their desk. However, it was designed to help employees work remotely while traveling. A sudden need for all office employees to work from home put the system to near 100% capacity, and it became a challenge to ensure security over the internet connection. The internet bandwidth was managed successfully at the organization's end, but internet connectivity was challenging for employees living in the countryside. There were no changes in the use of technology to over the challenges during this pandemic. "No new technologies deployed related to COVID. Just moving along the technology curve as we ordinarily would, using AI and 3D technology in the new paper mill," said an executive. However, expansion in IT infrastructure is anticipated to make it more robust and meet the expansion in the future. "We are double purchasing

our IT infrastructure. We will set up office-like situations for our employees at home, so we double up on monitors, towers, etc. Our employees will be able to choose freely between home and office without dragging equipment back and forth," said another executive.

No executive believes that they will ever return 100% to the pre-pandemic state. Mask and sensitization have circumvented the flu season, and masks may become mandatory in parts of operations. More employees will be working from home. The system and procedures to work remotely have been stress tested due to the sudden onset of this situation and modified wherever required. "As long as are people are productive, there is no benefit to micromanaging them." Business travel will reduce because people are now used to video conferencing. "Business travel expenses will come down, and drivers do not have to come to the office any longer." Digital or touch-free technology is now an acceptable norm. If a physical paper is received, its picture is taken and transmitted into the system.

This disruption has caused business leaders to take a hard look at their supply chains' backward and forward integration. This is one area where changes will take place in the post-pandemic world. However, these are strategic issues, and such decisions require information gathering, analysis, and time.

Conclusion

COVID-19 caused challenges in almost every area of business and social life. It affected many companies adversely and caused a large number of human tragedies. The scope of this paper is limited to identifying the effects of COVID-19 on supply chains in the paper and packaging industry. Every product needs some packaging, and every person has experienced its usefulness. When the packaging industry is affected, consumers do not get the finished products even though the products may be available.

Paper is an essential component that goes into packaging besides being used for various other purposes in daily life. Almost everyone experienced a shortage of bath tissues and paper towels during the pandemic. Almost all big-box retailers had empty shelves for these products. Many stores put a sign at the entrance that they do not have these products. Many stores limited selling products in short supply (bath tissues and paper towels) in large quantities and prohibited returning/exchanging to discourage consumers from hoarding. In order to serve more consumers, packaging organizations changed the size of packaging (SKU), and some retailers started selling individual rolls instead of multi-roll packs. The consumer behavior created a shortage of domestic paper products in the market.

Nonetheless, commercial paper products were in excess because there were no buyers in this section. Commercial sectors include offices, the hospitality industry (hotels, bars, restaurants, stadiums), educational institutions (schools, colleges, universities), and public transport. Nevertheless, the quality, product sizes, and packaging sizes are not interchangeable between these two segments of the same products. For example, toilet roll sizes used at homes and offices are different. The manufacturers of products in these two segments are different due to input materials and the final quality. This created another challenge for organizations serving commercial sectors. Since all the offices and educational institutions were closed, there was a shortage of paper for recycling, which is the primary input material for commercial products. Another challenge was finding retailers for such products because organizations dealing with institutions did not have a sales team to interact with retailers.

The research discussions and findings in this paper have given some interesting insights into the challenges faced by the paper and packaging industry. First, there is a lack of people with specific skill sets required for operations. The tightening of rules and protocols in the manufacturing sector reduced productivity and increased unemployment due to the unwillingness of people to work due to the possibility of exposure to COVID-19. Governments gave various relief packages to people to help them manage the crisis. This added to the non-availability of people in the workforce because people were getting as much money without working. Second, the unprecedented shift in the supply chain from commercial to consumer product categories further added to the challenges of the paper and packaging industry. The raw material, processes, machine set-up, product size, packaging, distribution networks for these two segments are entirely different, and most of the manufacturers serve only one of the segments. Switching from one segment to another without considerable investments and time is not practical besides a strategic decision that cannot be taken during a crisis. However, many manufacturers will consider this now, and many may diversify their product portfolio in the future.

Finally, the industry needs to work on effective business models for sustainability, sustained diversification, and interconnection between product groups for risk minimization in the supply chain network.

This pandemic has added many new dimensions to the planning process of every organization. Most of the paper and packing industry will try to have better vertical integration and diversify its product and customer portfolio. They will also include pandemics in their risk assessment and develop plans to manage such crises in the future. The shortage of paper for recycling may develop new programs for collecting papers from home. The silver lining in all this is that operating expenses for travel and office space may reduce in the future.

This research has some limitations too. The study was limited to organizations in Midwest U.S.A. There was a lack of understanding of issues faced by the paper and packaging industry, which limited this initial research to structured but qualitative interviews rather than a survey for statistical validation. This leads to the possibility of extending this research to survey-based empirical research. Another possible extension is to include organizations from other parts of the world in this study to make it more comprehensive. Also, this study can be extended to the changes in the paper and packaging industry in the USA due to the pandemic and compare the process before the pandemic and after stabilizing in a post-pandemic state.

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State employment centers in Russia: assessment by service recipients[1]

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Abstract

Background: Many countries spend up to 1% of GDP on implementing employment policies and assisting unemployed citizens, so it is important to assess the effectiveness of spending these funds. One of the Russian federal projects focuses on increasing the level of service recipients' satisfaction. The target indicator is 90.0% of satisfied recipients by the end of 2024.

Purpose: This study aims to analyze the state of employment policy implementation in Russia.

Study design/methodology/approach: The information base of the study is data of two questionnaire surveys of registered unemployed conducted in 2020-2021. In 2020, 4,800 unemployed people were interviewed in order to assess their satisfaction with the services received at the employment center. In 2021, 1,000 people from this number were re-interviewed in order to assess usefulness of the provided services. The survey evaluated several parameters, which influence the recipient's satisfaction with provided state employment services. Descriptive statistics methods were used to analyze the data.

Finding/conclusions: The results show that over the past 3 years, respondents have noted positive changes in the work of state employment centers - expanding opportunities to receive services via the Internet, reducing queues in employment centers, increasing the availability of information about services. Also, the respondents rate usefulness of the received services for future quite highly employment. At the same time, low speed of service delivery, a large list of necessary documents, and insufficient customer orientation of employment centers staff are still being zones for development and improvement.

Limitations/future research: The limitations of the study include a small number of existing studies on this problem, as well as the sample size. In further research, it is advisable to increase the number of unemployed interviewed in order to obtain more accurate and objective assessments of satisfaction with the services provided in employment centers.

Keywords
Unemployment, public employment services, employment centers, service recipients, Russia

[1] Extended version of the paper presented at Strategic Management and Decision Support Systems in Strategic Management SM 2021 scientific conference

Introduction

Many countries of the world spend huge resources on implementing employment policies and providing assistance to the unemployed. These measures include payment of unemployment benefits, costs of training the unemployed, employment subsidies, etc. (Martin, 2015). The amount of these expenditures is significant and can reach 1% of GDP (Altavilla, Floro, 2009), so it is important to assess the effectiveness of spending these funds on the implementation of employment policy measures. All this determined the motivation of this study, which is aimed at assessing the effectiveness of the implementation of an active employment policy on the example of the Russian Federation.

The development strategy of the Russian Federation is implemented through several federal projects. One of these projects is the "Labor Productivity and Employment Support", which was adopted by the government in 2018 and is valid until the end of 2024. The purpose of this federal project is to support employment through training of employees of Russian enterprises participating in the project and to modernize the employment infrastructure in the regions of the Russian Federation.

In turn, the effectiveness of the implementation of the federal project is evaluated through several key indicators. One of the main indicators is the satisfaction of citizens with the services received in the state employment center. In 2018, the value of this indicator was equal to 60.0%, and it is planned to reach the level of 90.0% of citizens satisfied with the received services of employment centers by the end of 2024 (Federal Project "Promoting Employment", 2018).

1. Literature analysis

“A set of methods and tools for working with unemployed aimed at reducing unemployment” is called active labor market policy (ALMP) (Stuken et al., 2021). It reflects the state's interference in the labor market functioning and may be performed in forms of training, subsidized employment, job search assistance, and free access to the job database (Martin, 2015; Mušikić et al., 2017; Stuken et al., 2021).

A literature analysis has shown that there are many works published by Russian and foreign authors that are devoted to assessing the effectiveness of employment centers performance (Boeri, & Burda, 1996; Brown & Koettl, 2015; Card et al., 2020, 2018) and customer satisfaction with its services (Gennari, Barbieri, & Sestito, 2001; Suárez, Cueto, & Mayor, 2014; Kalvane, 206; Elezaj et al., 2019).

Research conducted by Russian authors shows that recipients of public employment services are not satisfied with their quality and availability. As of 2010, only 20% of recipients report that they are satisfied with the quality of public services provided to them. As for disadvantages, they state the inconvenient working hours of employment centers, lack of information about procedure and conditions of obtaining the service, long waiting time for receiving the service, lack of politeness and low customer orientation of the employment centers specialists (Akhmedov et al., 2003; Ogneva, 2010, Bushmin & Kalneus, 2012).

Foreign authors also mention bureaucratization as one of the reasons for dissatisfaction with the services of state employment centers (Redman & Fletcher, 2021).

In addition, the unemployed are often dissatisfied with the characteristics of the job provided. Employment centers usually provide the unemployed with seasonal or temporary job offers from autumn to spring, which are during the highest unemployment rate periods. “The organization of public works is often complicated due to a mismatch in the skills needed and the qualifications possessed by the jobseekers. There are also some social and psychological aspects of participation in public works, such as low prestige and low qualifications for the work, which are not desirable or sufficient to satisfy certain jobseekers” (Meager, 2007; Kuddo, 2009).

Moreover, the satisfaction of citizens with provided services largely depends on the emotions that a person experiences while receiving the service (Liljander & Strandvik, 1997). The results from an empirical study of customers’ experiences of the services of a labor force bureau show that negative emotions have the largest impact on customers’ satisfaction.

It is also of interest to assess the satisfaction with public employment services of recipients with different socio-demographic characteristics (Caliendo et al., 2017; Escudero, 2018).

Some researchers study gender effects on satisfaction with employment services. According to results, women have higher expectations regarding the importance of service delivery

issues than men. However, there were found no differences between male and female respondents in their actual satisfaction with the employment service received (Ross et al., 1999).

2. Research

The purpose of this study is to analyze the implementation of the state employment policy. In order to do that, we used the assessments of citizens who have received employment services. The range of serviced provided by state employment centers include temporary employment, informing about the state of the labor market, public works, organization of job fairs, professional training, career guidance, psychological support, assistance in self-employment, assistance in relocation to another area, assistance in job search, support for the employment of disabled people, social adaptation and other services.

The information base of the study is the data of questionnaire surveys of registered unemployed, which were conducted in 2020 and 2021 in one of the typical regions of the Russian Federation (Omsk region).

In 2020, we interviewed 4,800 unemployed people in order to assess their satisfaction with the services received at the employment center. A year later, in 2021, 1,000 people from this number were re-interviewed in order to assess the usefulness of the provided services for employment.

Our hypothesis was that the satisfaction of the unemployed with the help they receive in finding a job increased from 2020 to 2021, as state employment centers improve their performance, including increasing the availability of services for recipients.

Descriptive statistics methods were used to analyze the data.

Let us consider the main results of the study.

First, the respondents were asked to assess the development level of different characteristics of the employment centers' performance. Such characteristics are speed of service delivery, attentiveness and politeness of personnel in employment centers, territorial convenience of the employment center location, availability of information about the provision of services, comfort (availability of parking, comfortable seats, etc.), work schedule of the employment centers, qualifications of personnel in employment centers, clarity of the rules for receiving services.

The results are shown in table 1.

Table 1 Assessment of characteristics of employment centers' performance, % of responses

Performance characteristics	Type of settlement	Excellent	Good	Poor	Very poor	N/A
Speed of service delivery	City	60.5	26.2	2.9	1.5	8.9
	Region	59.0	30.4	2.2	1.7	7.3
Attentiveness and politeness of personnel	City	67.7	21.1	1.5	1.3	8.4
	Region	63.4	28.7	1.6	1.4	4.9
Territorial convenience of the employment center location	City	54.9	27.1	2.4	1.2	14.4
	Region	52.9	34.1	2.0	2.2	8.8
Availability of information about the provision of services	City	57.1	28.7	2.4	1.3	11.5
	Region	61.2	31.2	1.5	1.5	4.6
Comfort (availability of parking, comfortable seats, etc.)	City	49.0	24.6	4.9	1.3	20.2
	Region	55.5	33.4	1.8	2.3	7.0
Work schedule of the employment center	City	63.0	25.3	1.3	1.0	9.4
	Region	62.6	30.8	1.2	1.1	4.3
Personnel qualifications	City	66.3	22.6	1.3	0.9	8.9
	Region	68.7	24.4	1.3	0.9	4.7
Clarity of the rules for receiving services	City	64.0	23.2	2.1	1.3	9.4
	Region	64.4	28.1	1.5	1.2	4.8

Source: the authors

All the characteristics of employment centres' performance were evaluated in the context of the settlement type - city or region. It was found that respondents who live in the Omsk region rate the performance of employment centres higher (the sum of excellent and good ratings) than those who live in the city of Omsk. This situation is observed for all the evaluated characteristics (the gap in

ratings ranges from 2.2% to 15.4% for different characteristics). In general, it can be noted that the respondents assess the characteristics of employment centres' performance rather highly; the sum of excellent and good ratings was more than 80.0% for almost all characteristics.

The possible explanation might be the fact that the employment centres located in the city have more requests from citizens and, consequently, the specialists of these centres are busier. In addition, people living in the city have more opportunities to find a job independently or to apply to non-state recruitment agencies. This can also affect their assessment of the employment centres' performance.

40.5% of the total number of respondents who took part in the survey had already applied for the state employment services before. We were interested in how these people assess the changes in the quality of service delivery over the past time.

As can be seen from the figure 1, respondents note that some characteristics of the employment centres' performance have been changed over the past 3 years. In particular, the majority of respondents say that it has become possible to receive employment services via the Internet, what makes the process of applying for a service simpler and faster. Despite the fact that employment centres have been working in this direction for a long time, this has largely become possible due to the coronavirus outbreak and the lockdown introduced because of it.

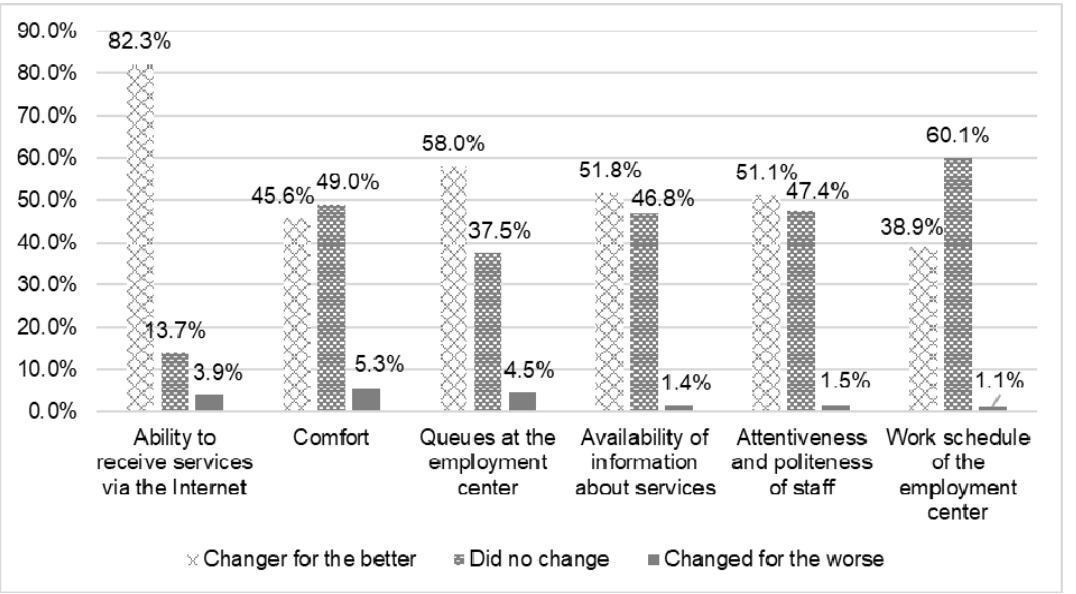

Figure 1 Changes in the employment centers' performance characteristics over the past 3 years, % of responses
Source: the authors

It should be noted that over 50.0% of the respondents noticed changes for the better over the past 3 years. These are a more convenient work schedule, a more attentive attitude of personnel in employment centres, and a reduction in queues at employment centres. These results confirm our hypothesis.

Also, 7.2% of all unemployed people who took part in the survey admitted that they are not satisfied with the work of employment centres. So, the respondents from this group of unemployed were asked specifically about what they did not like about the work of employment centres.

The following responses were received (Table 2).

The main reason for the dissatisfaction of the unemployed applying to state employment centres is the level of unemployment benefits, which is considered by them too low. At the time of conducting the survey, the maximum unemployment benefit was 12,130 rubles, which corresponds to 158 US dollars and is equal to the minimum wage in the Russian Federation.

Table 2 Reasons for the dissatisfaction of the unemployed with the work of employment centers), %

Reasons for the dissatisfaction	% of responses
Low level of unemployment benefits	58.2
Lack of suitable vacancies	27.4
Large number of required documents	25.4
Slow service delivery	14.1

Formal approach of specialists to solving problems of a service recipient	6.9
Lack of help and responsiveness from specialists of employment centers	6.1
Excessive requirements of regulatory documents	4.3
Impolite attitude of the staff	4.3
The specialists of employment center do not answer the phone calls	2.0

Source: the authors

The responses of the unemployed confirm that the provision of services in state employment centres still remains a bureaucratic procedure. So, every fourth unemployed person (25.4%) notes that it is necessary to collect a large number of documents in order to receive a state employment service. Every seventh respondent (14.1%) is dissatisfied with the speed of service delivery and considers it low. As the reason for dissatisfaction, there were also mentioned excessive requirements of regulatory documents, which make it almost impossible to get the necessary service (4.3%).

Another group of reasons for citizens' dissatisfaction is related to the personnel of employment centres. Respondents note the formality and disinterest of the employment centres specialists (6.9%), the lack of their help (6.1%), impolite attitude (4.3%), as well as the fact that the specialists do not answer the phone calls (2.0%). In addition, the lack of suitable vacancies is also a reason of dissatisfaction with state employment services for 25.4% of the unemployed.

According to the results of the repeated survey, it was revealed how people who have applied to the employment centres before assess the usefulness of the services received for employment. Respondents were asked to rate the usefulness of the received employment services on a scale from 1 to 5 (where 1 - absolutely useless, 5 - very useful).

Table 3 Average ratings of the usefulness of services provided by employment centers

Service	Average rating
Assistance in finding a suitable job	3.9
Psychological support	4.1
Professional training	4.5
Career guidance	4.4
Social adaptation in the labor market	4.0
Assistance in self-employment	3.9
Public works	4.1

Source: the authors

As can be seen from the data in table 3, in general, the clients of employment centers rate the usefulness of the services received quite highly. The average ratings obtained vary from 3.9 to 4.5 for different services.

Professional training (4.5 out of 5) and vocational guidance (4.4 out of 5) received the highest rating according to the criterion of usefulness for future employment. Such high ratings of the usefulness of these services can be explained by the fact that career guidance and professional training allow a person to acquire a new or additional profession, which increases the competitiveness of an employee in the labor market and increases his chances to be employment.

Service recipients gave the lowest ratings to assistance in finding a suitable job and assistance in self-employment. - 3.9 out of 5 for each service. Many respondents noted the lack of suitable vacancies for them in the labor market, which is why the specialists of employment centers did not provide much help when looking for a job.

Conclusion

The obtained results made it possible to draw several conclusions.

First, the level of satisfaction of the unemployed with the services provided by state employment centers is quite high. More than 80% of the surveyed unemployed give a positive assessment of the employment centers performance according to most criteria (except for the comfort criterion, which characterizes the presence of parking, comfortable seats, etc.). At the same time, unemployed people living in the region demonstrate higher satisfaction with the received services than unemployed people living in the city.

Also, the clients of employment centers rate the usefulness of received services in terms of increasing the probability of future employment quite highly. According to the respondents, the most useful services of employment centers are career guidance and professional training for the unemployed.

Our assessment of the satisfaction level with the received services is higher than those obtained in previous studies of other authors. Nevertheless, although today the satisfaction level is quite high, it does not yet meet the target value that is fixed in the national project of the Russian Federation (90.0% of recipients satisfied with state employment services by 2024).

Second, unemployed people who have previously used the services of employment

centers note positive changes in their work. Thus, the following changes were noted as changes for the better: the ability to receive services via the Internet, reducing queues in employment centers, increasing the convenience of the employment centers' work schedule, and the increasing attentiveness of the employment center specialists to clients.

Third, the study showed that the provision of services by state employment centers remains a bureaucratic procedure. A significant part of the unemployed notes that the specialists of the employment centers approach the provision of services formally, do not answer phone calls, work slowly, and in order to apply for any service, the unemployed need to collect a lot of documents.

Thus, we can conclude that, in general, there is a positive trend in the work of state employment centers and customer satisfaction with the received services. Our hypothesis has been confirmed: we can indeed observe a positive trend in the satisfaction indicators of recipients of employment assistance services.

But, at the same time, there are areas for further development in the employment centers' performance. One of the problems that respondents noted was the lack of suitable vacancies in the labor market. In this case, we consider it necessary to strengthen the direction of professional training by selecting such educational programs for the unemployed that would meet not only the needs of the labor market, but also take into account the personal characteristics of the unemployed.

The solution of the identified problems could be facilitated by the revision of the amount of unemployment benefits (regular indexation for the inflation rate), automation of the registration process of the unemployed, as well as an increase in the level of customer orientation of employees of employment centers.

This study also has a number of limitations. These include a small number of studies on the satisfaction of the unemployed with public services, as well as the sample size. In further research, it is advisable to increase the number of unemployed interviewed in order to obtain more accurate and objective assessments of satisfaction with the services provided in employment centers.

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Pallet truck selection with MEREC and WISP-S methods

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Abstract
Background: The article presents an MCDM model based on the MEREC and WISP-S methods for pallet truck selection.
Purpose: The main purpose of the study was to apply a new MCDM model for pallet truck selection in the textile workshop.
Study design/methodology/approach: This article presents a simplified adoption of the Simple Weighted Sum Product (WISP) method, the Simplified WISP (WISP-S) method. The proposed method has fewer computation steps than the regular WISP method. In addition, this study proposes a new hybrid MCDM model in the literature by combining the MEREC method and the WISP-S method.
Finding/conclusions: The obtained results can be achieved in a shorter time compared to regular WISP. The application of the new method is considered in this study. In order to check whether the WISP-S method achieves accurate results, the results of the WISP-S method and the results of the ROV and WASPAS methods were compared. As a result of the comparison of the results of the methods, it was observed that the WISP-S method achieved accurate results.
Limitations/future research: As a direction for future research, other MCDM models can be applied for solving the same problem. When it comes to the limitations of the proposed model, it can be mentioned that the MCDM model is based on the use of crisp numbers.

Keywords
WISP-S, MEREC, pallet truck, logistics

Introduction

In many research areas, the use of multiple criteria decision-making (MCDM) methods for solving many various decision-making problems, is still an topica research subject (Veličkovska, 2022; Stanujkic, Karabasevic, & Popovic, 2021; Popović, Popović, & Karabašević 2021;

Mukhametzyanov, 2021; Shadrina & Ikatrinasari, 2021; Karabasevic, Radanov, Stanujkic, Popovic, & Predic 2021; Jauković-Jocić, Karabašević, & Jocić, 2020). As a result of previous research, many well-known MCDM methods have been proposed, such as the SAW method (MacCrimon, 1968), AHP method (Saaty, 1977), TOPSIS (Hwang & Yoon, 1981), VIKOR method (Opricovic, 1998), MULTIMOORA method (Brauers & Zavadskas, 2010)

In addition, some new MCDM methods have also been proposed, such as ARAS method (Zavadskas & Turskis, 2010), WASPAS (Zavadskas, Turskis, Antucheviciene, & Zakarevicius, 2012), EDAS method (Keshavarz Ghorabaee, Zavadskas, Olfat, & Turskis, 2015), MABAC (Pamučar & Ćirović, 2015), CODAS method (Keshavarz Ghorabaee, Zavadskas, Turskis, & Antucheviciene 2016), PIPRECIA method (Stanujkic, Zavadskas, Karabasevic, Smarandache, & Turskis, 2017), SECA method (Keshavarz-Ghorabaee, Amiri, Zavadskas, Turskis, & Antucheviciene, 2018), FUCOM method (Pamuča, Stević, & Sremac, 2018), CoCoSo method (Yazdani, Zarate, Zavadskas, & Turskis, 2019), PIPRECIA-S (Stanujkic, Karabasevic, Popovic, & Sava, 2021) and the MULTIMOOSRAL method (Ulutaş et al., 2021).

Finally, Stanujkic, Popovic, Karabasevic, Meidute-Kavaliauskiene and Ulutaş (2021) developed a new MCDM method called Simple Weighted Sum-Product (WISP) method combining some approaches implemented in the ARAS, WASPAS, CoCoSo, and MULTIMOORA methods. The Simple WISP method uses four utility measures to determine the overall utility of the alternative. In this article, the possibility of using the WISP-S method based on the usage of two utility measures is considered. Thus, results can be achieved in a shorter time compared to regular WISP.

MCDM methods have been used to solve many different decision-making problems, such as e-Learning website selection (Khan, Ansari, Siddiquee, & Khan, 2019), warehouse location selection (Ocampo et al., 2020), motorcycle selection (Özdağoğlu, Keleş, Altınata, & Ulutaş, 2021), personnel selection (Popović, 2021), hotel selection (Peng, Wang, & Wang, 2021), and pandemic hospital site selection (Boyacı & Şişman, 2022). In this study, the pallet truck, which is one of the Material Handling Equipment, will be selected. In the literature, MCDM methods have been used for the selection of material handling equipment. Pamučar and Ćirović (2015) selected forklifts with DEMATEL and MABAC methods. Sarıçalı and Kundakçı (2017) selected forklifts with the KEMIRA-M method. Fazlollahtabar, Smailbašić and Stević (2019) made a forklift selection for a warehouse with the FUCOM method. Ulutas et al. (2020) made stacker selection with CCSD, ITARA, and MARCOS methods. Vesković, Stević, Nunić, Milinković, and Mladenović (2022) selected the reach stacker using Fuzzy FUCOM and Fuzzy MARCOS methods.

The application of the WISP-S method was carried out in a textile workshop. Since the MEREC method is a very new method, it has been used in very few publications in the literature. In this study, the MEREC method will be used to obtain criteria weights. This study makes two contributions to the literature. First, a new MCDM method will be introduced to the literature. Secondly, a new hybrid MCDM model consisting of MEREC and WISP-S methods will be presented to the literature. In this study, the application possibilities of the proposed WISP-S method are demonstrated on the example of pallet truck selection process.

Therefore, this article is organized as follows. In Section 1, the methodologies of MEREC and WISP-S method are presented in detail. Section 1 presents the application of the proposed model. Finally, a conclusion is presented.

1. Preliminaries

1.1. MEREC method

The steps of the MEREC method are described below (Ghorabaee, Amiri, Zavadskas, Turskis, & Antucheviciene 2021; Ghorabaee, 2021).

Step 1. A decision matrix is arranged. The decision matrix is presented below.

$$X = \left[x_{ij}\right]_{m\times n} \tag{1}$$

Step 2. The decision matrix is normalized with Equations 2 and 3.

$$v_{ij} = \frac{x_{ij}}{\max_i x_{ij}} \quad if\ j \in NB \tag{2}$$

$$v_{ij} = \frac{\min_i x_{ij}}{x_{ij}} \quad if\ j \in B \tag{3}$$

B and NB are shown in the equations mean Beneficial and Non-Beneficial, respectively.

Step 3. The overall performance (T_i) of the alternatives are computed.

$$T_i = ln\left(1 + \left(\frac{1}{m}\sum_j \left|ln\left(v_{ij}\right)\right|\right)\right) \quad (4)$$

Step 4. The performance of alternatives (T'_{ij}) are computed by removing each criterion.

$$T'_{ij} = ln\left(1 + \left(\frac{1}{m}\sum_{k,k\neq j} \left|ln\left(v_{ij}\right)\right|\right)\right) \quad (5)$$

Step 5. The summation of absolute deviations (Y_j) are obtained as follows.

$$Y_j = \sum_i \left|T'_{ij} - T_i\right| \quad (6)$$

Step 6. The weights (w_j) of criteria are computed with Equation 7.

$$w_j = \frac{Y_j}{\sum_k Y_k} \quad (7)$$

1.2. The Simplified WISP (WISP-S) Method

The basic intention of the WISP-S method is to use two instead of four utility measures. Therefore, the calculation procedure of the WISP-S method can be represented by applying the following steps:

Step 1. A decision-making matrix, which is shown in Eq.1, is constructed.

Step 2. A normalized matrix with Equation 8 is constructed.

$$r_{ij} = \frac{x_{ij}}{\max_i x_{ij}} \quad (8)$$

Step 3. Two utility measures (u_i^{sd} and u_i^{pr}) are computed as follows.

$$u_i^{sd} = \sum_{j\in\Omega_{\max}} r_{ij}w_j - \sum_{j\in\Omega_{\min}} r_{ij}w_j \quad (9)$$

$$u_i^{pr} = \frac{\prod_{j\in\Omega_{\max}} r_{ij}w_j}{\prod_{j\in\Omega_{\min}} r_{ij}w_j} \quad (10)$$

where: u_i^{sd} shows differences between the weighted sum of normalized ratings, and u_i^{pr} denotes ratios between a weighted product of normalized ratings of alternative i, respectively.

Step 4. Two utility measures are recalculated as follows.

$$\bar{u}_i^{sd} = \frac{1+u_i^{sd}}{1+max_i\, u_i^{sd}} \quad (11)$$

$$\bar{u}_i^{pr} = \frac{1+u_i^{pr}}{1+max_i\, u_i^{pr}} \quad (12)$$

where: $\bar{u}_i^{sd}$ and $\bar{u}_i^{pr}$ denote recalculated values of u_i^{sd} and u_i^{pr}.

Step 5. The overall utility u_i of each alternative is calculated with Equation 13.

$$u_i = \frac{1}{2}(\bar{u}_i^{sd} + \bar{u}_i^{pr}) \quad (13)$$

Step 6. The alternatives are sorted. The alternative having the highest utility (u_i) is the most suitable one.

2. Application

The application of the proposed method is carried out in a textile workshop. The textile workshop would like to buy two manual pallet trucks (PT) to take the products they make to the warehouses. The owner of the workshop has determined 6 PT brands for this selection problem and has determined 7 criteria for the selection of these PT alternatives. The criteria used in the evaluation are Lifting Capacity (LC) (kilogram), Price (P) (Turkish Liras), Warrant Period (WP) (Months), Fork Length (FL) (millimeter), Maximum Fork Height (MFH) (millimeter), Brand Reliability (BR), and Ease of Finding Spare Parts (EFSP). The first 5 criteria were taken from an organization that sells pallet trucks. The owner of the workshop scored the other two criteria (BR and EFSP) between 1(Lowest)-9 (Highest). Only 2 of the 7 criteria used in the evaluation were determined as non-beneficial criteria. Non-beneficial criteria are P and FL. The decision matrix is shown in Table 1.

The matrix is normalized by applying Equations 2 and 3 to the matrix shown in Table 1. The normalized matrix is presented in Table 2.

Table 1 Decision Matrix

Criteria / Pallet Trucks	LC	P	WP	FL	MFH	BR	EFSP
PT 1	2500	6150	18	1150	200	5	7
PT 2	2500	7400	18	1150	195	8	7
PT 3	2000	7250	12	800	190	5	8
PT 4	2000	5750	24	1100	200	7	8
PT 5	3000	7600	18	1150	190	7	7
PT 6	3000	8400	24	1100	200	5	8

Source: the authors' calculations

Table 2 Normalized Decision Matrix (MEREC)

Criteria / Pallet Trucks	LC	P	WP	FL	MFH	BR	EFSP
PT 1	0.800	0.732	0.667	1	0.950	1	1
PT 2	0.800	0.881	0.667	1	0.974	0.625	1
PT 3	1	0.863	1	0.696	1	1	0.875
PT 4	1	0.685	0.500	0.957	0.950	0.714	0.875
PT 5	0.667	0.905	0.667	1	1	0.714	1
PT 6	0.667	1	0.500	0.957	0.950	1	0.875

Source: the authors' calculations

With Equation 4, T_i values are found. Table 3 presents these values.

Table 3 T_i Values

Pallet Trucks	T_i
PT 1	0.153
PT 2	0.189
PT 3	0.102
PT 4	0.241
PT 5	0.189
PT 6	0.200

Source: the authors' calculations

T'_{ij} values are obtained by using Equation 5. These values are presented in Table 4.

Table 4 T'_{ij} Values

Criteria / Pallet Trucks	LC	P	WP	FL	MFH	BR	EFSP
PT 1	0.120	0.107	0.093	0.153	0.146	0.153	0.153
PT 2	0.158	0.172	0.132	0.189	0.186	0.122	0.189
PT 3	0.102	0.079	0.102	0.046	0.102	0.102	0.082
PT 4	0.241	0.190	0.146	0.235	0.235	0.196	0.224
PT 5	0.131	0.175	0.131	0.189	0.189	0.141	0.189
PT 6	0.143	0.200	0.100	0.194	0.193	0.200	0.181

Source: the authors' calculations

With Equations 6 and 7, Y_j values and weights (w_j) of the criteria are found. The results of the MEREC method are shown in Table 5.

Table 5 The Results of MEREC

Criteria / Results	LC	P	WP	FL	MFH	BR	EFSP
Y_j	0.179	0.151	0.370	0.068	0.023	0,160	0.056
w_j	0.178	0.150	0.367	0.068	0.023	0.159	0.056

Source: the authors' calculations

After finding the weights of the criteria, the proposed WISP-S method is used. With Equation 8, the decision matrix is normalized. Table 6 presents the normalized decision matrix.

Table 6 Normalized Decision Matrix (WISP-S)

Criteria / Pallet Trucks	LC	P	WP	FL	MFH	BR	EFSP
PT 1	0.833	0.732	0.750	1	1	0.625	0.875
PT 2	0.833	0.881	0.750	1	0.975	1	0.875
PT 3	0.667	0.863	0.500	0.696	0.950	0.625	1
PT 4	0.667	0.685	1	0.957	1	0.875	1
PT 5	1	0.905	0.750	1	0.950	0.875	0.875
PT 6	1	1	1	0.957	1	0.625	1

Source: the authors' calculations

After the normalization processes, Equations 9-13 are applied to obtain the results of the WISP-S method, which are indicated in Table 7.

Table 7 The Results of WISP-S

Results / Pallet Trucks	u_i^{sd}	u_i^{pr}	$\overline{u}_i^{sd}$	$\overline{u}_i^{pr}$	u_i	Rankings
PT 1	0.417	0.000612184	0.923	0.999445135	0.961	5
PT 2	0.454	0.000793491	0.947	0.999626230	0.973	4
PT 3	0.302	0.000432393	0.848	0.999265553	0.924	6
PT 4	0.536	0.001167697	1	1	1	1
PT 5	0.459	0.000790590	0.950	0.999623333	0.975	3
PT 6	0.508	0.000856578	0.982	0.999689244	0.991	2

Source: the authors' calculations

ROV and WASPAS methods were applied to the decision matrix shown in Table 1 to check whether the WISP-S method achieved correct results. The results of the ROV and WASPAS methods and the results of the WISP-S method are shown in Table 8. According to the results of the WISP-S method, pallet trucks are listed as follows; PT4, PT6, PT5, PT2, PT1, and PT3.

Table 8 The Results of methods

Methods / Pallet Trucks	WISP-S	ROV	WASPAS
PT 1	5	5	5
PT 2	4	4	4
PT 3	6	6	6
PT 4	1	1	1
PT 5	3	3	3
PT 6	2	2	2

Source: the authors' calculations

As can be seen from Table 8, the results of all three methods are the same. As a result, it is seen that the WISP-S method achieves accurate results.

Conclusion

This article considers a simplification of the Simple WISP method, the WISP-S method. Compared to the Simple WISP method, which uses four utility measures to determine the overall utility of an alternative, the WISP-S method uses only two utility measures which express the difference and the ratio between the sum of weight-normalized ratings of beneficial and non-beneficial criteria of each alternative.

The application of the WISP-S method was demonstrated in the pallet selection problem of a textile workshop. According to the results of the WISP-S method, pallet trucks are listed as follows; PT4, PT6, PT5, PT2, PT1, and PT3. ROV and

WASPAS methods were used to check whether the newly developed WISP-S method reached accurate results. The results of the ROV and WASPAS methods and the results of the WISP-S method were the same. Therefore, it has been proven that the WISP-S method achieves accurate results. This study makes two contributions to the literature. First, a new MCDM method has been developed. Secondly, a new hybrid MCDM model consisting of MEREC and WISP-S methods has been introduced to the literature. Future studies may develop fuzzy and grey extensions of the WISP-S method.

As a direction for future research, other MCDM-based models can be applied for solving the pallet truck selection problem. When it comes to the limitations of the proposed model, it can be mentioned that the MCDM model (MEREC-WISP-S) is based on the use of crisp numbers.

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Investigating critical factors influencing the acceptance of e-learning during COVID-19

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Abstract
Background: In order to prevent the spread of the Covid-19 virus, a temporary interruption of teaching and educational activities in classrooms occurred. Most schools and faculties were forced to switch from traditional to online teaching.
Purpose: This research aims to examine the key factors influencing students' intention to use e-learning, as well as predictors of student satisfaction with online teaching during the Covid-19 pandemic.
Study design/methodology/approach: The analysis includes 312 students on the territory of the Republic of Serbia who use e-learning. Reliability analysis, confirmatory factor analysis and structural equations modeling are applied in the paper.
Findings/conclusions: It is found that course design significantly affects perceived usefulness, perceived ease of use and quality of e-learning, and perceived usefulness and quality of e-learning are the main drivers of student satisfaction. Then, perceived usefulness, perceived ease of use and satisfaction with online teaching are important predictors of the attitude towards the use of e-learning, and attitude is an important driver of the intention to use e-learning. The results of the research and the implications derived from them can be helpful to educational institutions in creating, introducing and implementing e-learning, as well as increasing student satisfaction with online teaching during the pandemic.
Limitations/future research: The limitation of the research stems from the selection of the sample (students). In addition, the research was conducted on the territory of Serbia, so the results cannot be generalized. Third, the possible bias of the respondents in giving answers can lead to wrong conclusions. The recommendation for future research is to examine the attitudes of professors who use e-learning, in addition to students. Another recommendation is to do a segment analysis (by gender, year of study) in order to develop specific strategies for each segment. Another suggestion is to compare students' opinions on e-learning and traditional ways of learning.

Keywords
e-learning, COVID-19, TAM, course design, satisfaction, online teaching

Introduction

The Internet and modern technology have greatly influenced education and led to the emergence of online learning. Online learning, i.e. e-learning, has been applied in many higher education institutions around the world for the last 15-20 years (Ibrahim, Leng, Yusoff, Samy, Masrom & Rizman, 2017; Li, Zhan, Liu & Tong, 2022; Gamage, Ayres & Behrend, 2022; Ratna & Mehra, 2015; Cheng, 2012; Drennan, Kennedy & Pisarski, 2005). E-learning differs from the traditional way of learning in that it gives priority to individual learning over group learning, because it encourages students to learn individually at home, rather than in groups and classes (Al-Rahmi et al.,

2018). It can also be seen as an innovative approach to providing educational services through information in electronic form that improves the knowledge and skills of students (Pham, Limbu, Bui, Nguyen & Pham, 2019).

The Covid-19 pandemic has encouraged all educational institutions to incorporate technology into learning processes. In general, there is a much greater use of e-learning, as many educational institutions have transferred traditional teaching activities to the online world. In such conditions, there is a growing need for the adoption of e-learning, both by teachers and students. The Technology Acceptance Model (TAM) developed by Davis, Bagozzi and Warshaw (1989) is the most commonly used model in studies that examine user technology acceptance. The TAM model has also been widely applied in studies researching e-learning. Using TAM as a theoretical basis, this research aims to examine the key factors influencing students' intention to use e-learning, as well as predictors of student satisfaction with online teaching during the Covid-19 pandemic. Although a great number of studies focus on e-learning, the main research motivation is e-learning in the specific conditions of the Covid-19 pandemic. This research is expected to contribute to the literature, spreading knowledge about key predictors of e-learning technology acceptance, as well as about the factors that affect student satisfaction with online classes during the COVID-19 pandemic. In addition, the results of the research and the implications derived from them can be helpful to educational institutions in creating, introducing and implementing e-learning, as well as increasing student satisfaction with online teaching during the pandemic.

The paper consists of four parts. The first part of the paper refers to the literature review in which theoretical and empirical findings in the field of e-learning are given. The second part of the paper includes the research methodology, and the third the results of the conducted empirical research. The fourth part of the paper presents a discussion of the obtained results, theoretical and practical implications, limitations, as well as future directions of research.

1. Review of literature

1.1. E-learning

In order to prevent the spread of the COVID -19 virus, a temporary interruption of teaching and educational activities in classrooms occurred. Most schools and faculties were forced to switch from traditional to online teaching, which was a real challenge for these educational institutions. Obeidat, Obeidat, Obeidat and Al-Shalabi (2020) point out the lack of technical support, awareness, readiness, skills, resources and infrastructure as challenges for the adoption of e-learning. In addition, trust issues, resistance to change and financial issues are important factors for the success of e-learning.

E-learning is the use of telecommunications to deliver information for education and training (Sun, Tsai, Finger, Chen & Yeh, 2008, p. 1183). Ibrahim et al. (2017, p. 872) state that e-learning is the use of an Internet connection to improve the delivery of teaching materials, communication and cooperation between students and professors in a virtual environment. Nikou and Maslov (2021, p. 300) define e-learning as a comprehensive technological system for teaching, while participation in e-learning for them is an act of using telecommunications to attend classes and learn within such a system. As a model of learning unlimited in time or space, e-learning enables fast and efficient transfer of digitized teaching material, reduces costs, as well as the time required for students to find the content necessary for independent learning (Chen & Teseng, 2012, p. 399). Modern learning platforms developed by well-known software companies offer multi-level and fully integrated distance education, as well as interactive communication opportunities (Chang, 2013, p. 42). The great advantage of e-learning is reflected in flexibility and accessibility (Al-Azawei, Parslow & Lundqvist, 2017, p. 1). In addition, e-learning leads students to independent learning, at the same time giving them the opportunity to save the conversation and listen to it later (Salamat, Ahmad, Bakht & Saifi, 2018, p. 5). It increases the effectiveness of knowledge and skills by enabling access to a massive amount of data, and enhances collaboration, and also strengthens learning sustaining relationships (Maatuk, Elberkawi, Aljawarneh, Rashaideh & Alharbi, 2021). However, Lee, Yoon and Lee (2009, p. 1321) cite certain limitations of e-learning. E-learning generally requires new pedagogical skills, discipline, as well as student motivation. In addition, there are certain security issues (cyber-attacks and hacking of e-learning systems). One of the challenges is the authentication of students who take the exam. Butnaru, Nită, Anichiti and Brînză (2021, p. 2) point out the lack of interactivity compared to

classroom learning, technical problems, poor internet connection, lack of socialization that can lead to anxiety and depression of students as shortcomings of online learning.

1.2. Technology Acceptance Model (TAM)

Davis et al. (1989) develop the Technology Acceptance Model (TAM) to examine the effects of technology on user behavior. In this model, perceived usefulness and perceived ease of use are two key variables that affect the user's attitude towards the use of a particular technology, and attitude is an important predictor of the intention to use the technology. In addition to the above, it is assumed that the perceived ease of use affects the perceived usefulness. Perceived usefulness is defined as the potential user's subjective feeling that using a particular application system will increase his or her performance, and perceived ease of use refers to the degree to which a user believes that he or she will use a particular system effortlessly (Davis et al., 1989, p. 985). Numerous studies apply the TAM model in the field of education in order to examine the readiness of students to accept e-learning systems (Liu, Chen, Sun, Wible & Kuo, 2010; Sukendro et al., 2020; Ibrahim et al., 2017; Cheung & Vogel, 2013). Ratna and Mehra (2015) point out that TAM enables the analysis of the reasons for resistance to technology, as well as the taking of effective measures for better acceptance of e-learning by users. Therefore, the TAM model represents the scientific basis for this research. In addition to the original TAM variables (perceived usefulness, perceived ease of use, attitude towards technology, intention to use technology), research model includes three other variables (course design, quality of e-learning and satisfaction with online teaching).

1.3. Research model and hypotheses

Designing online learning refers to selecting components that help improve student learning and enable students to access course content (Lister, 2014). Good design plays an important role in attracting and retaining consumer interest in a website (Ranganathan & Ganapathy, 2002). Liu et al. (2010) find that online course design is a key factor in the success or failure of online learning. They emphasize design as the most important predictor of perceived usefulness, because the more satisfied users are with the online curriculum, the more useful the online course will be. The design of online courses should meet the needs of participants at different levels and provide students with easy access to learning materials (Cheng, 2012). If appropriate content is posted and updated in a timely manner, users will find the e-learning portal a useful learning tool (Lee et al., 2009). Course designers must carefully consider their structure when designing e-learning courses (Lister, 2014). Distance learning is much easier for students if the e-learning course is well structured and has an attractive design that is in line with student competencies (Elumalai et al., 2020). Many studies conclude that e-learning course design has significant effects on perceived usefulness and perceived ease of use (Liu et al., 2010; Lee et al., 2009). In addition, Elumalai et al (2020) find that course design is an important predictor of e-learning quality. Having in mind the above, the following hypotheses are formulated:

H1a: Course design has statistically significant effects on perceived usefulness.

H1b: Course design has statistically significant effects on perceived ease of use.

H1c: Course design has statistically significant effects on the quality of e-learning.

For the purposes of this research, perceived usefulness can be described as the degree to which students believe that the use of e-learning during the COVID-19 pandemic improved their learning effects. Perceived ease of use refers to students' perception that the use of e-learning technology during the COVID-19 pandemic does not require much effort. Siron, Wibowo and Narmaditya (2020) find that perceived usefulness and perceived ease of use positively influence the intent to use e-learning during the COVID-19 pandemic.

Malathi and Rohani (2011) investigate the use of e-books by students from Malaysia. They point out the connection between perceived ease of use and perceived usefulness, as well as the effects of perceived usefulness on the attitude and intention of using e-books. Thus, technology will only be accepted if it offers potential customers a unique advantage over existing solutions (Rogers, 1995). Ratna and Mehra (2015) examine the acceptance of e-learning technology on the example of students from India and conclude that perceived usefulness has positive effects on attitude, as well as that perceived ease of use has positive effects on perceived usefulness and attitude towards the use of e-learning. If users find e-learning easy to use, then they will feel it is useful and will be willing to use it (Liu et al., 2010). Given previous studies that show a statistically significant impact of perceived

usefulness and perceived ease of use on attitudes toward the use of e-learning (Jović, Kostić Stanković & Nešković, 2017; Mailizar, Almanthari & Maulina, 2021; Ratna & Mehra, 2015; Cheung & Vogel, 2013), as well as the effects of perceived ease of use on perceived usefulness (Nikou & Maslov, 2021; Siron et al., 2020; Cheng, 2012; Mailizar et al., 2021; Mohammadi, 2015; Chen & Tseng, 2012), the following hypotheses are formulated:

H2a: Perceived usefulness has statistically significant effects on attitudes towards the use of e-learning.

H2b: Perceived ease of use has statistically significant effects on attitudes towards the use of e-learning.

H2c: Perceived ease of use has statistically significant effects on perceived usefulness.

Students' acceptance of online learning technology can significantly affect student satisfaction (Lee, 2010). Drennan et al. (2005) conclude that perceived usefulness is an important predictor of satisfaction. E-learning users will not be satisfied if they find the technology difficult to use or if it does not help them improve their learning performance (Al-Azawei et al., 2017). Research states that perceived usefulness and perceived ease of use have significant effects on student satisfaction (Al-Azawei et al., 2017; Sun et al., 2008). If e-learning is easy to use and students access online teaching easily, then they will be able to devote more time to learning itself, instead of investing extra effort and time to master the use of technology (Sun et al., 2008). Based on the above, the following hypotheses are formulated:

H3a: Perceived usefulness has statistically significant effects on student satisfaction with online teaching.

H3b: Perceived ease of use has statistically significant effects on student satisfaction with online teaching.

In the field of higher education, service quality is defined as the difference between students' expectations and their experience with higher education services (Stodnick & Rogers, 2008). The quality of e-learning services has a positive effect on student satisfaction, which in turn has a positive effect on the loyalty of e-learning users (Pham et al., 2019). In order to monitor student satisfaction in online education, it is important to evaluate the quality of technology, support services and course design (Rovai, 2003). Quality of service, quality of content, quality of systems are important factors for assessing the satisfaction of students who use e-learning (Ozkan & Koseler, 2009). In the context of e-learning, the quality of service has a significant positive impact on student satisfaction (Chang, 2013; Poulova & Simonova, 2014). Students will embrace e-learning and will be satisfied if there is a high-quality e-learning service (Lee, 2010). Lee et al. (2009) state that students will be more positive toward e-learning with the improvement of its quality. With this in mind, the following hypothesis will be tested:

H4: The quality of e-learning has statistically significant effects on student satisfaction with online teaching.

Satisfaction is defined as meeting consumer expectations about the performance of products and services (Oliver, 1980). If the performance of products/services exceeds consumer expectations, a high degree of satisfaction is achieved. Satisfaction is an important determinant of information system success (Rai, Lang & Welker, 2002). Pham et al. (2019) state that in the era of ICT development, online satisfaction can be defined as the overall user assessment of the quality of products or services offered on the online market. In this regard, they point out that students are viewed as consumers and that student satisfaction is one of the most important university goals. In this study, satisfaction is seen as meeting consumer expectations about how to teach online during the COVID 19 pandemic. Satisfaction is related to students' experience in using e-learning (Richardson, 2017) and is an important predictor of e-learning intent (Chang, 2013; Mohammadi, 2015; Liaw, 2008; Al-Rahmi et al., 2018). In addition to the effect on intended use, a positive experience can also positively affect student attitudes (De Vos, Singleton & Gärling, 2021). So, if students are satisfied with online teaching, they will continue to use e-learning. On the other hand, if there is no satisfaction, students will have a negative attitude towards e-learning and will reduce or stop using it altogether. Therefore, it is very important to examine the satisfaction of students with online teaching. In this regard, the following hypotheses have been formulated:

H5a: Satisfaction with online teaching has a statistically significant impact on attitudes towards e-learning.

H5b: Satisfaction with online teaching has a statistically significant impact on the intention to use e-learning.

In this study, the attitude refers to the opinion of students about the use of e-learning during the Covid-19 pandemic. Users of e-learning

technology tend to follow certain behaviours based on their positive attitude towards that technology (Keong, Albadry & Raad, 2014). Numerous studies find that attitude is an important predictor of the intention to use e-learning (Mailizar et al., 2021; Ratna & Mehra, 2015; Sukendro et al., 2020; Cheung & Vogel, 2013; Cicha, Rizun, Rutecka & Strzelecki, 2021). Thus, a positive attitude towards e-learning increases the likelihood of its actual use by students. In this regard, the following hypothesis will be tested:

H6: Attitudes towards the use of e-learning have a statistically significant impact on the intention to use e-learning.

The research model is shown in Figure 1.

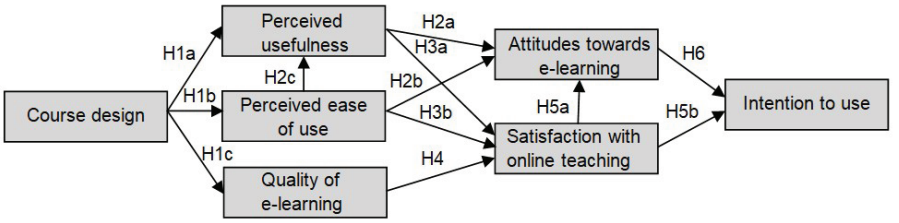

Figure 1 The research model
Source: the authors

2. Research methodology

Empirical research uses a survey method to collect primary data. The questionnaire is distributed to students on the territory of the Republic of Serbia who use e-learning, and 312 respondents answer the questions. Female respondents dominate the sample, 192 of them or 61.5%, while men make up 38.5% of the sample (120 respondents). First-year students make up 23.7% of the sample (74 respondents), second-year students 29.8% (93 respondents), then 54 respondents attend the third year (17.3%), 57 fourth (18.3%), and 10 respondents attend the fifth year (3.20%). Master students make up 6.40% of the sample (20 respondents) and 1.30% are doctoral students (4 respondents). The sample structure is shown in Table 1.

In addition to these two demographic questions, the questionnaire also contains 22 items scaled on a seven-point Likert scale, with which respondents expressed their degree of agreement (1 – I strongly disagree: 7 – I strongly agree). The design of the e-learning portal is measured through 4 items (Ibrahim et al., 2017), the perceived usefulness includes 4 items (Sukendro et al., 2020; Thapa, Bhandari & Pathak, 2021), and 4 items make up the perceived ease of use (Ibrahim et al, 2017). The quality of e-learning is observed through 3 items (Elumalai et al., 2020), attitude to the use of e-learning using 2 (Malkavi, Bawaneh & Bawaneh, 2021; Ratna & Mehra, 2015), satisfaction with online teaching using 3 (Mohammadi, 2015; Sun et al., 2008), and the intention to use it with 2 items (Sukendro et al., 2020).

Table 1 Sample structure

		Number of respondents	%
Gender	Female	192	61.5
	Male	120	38.5
Year of study	I	74	23.7
	II	93	29.8
	III	54	17.3
	IV	57	18.3
	V	10	3.2
	Master studies	20	6.4
	PhD studies	4	1.3
	Total	312	

Source: the authors

The data analysis is performed in the statistical packages for social sciences IBM SPSS 20 and IBM AMOS 23. The SPSS program is used to conduct a reliability analysis to determine the internal consistency of the formed variables. With the help of the AMOS program, the validity of the research model is tested using confirmatory factor analysis (CFA), and then a structural equation model is used to test the effects of independent on dependent variables.

3. Research results

3.1. Model reliability and validity analysis

In order to determine the internal consistency of the variables that make up the research model, a reliability analysis is conducted. The results are shown in Table 2.

Table 2 Reliability analysis

Variables	Cronbach' alpha
Course design	0.828
Perceived usefulness	0.885
Perceived ease of use	0.893
Quality of e-learning	0.872
Attitudes towards e-learning	0.849
Satisfaction with online teaching	0.956
Intention to use	0.952

Source: the authors

Since the value of the Cronbach's alpha coefficient for each formed variable is higher than the lowest required value of 0.7 proposed by Nunnally (1978), it can be concluded that all variables have the appropriate internal consistency of the items that make them, i.e. that all variables are reliable.

Table 3 Model-fit indices

Fit indices	Value in the model	Recommended value
x^2/df	2.59	<3
CFI	0.952	>0.9
TLI	0.941	>0.9
IFI	0.953	>0.9
RMSEA	0.072	<0.08

Source: the authors

In order to test the validity of the model, a confirmatory factor analysis is conducted. Values of CFI (Comparative Fit Index), TLI (Tucker-Lewis Index) and IFI (Incremental Fit Index) higher than 0.9 (Byrne, 1998), RMSEA (Root Mean Square Error of Approximation) lower than 0.08 (Hair, Black, Babin & Anderson 2010), and x^2/df ratio lower than 3 (Carmines & McIver, 1981) indicate that there is an acceptable model fit (Table 3). The results of the confirmatory factor analysis also indicate the convergent validity of the model, since the AVE values of all variables are greater than 0.5 (Fornell & Larcker, 1981). In addition, CR values (Composite Reliability) in all variables are higher than 0.6, as recommended by Bagozzi and Yi (1988). The results are shown in Table 4.

Table 4 Composite reliability (CR) and Average variance extracted (AVE)

Variables	*CR*	*AVE*
Course design	0.828	0.547
Perceived usefulness	0.886	0.661
Perceived ease of use	0.903	0.702
Quality of e-learning	0.875	0.701
Attitudes towards e-learning	0.863	0.761
Satisfaction with online teaching	0.957	0.882
Intention to use	0.953	0,909

Source: the authors

3.2. Testing the hypotheses

In order to test the set hypotheses, a model of structural equations is used. Twelve influences are tested, and 10 prove to be statistically significant.

Table 5 Hypothesized relationships

Hypotheses	β	p
H1a: Course design → Perceived usefulness	0.338	0.026**
H1b: Course design → Perceived ease of use	0.872	0.000***
H1c: Course design → Quality of e-learning	0.767	0.000***
H2a: Perceived usefulness → Attitudes towards e-learning	0.671	0.000***
H2b: Perceived ease of use → Attitudes towards e-learning	-0.225	0.000***
H2c: Perceived ease of use → Perceived usefulness	0.413	0.004***
H3a: Perceived usefulness → Satisfaction with online teaching	0.427	0.000***
H3b: Perceived ease of use → Satisfaction with online teaching	0.029	0.660
H4: Quality of e-learning → Satisfaction with online teaching	0.458	0.000***
H5a: Satisfaction with online teaching → Attitudes towards e-learning	0.479	0.000***
H5b: Satisfaction with online teaching → Intention to use	0.088	0.440
H6: Attitudes towards e-learning → Intention to use	0.767	0.000***

*** Significant at a 0.01 level.
** Significant at a 0.05 level.
Source: the authors

The analysis shows that course design has a statistically significant impact on perceived usefulness ($\beta = 0.338$, $p < 0.05$), perceived ease of use ($\beta = 0.872$, $p < 0.01$) and e-learning quality ($\beta = 0.767$, $p < 0.01$), which confirms the hypotheses H1a, H1b and H1c (Table 5). Then, it finds that perceived usefulness ($\beta = 0.671$, $p < 0.01$) and perceived ease of use ($\beta = -0.225$, $p < 0.01$) have statistically significant effects on attitudes towards the use of e-learning, as well as that perceived ease of use significantly affects the perceived usefulness ($\beta = 0.413$, $p < 0.01$), which proves the hypotheses H2a, H2b and H2c.

Hypothesis H3a is also confirmed, having in mind the statistically significant effects of perceived usefulness on satisfaction with online teaching ($\beta = 0.427$, $p < 0.01$). On the other hand, hypothesis H3b is rejected, since the perceived ease of use does not have a statistically significant effect on satisfaction with online teaching. The quality of e-learning has statistically significant positive effects on satisfaction with online teaching ($\beta = 0.458$, $p < 0.01$), which confirms hypothesis H4. Hypothesis H5a is also accepted, due to the

statistically significant influence of satisfaction with online teaching on the attitude towards the use of e-learning ($\beta = 0.479$, $p < 0.01$). However, hypothesis H5b is not accepted due to the lack of a statistically significant effect of online teaching satisfaction on intention to use. Finally, it is found that the attitude towards the use of e-learning has a statistically significant impact on the intention to use ($\beta = 0.767$, $p < 0.01$), which confirms hypothesis H6.

4. Discussion of results

The analysis shows that course design has statistically significant positive effects on both TAM dimensions (perceived usefulness and perceived ease of use), which is consistent with a number of studies (Liu et al., 2010; Lee et al., 2009). The strongest influence of the course design is on the perceived ease of use. So, if the e-learning course is designed in an appropriate way, students will consider e-learning technology easy and simple to use, i.e. the course design depends on how much effort it takes students to master the use of e-learning. Also, a well-structured and designed e-learning course will help students improve their learning effects. In addition to the above, it is found that the design of the course is a very strong predictor of the quality of e-learning. Elumalai et al. (2020) reach a similar conclusion. Visually appealing design, timely uploaded and updated materials and, appropriate and easy navigation through the e-learning portal can contribute to improving the quality of online teaching.

In accordance with previous studies (Jović et al., 2017; Mailizar et al., 2021; Ratna & Mehra, 2015), this research finds that perceived usefulness has statistically significant positive effects on attitudes toward the use of e-learning. So, if students think that e-learning helps them master the material more easily, as well as in achieving better learning performance, they will have a more favourable attitude towards it. On the other hand, the analysis shows that the perceived ease of use has negative effects on the attitude towards the use of e-learning. In the context of the COVID 19 pandemic, educational institutions were forced to use online teaching instead of traditional teaching. In such circumstances, students may feel that due to the simplicity of using e-learning, online teaching will not be at the same level as traditional, and therefore there may be a negative impact of perceived ease of use on the attitude towards e-learning. Then, it is found that the perceived ease of use has a significant positive impact on the perceived usefulness. A large number of other studies reach identical conclusion (Nikou & Maslov, 2021; Siron et al., 2020; Cheng, 2012; Mailizar et al., 2021; Mohammadi, 2015; Chen & Tseng, 2012). So, the easier e-learning is to use, the more useful students find it.

Perceived usefulness is an important predictor of student satisfaction with online teaching, which is in line with previous studies (Al-Azawei et al., 2017; Sun et al., 2008; Drennan et al., 2005; Al-Fraihat, Joy, Masa'deh & Sinclair, 2019). If students perceive e-learning as useful, i.e. it helps them master the material faster, easier and better, thanks to accessibility and availability at any time and in any place, a higher level of their satisfaction will be achieved with this way of teaching. On the other hand, in a study by Drennan et al. (2005), it is found that perceived ease of use has no significant impact on satisfaction. This can be explained by the fact that students mostly belong to the younger population, which is generally skilled and experienced in the use of technology. The mere fact that the technology is easy to use does not give students much satisfaction. In order to achieve a higher level of satisfaction, it is much more important that the use of e-learning and the online classes they attend are useful than easy to use. Then, it is shown that the quality of e-learning can significantly affect student satisfaction, which is in line with the conclusions reached by Pham et al. (2019), Lee (2010), Liaw (2008), Sun et al. (2008), Chang (2013), Poulova and Simonova (2014). If e-learning is adapted to students, enables them to raise the level of their achievements and provides timely feedback, as well as everything else they need to successfully master the subject matter, students are satisfied with this way of teaching.

This study concludes that student satisfaction with online teaching has significant positive effects on attitudes toward the use of e-learning. De Vos et al. (2021) come to the conclusion about the influence of satisfaction on attitude. However, satisfaction with online teaching has been found to have no impact on the intention to use e-learning, which differs from the conclusions of previous studies (Chang, 2013; Mohammadi, 2015; Liaw, 2008; Al-Rahmi et al., 2018). If online teaching meets or exceeds students' expectations, i.e. a high degree of satisfaction is achieved with the way online teaching is realized, there will be a more favourable attitude and positive opinion of students towards e-learning. However, the fact that students are satisfied with online teaching does not necessarily mean that it has a decisive influence on

their intention to use e-learning. In the conditions of the pandemic, students used e-learning not only because they were satisfied with it, but also because they were forced to do so. Due to the prescribed measures and quarantines during the COVID-19 pandemic, many educational institutions partially or completely switched to online teaching, so that students had no choice but to use e-learning, whether they were satisfied with online teaching or not. Finally, attitude has been found to be an important predictor of intention to use e-learning, as confirmed by other studies (Mailizar et al., 2021; Ratna & Mehra, 2015; Sukendro et al., 2020). So, if students have a more positive attitude towards the use of e-learning during the COVID-19 pandemic, they are more likely to accept and use it.

Conclusion

The current epidemiological situation caused by the COVID-19 virus pandemic has led to an increase in the number of e-learning users, which is why the importance of research in this area is emphasized. In this regard, the purpose of this study is to examine the key factors influencing the intention of students to use e-learning, as well as predictors of student satisfaction with online teaching during the COVID-19 pandemic. It is found that course design significantly affects perceived usefulness, perceived ease of use and quality of e-learning, and perceived usefulness and quality of e-learning are the main drivers of student satisfaction. Then, perceived usefulness, perceived ease of use and satisfaction with online teaching are important predictors of the attitude towards the use of e-learning, and attitude is an important driver of the intention to use e-learning.

This research is expected to contribute to the literature in the field, spreading knowledge about key predictors of e-learning technology acceptance, as well as factors influencing student satisfaction with online teaching during the COVID-19 pandemic. Scientific contribution of this paper lies in a unique structure of a research model with scientific bases (Davis et al., 1989). Based on TAM, this study integrated satisfaction with online teaching with the adoption of e-learning technology, thus extending the original TAM model. Most research related to e-learning used users' attitudes towards e-learning technology and/or the intention to use e-learning as dependent variables, and a smaller number of authors found a dependent variable in satisfaction with online teaching itself, which is an additional contribution of this research. Although a large number of studies have examined e-learning, the main research motivation is the study of e-learning in the specific conditions of the COVID-19 virus pandemic, which contributes to the originality of this paper.

Based on the results of the research, implications have been derived that can be of help to educational institutions in creating, introducing and implementing e-learning, as well as for increasing student satisfaction with online teaching during the pandemic. Due to the pronounced influences of the course design, it is important to pay special attention to it. Therefore, when creating a course, it is desirable to take care that it is not too complicated to use, that it has easy navigation and appropriate structure, and that it contains all the functionalities necessary for everyday use of e-learning by students and professors. In addition to the above, it is recommended to take into account the visual appearance of the user interface. Aesthetically appealing shapes, colours, as well as wallpaper can provide additional atmosphere to users. If the main obstacle for students to use e-learning is that the technology is complicated to use, it is recommended to conduct student training or make brochures and video instructions with a detailed explanation of how to use. In addition to training for students, it is desirable to conduct training for teachers, in order to better master the use of e-learning technology and thus improve the quality of online teaching they perform. If there is resistance of a certain number of students to the acceptance of e-learning technology, it is recommended to point out to students in cooperation with the student parliament all the benefits of e-learning, such as flexibility, saving time and avoiding physical contact, which is desirable during the COVID-19 pandemic.

It is of special importance that the courses are updated in a timely manner and appropriate materials are set up that will satisfy the educational needs of students. This is especially important in a pandemic, given that many students were infected or forced into isolation at some point, and, therefore, could not attend classes in educational buildings. In such situations, the only option for students is to follow online classes. Given that online teaching is characterized by a lack of interactivity compared to traditional teaching, it is important for students to be provided with all necessary feedback in a timely manner, rather than reducing online teaching to posting material on the portal. In addition to the above, online teaching is characterized by a lack of socialization and

pronounced individual in relation to teamwork. In this regard, it is desirable that students have more tasks and projects that require teamwork and cooperation with other students, and thus alleviate these shortcomings of online teaching. In this way, students will be more motivated and satisfied with online teaching, which will lead to more favourable attitudes towards the use of e-learning technology. It is also recommended that higher education institutions conduct a survey of their students in order to collect data on their opinions related to e-learning technology and online teaching and thus assess their overall satisfaction. In that way, the analysis of the obtained data will determine the existence of possible problems and allow taking appropriate measures in time.

The research conducted has several limitations. First, only students were examined in the study; the professors' opinion was not taken into account. Second, the research was conducted on the territory of the Republic of Serbia, so the results cannot be generalized. Third, the possible bias of the respondents in giving answers can lead to wrong conclusions. The recommendation for future research is to examine the attitudes of professors who use e-learning, in addition to students. Another recommendation is to do a segment analysis (by gender, year of study) in order to develop specific strategies for each segment. Another suggestion is to compare students' opinions on e-learning and traditional ways of learning.

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The influence of retail facility lighting on shoppers' product perception

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Abstract
Background: The subject of the paper is lighting, which represents one of the instruments of shopper marketing. Review of the relevant literature suggests that lighting can have a significant impact on the appearance of the observed product.
Purpose: The aim of this paper is to evaluate whether lighting in a retail facility affects the behaviour of shoppers on the Serbian market.
Study design/methodology/approach: Data for testing hypotheses were collected from the sample on the market of Serbia. In order to collect data, an online experiment was conducted. Data were processed using repeated measures one-factor analysis of variance.
Findings/conclusions: Based on the research results the conclusion is that different treatments of lighting colour and temperature affect the shoppers' perception of the quality of the observed product, but do not affect shoppers' price perception of the observed product on the Serbian market.
Limitations/future research: Limitations of this research are: research on the basis of one characteristics of lighting, online research, one subject of observation, number of treatments, light source and influence of the device screen characteristics. Future research should include: research in more realistic conditions, usage of various stimulus and sources of artificial lighting and identification of the device by which the respondent accessed the questionnaire with the aim of comparison of the obtained results.

Keywords
lighting, lighting colour temperature, quality perception, price perception, retail

Introduction

In the context of a retail facility, the term "atmosphere" was first introduced by Kotler (1973), who stated that conscious planning of the atmosphere in a retail facility could contribute to a shopper's propensity to purchase. Designing the desired atmosphere is achieved by a combination of factors that represent the variables of the atmosphere. According to Turley and Milliman (2000), there are as many as 43 purchase triggers within a retail facility, which have the potential to influence shopper evaluation and behaviour. The adaptation of the atmosphere to the type of shoppers that visit retail premises is crucial for the potential increase in the number of visits to the facility in question, as well as for the influencing the amount of time spent within the facility, which can ultimately affect the shoppers' desire to view and feel products (Hyllegard, Ogle & Dunbar, 2006), and increase the number and amount of purchases (Turley & Chebat, 2002). Regarding the aforementioned goals, atmosphere in a retail facility could be seen as a part of shopper marketing (Petković & Bogetić, 2014; Bogetić & Petković, 2015).

One of the most significant atmosphere variables is lighting. In an effort to create practical, very often "theatrical" experience, many of the world's leading retailers pay close attention to this factor, understanding its potential to change shoppers' perception (Hyllegard, et al., 2006). The first research on the importance of the role of lighting in retail was focussed on the functional and technical characteristics of lighting, such as glare and flicker of light. During the 1960s and 1970s, researchers began shifting their focus to the impact of retail facility lighting on the feelings of individuals, i.e. shoppers (Murdoch & Caughey, 2004). A significant number of studies on the psychological effects of lighting in retail appeared in the 90s (Knez, 1995). The reason for such a development in understanding of the impact of lighting on an individual's emotional response lies in the fact that, until the 1970s, stores mostly relied on daylight as the dominant source of illumination. The 1970s and the beginning of a revolution in energy consumption in retail facilities caused the situation where approximately 70% of total energy consumption went to the creation of artificial lighting (Henderson-Smith, 2003). Daylight, as a source of illumination, became obsolete because of its inability to cover large enclosed areas where light does not reach distant parts of the facility. In addition to this, it largely depends on atmospheric conditions (sunshine, clouds, rain, etc.).

Certain characteristics of lighting, such as brightness and colour temperature, change shopper behaviour and increase or decrease retailer's revenue. For example, a "cooler" colour temperature of lighting affects shopper's longer stay in a retail facility and, potentially, a higher amount of purchased goods (Barlı, Aktan, Bilgili & Dane, 2012). With the development of technology, an increasing body of research in the field of the impact of lighting on retail shopper behaviour is being conducted in the laboratory instead of retail facilities (Park & Farr, 2007). Laboratory conditions allow researchers to distinguish the influence of lighting from other factors that make up the overall atmosphere (music, crowds, smells, etc.), which is practically impossible in terms of observing shopper behaviour in real retail facilities (Reddy, Reddy & Azeem, 2011).

Lighting in a retail facility is influenced by many factors, and the task of the retailer is to find the right combination of its characteristics in order to achieve optimal lighting for the interior of a particular retail facility (Custers, De Kort, Ijsselsteijn & De Kruiff, 2010).

When creating a lighting strategy in a retail facility, the retailer should pay attention to three key lighting characteristics (Hartnett, 1995):

- illumination;
- lighting colour temperature;
- colour rendering index.

Brightness is a characteristic of lighting that stems from the visual impression that an illuminated object emits more or less light. The brightness level varies depending on the colour of the observed object. Lighter shades of the same colour create the impression of a higher level of brightness than darker shades. In addition to this, under the same lighting conditions, some colours create the impression of a higher level of illumination. On the colour scale, under the same lighting conditions, white objects give the impression of the highest level of illumination, while black objects do the opposite. However, we should bear in mind that the level of illumination is a subjective category that varies from individual to individual. A higher level of illumination causes shoppers to take a larger number of products into consideration, and consequently stimulates the purchase of products (Reynolds-McIlnay, Morrin & Nordfal, 2017).

Artificial light sources emit lighting that consists of different combinations of wavelengths, which means that the manipulation of those wavelengths can affect the colour of the lighting perceived by the observer. The colour of the light emitted by an artificial light source is characterized by the Correlated Colour Temperature (CCT). The colour temperature of illumination is expressed in Kelvin. When we encompass all light sources, both natural and artificial, the temperature range of lighting colour ranges from 1700K (lighted candle) to approximately 6500K (daylight). According to Lechner (2009), individuals perceive light colour temperatures below 3,000 Kelvin as warm, and over 5,000 Kelvin as cold.

The Colour Rendering Index (CRI) refers to the characteristic of illumination that represents the ability of an artificial light source to display the colour of an illuminated object in the most faithful way, compared to the reference light source with the same light colour temperature. In other words, the colour rendering index shows how natural the colour of an object illuminated by

an artificial light source looks. The Colour Rendering Index is expressed on a scale from 0 to 100. Light sources that have CRI greater than 80 are considered to have excellent colour rendering. CRI below 60 is considered poor (Davis & Ohno, 2005).

Retailers usually have very little time to make contact with shoppers, and to present the products displayed on the shelves of a retail facility in a proper way (Mari & Poggesi, 2013). Therefore, in addition to the aforementioned influence of lighting on the mood, i.e. emotional response of the shopper indoors, it is important to explore the impact of lighting on the perception of the products that are subject to observation, that is, on the evaluation conducted by the shopper. Product perception refers to the perception of the aesthetic, symbolic and functional value of a product, as well as the perception of product's quality (Creusen, 2010). Aesthetic and symbolic values of products represent expressive aspects of products, while functional values and perception of quality represent utilitarian values. The expressive aspects of product are perceived by the shopper holistically, which means that the shopper's perception of aesthetic and symbolic values is based on the global impression of that product. The perception of product's utilitarian values is conducted based on evaluation of details and characteristics of products. Nevertheless, although the perception of product quality, resides in the domain of the utilitarian aspect of the product, it is based on a holistic evaluation of that product, and in that case, lighting can play a very important role. While in a retail facility, shopper often does not have time to perform a detailed analysis of product, and it is then and there that appropriate lighting, which corresponds to a holistic product evaluation, can determine the perception of product quality (Oh, Janiszewski, Baek, Choo & Yoon, 2016).

The following theoretical and empirical conclusions are based on data collected during work on the doctoral dissertation of the first author of this paper.

1. Literature review

The following section of this research brings concise presentation of relevant papers from acclaimed journals, in which the authors investigate the impact of lighting on shopper behaviour.

According to the conclusions of the research presented below, as part of the atmosphere in a retail facility, lighting can affect the shoppers' perception of certain characteristics of a retailer, as well as its behaviour during the shopping. Moreover, the lighting of product can affect the perception of its characteristics, such as quality perception, price perception, intention to buy, etc.

Areni and Kim (1994) investigate the impact of lighting on merchandising activities in a retail facility specialized in the sale of wine. The research was conducted in a restaurant with a wine cellar that visitors can visit, taste wine and make a purchase in it. Based on the collected data, the authors concluded that stronger lighting affected shoppers in the way that they pay more attention to the goods, especially those that are arranged at eye level. The changes in lighting do not impact the time spent in the retail facility, nor the change in the amount of goods sold.

Deepika and Neeraja (2014) investigated the impact of lighting on shopper behaviour in retail outlets specialized in clothing sales. In order to collect data, the authors conducted field research in 10 retail facilities, after which the authors concluded that lighting conditions in the retail facility do not greatly affect planned and unplanned purchase, or total time spent in the retail facility and the amount of money spent on purchases by the respondents. However, one of the conclusions of this research was that stronger lighting could be a factor that attracts shoppers to spend more time in a retail facility, which may prove to be a prerequisite for the increased amount of money spent on purchases.

Park and Farr (2007) investigated the impact of lighting on the emotional state and behaviour of shoppers in a retail environment. The experiment was conducted in the laboratory and their research had a cross-cultural quality. The test area was specially designed in order to minimize all environmental influences that could potentially infest the isolated observation of lighting and its influence as a stimulus capable of affecting shopper behaviour. By comparing two cultures of classified respondents, the authors came to the following conclusions: for both groups of subjects, light colour temperature of 5000 Kelvin caused a higher state of excitement than the second modality, when colour temperature was 3000 Kelvin. The respondents perceived colour temperature of lighting as warm in the case of the modality with a colour temperature of 3000 Kelvin, while colour temperature model of 5000 Kelvin was qualified as cold. In addition to this, both groups of the respondents claimed that the

3000 Kelvin light colour temperature modality created a greater sense of satisfaction, compared to the other modality. In the end, the authors concluded that shoppers generally prefer warm colour temperatures of lighting.

Quartier, Vanrie and Van Cleempoel (2014) focused their research on the phenomenon of lighting in a retail facility and its impacts on the perception of the atmosphere, emotions, and shopping behaviour. For the purpose of data collection, the authors designed an experiment based on the simulation of a retail facility in laboratory conditions. After the analysis of the obtained results, the authors concluded that there was no significant difference in the degree of the perception of the atmosphere, except for the dimension of liveliness. The difference was noticeable in the lighting setting that was characteristic for a retailer considered as a highly regarded retail brand, compared to the other two settings, which related to a medium-ranked and low-ranked retailer brands. In addition, the authors concluded that there was no statistically significant difference in the perception of quality, price and service, total duration of purchase time, the amount of purchased products and money spent on product purchase.

Barli et al. (2012) investigated the impact of lighting and interior colour on shopper behaviour and time spent in a retail facility. For the purposes of data collection, the authors conducted field research covering four categories of products sold in the retail facility: underwear, clothing, shoes and jewellery. Based on the processed data and obtained results, the authors concluded that the green colour of the interior walls and the time spent in the retail facility affect the purchase. The low-light mode had a positive effect on the time spent in the retail facility. The red colour of the interior walls negatively affected the time spent in the facility. The authors further concluded that poorer lighting affected purchases and the time shoppers spent in a retail facility.

Lin and Yoon (2015) investigated the impact of lighting on shopper behaviour in retail sale. The authors argued that lighting has the potential to attract shoppers, to arouse their interest in evaluation and later, in the purchase of products as well. A special focus of their paper was placed on the contrast and colour temperature of lighting as a characteristic of lighting, and their impact on shopper behaviour in the retail facility. For the purposes of data collection, the authors created and conducted an experiment in laboratory conditions. After analysing the results of empirical research, the authors came to the following conclusions: lighting in high contrast conditions attracts the attention of the respondents more, compared to lighting in high contrast conditions. In addition, the attention of the respondents is at a higher level in conditions when the lighting has a cold temperature of the lighting colour, in contrast to the setting with the warm lighting colour temperature.

Briand and Pras (2010) focused their research on the impact of lighting and temperature perception on the evaluation of the degree of the attractiveness of a retail facility. For the purposes of data collection, the authors devised an experiment aimed at creating the desired conditions of lighting modality and temperature. The results of the research indicated the following conclusions: strong lighting with a "cooler" temperature colour affects the degree of the stimulation factor in the retail facility. Poor lighting with a warm colour temperature affects the positioning degree. The respondents associate this lighting modality with retail facilities that belong to the "upper class". Regarding the relaxation factor, there is no significant statistical difference in the perception of the factor degree. Also, the authors conclude that there is a connection between the modality of lighting and the type of retail facility. Strong lighting with a "cooler" temperature of the lighting colour enhances the degree of stimulation in retail outlets specializing in the sale of books and retail stores specialized in furniture sale.

The focus of the work of the authors Tantanatewin and Inkarojrit (2016) was placed on the effects that lighting and colours have on the impression of shoppers regarding the retail facility, as well as on the brand image of the retailer. For the purposes of data collection, the authors created an experiment in which the respondents evaluated the perception of given attributes by observing images of a retail facility. Based on the collected data and the results obtained, the authors concluded the following: the perception of the retail space is influenced by the colour of the interior walls. The respondents rated coloured areas more positively than the space without colour (white colour). Regarding the lighting colour temperature, the respondents rated the interior of the retail facility illuminated with a warm colour temperature lighting modality with higher grades, compared to the modality with a cold colour temperature. In the case of

illumination of the room with the modality of warm lighting colour temperature, the respondents rated the space as expressive and exclusive, while the space illuminated with cold lighting colour temperature was perceived as "technical", lacking in the field of intimacy.

Biswas, Szocs, Chacko and Wansink (2017) focused their research on the influence of lighting in the field of food products category. To order to achieve the results of the research, the authors conducted five experiments. Based on the obtained results, the authors concluded that the respondents prefer "unhealthy" products in the conditions of poorer lighting. The results of the first experiment suggested that the respondents prefer to consume high-calorie products when the lighting is dimmer. The result of the second experiment showed that the respondents' awareness of healthy eating habits was at a higher level when the lighting was stronger or at a lower level when the lighting was poorer. The conclusion based on the results of the third experiment was that, despite the fact that the respondents had to choose the products aloud; there was no deviation from the results of the second experiment, although something like that was expected to happen. The fourth experiment proved that raising awareness regarding the consumption of "healthy" or "unhealthy" food led to an increased tendency toward "healthy" options, even in poor light conditions, and the same conclusion was reached by analysing the results of the fifth experiment, when the respondents were warned in advance to take care of healthy eating habits.

Horska and Bercik (2014) focused their research on the impact of lighting on the behaviour of food product shoppers. In order to establish the connection between lighting and shopper preferences, the authors conducted a research in which they used neuromarketing tools along with a questionnaire. Based on the results of the research, the authors concluded that lighting has an impact on the conscious and subconscious reactions of the shopper. The results of using an electroencephalograph indicated the fact that, when the lighting changes, the right hemisphere of the brain is more involved, which is associated with an emotional response. The largest number of subconscious reactions was registered when the subjects were exposed to lighting created by fluorescent light bulb. The greatest emotional reaction of the respondents was caused by the lighting source of a metal halide light bulb, while the respondents rated the lighting created by the halogen light bulb as the most attractive one. The least attractive lighting, according to the respondents, was the one of metal halide bulbs and LED bulbs.

Nagyova, Bercik and Horska (2014) focused on the efficiency, intensity and impact of directional lighting on shopper reactions in retail stores specialized in the field of groceries. The strongest emotional response of the respondents came as a consequence of observing the product with illuminated lighting modalities, whose source was a halogen and metal halide bulb with the colour temperature of the 2700 Kelvin and 3000 Kelvin, respectively. The smallest impact on the emotional response of the respondents occurred as a result of observing the product with illuminated lighting modalities whose source was an LED and metal halide bulb, the colour temperature of illumination of 5600 Kelvin and 5000 Kelvin, respectively. This meant that warm colour temperatures caused stronger emotional responses, compared to cold colour temperatures. Based on the data gathered in the questionnaire, the authors concluded that respondents identify as the most attractive lighting modality one that was caused by the radiation of a halogen bulb with a colour temperature of 2700 Kelvin. However, it was concluded that this lighting modality was the most uneconomical, both from the point of the initial investment and electricity consumption and the rate of necessary replacement of the bulb, due to the limited working hours. At the same time, the authors noticed that a higher degree of emotional response was present in female respondents, compared to respondents who were male.

Yang, Cho and Seo (2016) investigated the impact of lighting on the acceptability and shopper's desire for product consumption. The aim of the research was to establish whether there was a connection between the lighting environment and the perceptions of the characteristics of the observed products belonging to the food category (apples and peppers). The results of the research led to the following conclusions: there was a statistically significant difference in the degree of readiness for consumption of the observed products according to the lighting modality of illumination. The readiness to consume apples was the highest in the case of the yellow lighting modality, while it was lowest with blue lighting modality. In the case of the product number two (peppers), the

respondents reported that they were more willing to consume peppers illuminated with white or yellow colour than vegetables illuminated with modalities related to green, blue, or red. By observing the likeability of these two products, the influence of the lighting modality on the differences in the assessment was also noticed. Greater liking of both apples and peppers was noticed when the products were illuminated with yellow and white lighting modalities, compared to the other three lighting modalities.

Otterbring, Lofgren and Lestelius (2014) conducted an exploratory study to determine whether lighting affects the evaluation of packaged food products. The research was conducted in laboratory conditions. Based on the obtained results, the authors concluded that the age of the respondents and the colour of product packaging did not affect the evaluation of the mentioned dependent variables, while the colour temperature of lighting had a statistically significant influence on the evaluation of the observed variables. The respondents rated with statistically significantly higher grades perceptions of quality, attractiveness and taste of the products illuminated by lighting modality with a warm colour temperature, compared to the products illuminated by lighting modality with a cold colour temperature. In addition, they came to the conclusion that there was no statistically significant difference in the assessment of price perception, regardless of the lighting modality of the products observed.

Han and Suk (2019) investigated the influence of lighting and colour on the emotional response of shoppers. The subject of research was a product from the category of household appliances (electric stove). After collecting data and analysing the results, the authors concluded that the respondents preferred a light colour temperature of 3500 Kelvin. Food lit by a light emitting source of the aforementioned lighting temperature looked delicious. Nevertheless, the respondents estimated that the modality of lighting with a colour temperature of 5000 Kelvin contributed to making food look fresh. After conducting the first part of the research, the authors conducted the second part of the research, where they used the method of experiment. Based on the results of the research, the authors concluded that the respondents preferred ovens in which the light source emitted lighting with a cold lighting temperature (5000 Kelvin) compared to the modality with a warm light colour temperature (3000 Kelvin). This finding was the opposite of their expectation because, according to a review of the literature, people generally prefer warm to a "cold lighting colour temperatures."

Zielke and Schielke (2016) focused their work on the impact of lighting on shopper perceptions within the retail facility, as well as on their shopping behaviour. The aim of the author's endeavours was to establish how lighting affects shopper perception regarding the atmosphere, quality and price perceptions, and purchase intentions in the observed retail facility. To collect data, the authors designed and conducted two experiments. The results of the research, based on which the first experiment was conducted, indicated the following conclusions: a higher degree of intensity and emphasis of lighting affected a higher degree of satisfaction of the respondents, but not the perception of price. In the case of quality perception, the results of the research indicated the conclusion that the intensity of lighting did not affect the perception of quality, as well as the greater intention to buy products in the observed retail facility. The results of the second experiment suggested the following conclusions: by analysing the results of the influence of the lighting colour on the already states dependent variables, it was concluded that the warm temperature of the lighting colour affected a higher degree of satisfaction of the respondents. There was no statistically significant difference in the mean values of price perception, observed by the modalities of the colour temperature of lighting. In the case of the dependent variables related to the perception of quality and intention to buy, the conclusion was that the respondents gave a higher assessment of quality and expressed a higher degree of intention to buy in the case of lighting modality with a warm colour temperature, compared to lighting modality with a "cooler" colour temperature of lighting.

Yilmaz (2018) investigated the impact of lighting on shoppers' perceptions in a retail facility. The aim of the author's work was to establish the influence of lighting on the perception of the interior of a retail facility, as well as the perception of quality and price of products. To collect data, the author devised an experiment. Based on the data processing, the author concluded the following: when observing the influence of the lighting modalities on the perception of the entire interior of the retail

facility, the respondents gave the highest positive grades in the situation when the lighting modality was presented in such a way that only directed lighting is used. In the case of the perception of products, it was also found that lighting design affects this variable. The expectation of the highest price was expressed in the situation when the respondents observed the modality with exclusively directed lighting, while the price was perceived as low in the case of observing the display of a retail facility whose interior is illuminated by the usual lighting modality. Regarding the perception of quality of products located in a retail facility, the authors concluded that the perception of quality grows along with the change of lighting design, from the first modality with the usual design to the third modality with the design of exclusively directed lighting.

Based on a review of relevant literature, this paper seeks to answer the research question regarding whether the colour temperature of lighting, as one of the characteristics of lighting, affects the behaviour of shoppers in terms of their perception of quality and price perception of the observed product.

In order to answer this question, the following hypotheses were defined, and tested on the Serbian market:

- Colour temperature of lighting affects the shopper's perception of product quality;
- Colour temperature of lighting affects the shopper's perception of product's price

2. Methodology

The review of relevant literature that covered various issues in the field of examination of the impact of lighting on shopper behaviour in retail was used to create a specific research design; this framework is presented in Table 1.

Table 1 Research design

Research approach	Quantitative research
Method of data collection	Online experiment
Sample	Serbian market
Sample size	200 respondents
Subject of observation (product)	The products that are the subject of observation in the photo treatments are apples, photographed in a fruit display case typical for retail facilities in the surrounding area.
Dependent variables	Perception of product quality; and Product price perception
Independent variable	Colour temperature of lighting - 6 treatments.
Statistical methods used for data processing	Descriptive statistical methods: Arithmetic mean and standard deviation. Methods of statistical inference: One-factor analysis of the variance of repeated measurements.

Source: the authors' calculation

Specifically, in the case of research conducted for data collection purposes in this paper, an online panel was used. Online panels are one of the online sampling techniques, characterized by fast and flexible access to the sample plan. The main feature of the online sample panel is the high response rate of the respondents.

In order to achieve the greatest possible representativeness of the samples for the observed market of Serbia, used in the process of conducting an empirical research, the services of a professional market research agency were used.

Data collection in the target markets was performed using the CAWI (Computer Assisted Web Interviewing) technique, by conducting an online survey. The target group of respondents consisted of people who make decisions and buy groceries for the needs of the household – alone or with another member of the household. The created sample was nationally representative in terms of gender, age categories and regions of the targeted markets, all according to the latest censuses or population estimates.

At the very beginning of recruiting, the respondents answered two eliminatory questions, and only those who answered negatively to both questions, took part in the research. These two eliminatory questions relate to this:

- Are the respondents professionals in the field of lighting or in the field of indoor interior design? and
- Do the respondents have physical difficulties in distinguishing colours?

With the aforementioned questions, the influences of the respondents' answers that may impair the relevance and objectivity of the research were neutralized.

The respondents who participated in the survey answered questions from a two-part questionnaire.

In the first part, the respondents were asked to answer questions regarding demographic characteristics.

In the second part, the respondents had the task to evaluate photograph treatments of the product, which differ only in the temperature of the light colour used while taking photographs.

Table 2 Experiment design

Respondents (experimental units)	Treatment (level of independent variable) - lighting treatments by light colour temperature expressed in Kelvin (K)					
	Treatment 1 (2200K)	Treatment 2 (2700K)	Treatment 3 (3000K)	Treatment 4 (4230K)	Treatment 5 (5400K)	Treatment 6 (6500K)
Respondent 1	Effect of treatment 1 on subject 1	Effect of treatment 2 on subject 1	Effect of treatment 3 on subject 1	Effect of treatment 4 on subject 1	Effect of treatment 5 on subject 1	Effect of treatment 6 on subject 1
Respondent 2	Effect of treatment 1 on subject 2	Effect of treatment 2 on subject 2	Effect of treatment 3 on subject 2	Effect of treatment 4 on subject 2	Effect of treatment 5 on subject 2	Effect of treatment 6 on subject 2
Respondent 3	Effect of treatment 1 on subject 3	Effect of treatment 2 on subject 3	Effect of treatment 3 on subject 3	Effect of treatment 4 on subject 3	Effect of treatment 5 on subject 3	Effect of treatment 6 on subject 3
Respondent n	Effect of treatment 1 on subject n	Effect of treatment 2 on subject n	Effect of treatment 3 on subject n	Effect of treatment 4 on subject n	Effect of treatment 5 on subject n	Effect of treatment 6 on subject n

Source: the authors' calculation

The research was designed in the form of an experiment (Table 2), where each respondent (experimental unit) was required to evaluate all three dependent variables, i.e. effects (quality of perception and price perception sequentially in relation to six treatments of photographs created through the impact of independent variable "colour temperature of lighting".

3. Results

For the purposes of testing research hypotheses on the Serbian market, a sample, whose characteristics are shown in Table 3, was created.

Table 3 Sample characteristics

Demographic characteristics of respondents	Sum	Percentage
Gender		
• male	100	50,0%
• female	100	50,0%
The market region in which the respondent lives		
• Belgrade	51	25,5%
• Vojvodina	56	28,0%
• Šumadija and Western Serbia	52	26,0%
• Southern and Eastern Serbia	41	20,5%
The type of settlement in which the respondent lives		
• city	129	64,5%
• village	71	35,5%

Source: the authors' calculation

By analysing the data from Table 3 it can be concluded that, according to the gender of the respondents, we have an equal distribution of male (n = 100) and female (n = 100) respondents. As for the region of the Serbian market in which the respondents live, the largest number of respondents live in Vojvodina (n = 56), followed by Šumadija and Western Serbia (n = 52), Belgrade (n = 51) and, finally, Southern and Eastern Serbia (n = 41). According to the type of settlement in which the respondent lives, a larger number of respondents live cities (n = 129), compared to villages (n = 71).

Descriptive statistical methods are used to process and display data, along with the use of tables, graphs and summary measures. Based on the use of descriptive statistical methods, with the aim of analysing data collected from 200 respondents, the values of the arithmetic mean and standard deviation were obtained (Table 4).

Table 4 Descriptive statistics

	Treatment of 2200 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	4,41	1,491
Price perception	200	4,21	1,175
	Treatment of 2700 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	4,57	1,561
Price perception	200	4,36	1,111
	Treatment of 3000 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	4,81	1,380
Price perception	200	4,38	1,068
	Treatment of 4230 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	5,00	1,569
Price perception	200	4,49	1,199
	Treatment of 5400 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	4,81	1,575
Price perception	200	4,37	1,216
	Treatment of 6500 Kelvin		
	Number of respondents	**Arithmetic mean**	**Standard deviation**
Perception of quality	200	4,48	1,748
Price perception	200	4,39	1,420

Source: the authors' calculation

Based on the data from Table 12, we can conclude the following: in relation to the dependent variable "quality perception", the highest value of the arithmetic mean (5.00) is characteristic for the treatment of light colour temperature of 4230 Kelvin, while the lowest value of the arithmetic mean (4.41) of the same variable is characteristic for the treatment of 2200 Kelvin. In the case of the dependent variable

"price perception", the highest value of the arithmetic mean (4.49) is characteristic for the treatment of 4230 Kelvin, and the lowest value of the arithmetic mean (4.21) of the same variable is characteristic for the treatment of 2200 Kelvin. Based on the presented data, we can conclude that the highest values of means for both dependent variables are characteristic for the treatment of light colour temperature of 4230 Kelvin, while the lowest values of arithmetic means of the same dependent variables are characteristic for the treatment of 2200 Kelvin.

3.1 First hypothesis: The colour temperature of the lighting affects the shoppers' perception of product quality.

In order to test the first hypothesis, the statistical technique of one-factor repeated measures analysis of variance was used. Prior to the analysis, the successful application of this statistical technique required testing of the assumptions.

The data type satisfied the condition for the application of one-factor repeated measures analysis of variance because the independent variable was categorical and expressed on a nominal scale, while the dependent variable was quantitative and was expressed on an interval scale (7-point Likert scale).

The respondents were examined independently of each other, so it can be concluded that the assumption of the independence of the observation was fulfilled.

The Shapiro-Wilk test was used for the confirmation of the assumption of normality, and the results can be seen in Table 5.

Table 5 Verification of the assumption of normality

	Value	df	p-value
Perception of quality 2200K	0,910	200	0,000
Perception of quality 2700K	0,922	200	0,000
Perception of quality 3000K	0,909	200	0,000
Perception of quality 4230K	0,902	200	0,000
Perception of quality 5400K	0,914	200	0,000
Perception of quality 6500K	0,917	200	0,000

Source: the authors' calculation

Based on the results from Table 5, we can see that the p-values of the Shapiro-Wilk test for all effects are lower than the significance level $\alpha = 0.05$, so it can be concluded that, with an error risk of 5%, we reject the null hypothesis of normal distribution of observed effects.

Nevertheless, the statistical technique of one-factor repeated measures analysis of variance is robust for large samples ($n = 200 > 30$), so the verification of the sphericity assumption was continued.

Table 6 Verification of the assumption of sphericity

	Mauchly W	χ^2 value	df	P-value	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower bound
Quality perception	0,496	138,283	14	0,000	0,755	0,771	0,200

Source: the authors' calculation

According to the results of the Mauchly test (Table 6), we conclude that, with 5%, risk of error, we reject the null hypothesis of data sphericity ($\chi 2 = 138.28$; $p = 0.000$).

Based on the rejection of the null hypothesis of sphericity, two options become available, and they relate to the application of the Greenhouse-Geisser or Huynh-Feldt correction.

Guided by the "rule of thumb", when choosing one of the two types of these corrections, regarding the fact that the value was $\varepsilon = 0.755 > 0.75$, the Huynh-Feldt correction was chosen to check the statistical significance of the F-value. After applying the Huynh-Feldt correction (Table 7), it can be seen that the influence of colour temperature on quality perception was statistically significant at the level of $\alpha = 0.05$ ($F(3.86; 767.44) = 7.280$; $p = 0.000$). Considering the limit ε value in terms of the choice of correction, the statistical significance of the F-value, after the application of Greenhouse-Geisser correction, was tested and it was concluded that, in this case, the F-value at the level of $\alpha = 0.05$ was statistically significant ($F(3.77; 751.11) = 7.280$; $p = 0.000$).

Table 7 Test results of the first hypothesis

Source of variability		Sum of squares	df	Square mean	F - value	p - value
Treatments	**Greenhouse - Geisser correction**	52,207	3,774	13,832	7,280	0,000
	Huynh – Feldt correction	52,207	3,856	13,537	7,280	0,000
Error	**Greenhouse - Geisser correction**	1427,127	751,110	1,900		
	Huynh – Feldt correction	1427,127	767,440	1,860		

Source: the authors' calculation

After proving that the differences in arithmetic means of the treatment existed, a post hoc test with the Bonferroni correction was performed. Based on the results of the post hoc test, with 5%, risk of error, it can be concluded that there is a statistically significant difference between the average values of the dependent variable "quality

perception", between treatments with light colour temperature of 2200 Kelvin and 3000 Kelvin (p = 0.002), 2200 Kelvin and 4230 Kelvin (p = 0.000), 2200 Kelvin and 5400 Kelvin (p = 0.039), 2700 Kelvin and 4230 Kelvin (p = 0.006), 4230 Kelvin and 6500 Kelvin (p = 0.000) and 5400 Kelvin and 6500 Kelvin (p = 0.042).

The post hoc analysis of pairs of arithmetic means, for whose differences was determined that there was a statistically significant difference, along with the application of the Bonferroni correction, at the level of significance $\alpha = 0.05$, leads to the conclusion that shoppers of Serbia perceive the product as a higher quality product, when the observed product is illuminated:

- with the light colour temperature treatment of 3000 Kelvin (4.81), in comparison to the treatment of 2200 Kelvin (4.41);
- with the light colour temperature treatment of 4230 Kelvin (5.00), in comparison to the treatment of 2200 Kelvin (4.41);
- with the light colour temperature treatment of 5400 Kelvin (4.80), in comparison to the treatment of 2200 Kelvin (4.41);
- with the light colour temperature treatment of 4230 Kelvin (5.00), in comparison to the treatment of 2700 Kelvin (4.57);
- with the light colour temperature treatment of 4230 Kelvin (5.00), in comparison to the treatment of 6500 Kelvin (4.48);
- with the light colour temperature treatment of 4230 Kelvin (5.00), in comparison to the treatment of 6500 Kelvin (4.48); and
- with the light colour temperature treatment of 5400 Kelvin (4.81), in comparison to the treatment of 6500 Kelvin (4.48).

Based on the comparison of pairs of arithmetic means, it can be concluded that shoppers in Serbia perceive the observed product as better when illuminated with the light colour temperature treatments of 3000 Kelvin, 4230 Kelvin and 5400 Kelvin, compared to the light colour temperature treatment of 2200 Kelvin, as well as in the case of 4230 Kelvin treatment, in relation to the treatment of 2700 Kelvin, and the treatments of 4230 Kelvin and 5400 Kelvin in relation to the treatment of 6500 Kelvin. Considering the dichotomy between the preference for a warm or a cold light colour temperature, in all three cases (4230 Kelvin versus 2200 Kelvin, 5400 Kelvin versus 2200 Kelvin, and 4230 Kelvin versus 2700 Kelvin), in terms of quality perception, we can conclude that shoppers on the Serbian market perceive the product as higher quality goods when the product is illuminated by treatments that lean towards a "cooler" temperature of the lighting.

Accordingly, we conclude that the first hypothesis is accepted.

3.2 Second hypothesis: The colour temperature of the lighting affects the shopper's perception of the product price

To test the second hypothesis, as in the case of the first hypothesis, the statistical technique of one-factor repeated measures analysis of variance was used. As in the previous case, an examination of the assumptions, necessary for the application of the aforementioned statistical technique, was conducted.

Assumptions regarding data type and independence of observations were fully met.

To test the assumption of normality, as in the case of the first hypothesis, the Shapiro-Wilk test was applied. It is concluded that, with an risk error of 5%, we reject the null hypothesis regarding the normality of the distribution of the observed effects, because all effects the p-values were lower than the significance level $\alpha = 0.05$.

However, as already specified, the statistical technique of one-factor repeated measures analysis of variance proved to be robust for large samples ($n = 200 > 30$), and on this basis, as in testing the first hypothesis, the verification of the sphericity assumption was continued.

The Mauchly test was conducted to examine the assumption of data sphericity.

According to the results of the test in question, and with 5%, risk of error, the rejection of the null hypothesis of sphericity can be concluded ($\chi^2 = 102.68$; $p = 0.000$).

Based on the rejection of the sphericity hypothesis, since the value of $\varepsilon = 0.815 > 0.75$, the Huynh-Feldt correction was chosen to check the statistical significance of the F-value. After applying the Huynh-Feldt correction at the level of $\alpha = 0.05$, the conclusion is that the influence of colour temperature on price perception is not statistically significant ($F(4.17; 829.74) = 1.871$; $p = 0.111$).

According to the above, it can be concluded that the second hypothesis is not accepted.

4. Discussion

The discussion below represents a result of hypothesis testing and comparison of the research outcomes with the other authors' dealing with the topic in question.

4.1 First hypothesis: The colour temperature of lighting affects the shopper's perception of product quality.

Shoppers in Serbia give higher ratings of product quality when the observed product is illuminated by the treatments of a cold colour temperature, while lower ratings of product quality are given when the observed product is illuminated by the treatments of warm colour temperature.

The results obtained for the Serbian market are in accordance with the research conducted by Creusen, Pont and Schoormans (2017), which concludes that respondents favour a cold colour lighting temperature (4000 Kelvin) more than warm temperature of the light colour (2700 Kelvin). Oberfeld, Hecht, Allendorf, and Wickelmaier (2009) came to the similar conclusion, stating that cold colour lighting temperature inclining toward blue light affects the fact that respondents perceive the quality of the observed product as higher than the lighting with the characteristic warm colour temperature of lighting. Han and Suk (2019) state that the conclusion that a cold lighting colour temperature gives better results in terms of perception of dependent variables seems atypical, i.e. contrary to the expectation that warm colour temperature should be associated with higher ratings given by the respondents.

4.2 Second hypothesis: The colour temperature of the lighting affects the shopper perception of the product price

The analysis of the results of this research produced the conclusion that the second hypothesis, regarding the influence of lighting colour temperature on the shopper perception of the product price, was not confirmed in the case of the market observed.

This conclusion remains in line with the conclusions of certain studies. Thus, the research conducted by Zielke and Schielke (2016) did not confirm that lighting colour temperature affects the perception of product price; Otterbring, Lofgren and Lestelius (2014) came to the same conclusion.

Conclusion

Based on a review of the literature, it can be concluded that lighting has a significant impact on shoppers' behaviour and emotional responses. In addition to the general observation of lighting, the focus of the researchers was placed on the colour temperature of lighting as well, as one of very important characteristics of lighting.

Briand and Pras (2013) state that shoppers express a higher degree of satisfaction when they are in a retail facility that is illuminated by warm colour temperature of lighting, compared to a cold colour temperature treatment. The term warm light colour temperature is usually associated with a light colour temperature of less than 3000 Kelvins, while a cold light colour temperatures are associated with temperatures above 3000 Kelvin (Babin, Hardesty & Suter, 2003). Yilmaz (2018) states that retailers can increase the degree of shopper satisfaction by using lighting systems that represent a combination of general and direct (directional) lighting systems, i.e. combining different colour temperature levels of lighting within these systems. According to the works of Tantanatewin and Inkarojrit (2016) and Schielke and Leudesdorff (2015), it can be concluded that shoppers express a higher degree of satisfaction in terms of combining different lighting systems with different levels of colour temperature, in terms of warm and a cold lighting temperature.

In addition to the shoppers' emotional response, some research suggests that colour temperature also affects shopper's behaviour. Custers et al. (2010) state that colour temperature can influence changes in shopper's movement patterns within a retail facility. According to Briand Decre and Pras (2013), colour temperature of lighting can affect the time spent in a retail facility. Colour temperature of lighting is negatively correlated with the shopper's time spent in the retail facility, which means that, in the conditions with the characteristic cold colour temperature, shoppers will spend less time in the retail facility. This conclusion may affect the fact that, due to the less time spent in the retail facility, shoppers can potentially buy a smaller number of products, thus negatively affecting the business results of a retailer.

The results of the research for the Serbian market point to the conclusion that the first hypothesis is accepted, i.e. that colour temperature of lighting affects the shopper's perception of product quality. Looking at the lighting temperature treatments in relation to whether they refer to cold or warm colour temperature, the conclusion is that shoppers of Serbia prefer cold colour temperatures.

The analysis of the results in this research led to the conclusion that the second hypothesis

regarding the influence of colour temperature of lighting on the shopper's perception of the product price is not confirmed for the Serbian market.

When drawing conclusions and making recommendations for future research, certain research limitations should be taken into account. These research limitations are listed below, along with the recommendations for further research.

The influence of lighting on the behaviour of retail shoppers was investigated only on the basis of one characteristic of lighting, i.e. lighting colour temperature. Thus, based on this limitation, it would be useful to use the same methodology in order to investigate the impact of other lighting characteristics, such as brightness level and colour rendering index, on the behaviour of retail shoppers on these markets.

Through the online research, based on the displayed photos of the product, the respondents evaluated the perception of quality and price perception of the observed product. This type of research could be very useful when comes to importance of retail digitalization (Grubor, Đokić & Milićević, 2017; Končar & Leković, 2016; Nuševa and Marić, 2017; Končar, Grubor & Marić, 2019). Also, the influence of pandemic caused by the spread of a new coronavirus affects both changes in shopper behaviour and changes in retailer behaviour. A large percentage of shoppers will switch to online shopping because of fear of the consequences that may arise from shopping in retail outlets (Petković, Dokić, Stojković & Bogetić, 2020). According to the research cited in the research methodology, many authors support the use of photographs to assess shopper preferences for certain products, but, of course, all authors agree that this way of research is very similar to the research in real conditions (Engelke, Stokkermans & Murdoch, 2013). Therefore, as a recommendation for future research, a research design where, in laboratory conditions, respondents observe a real product illuminated by different lighting treatments, would be very useful.

The subject of observation was only one product (apple). Apple, as a product belonging to the category of fruits and vegetables, was chosen because of the intention to avoid the potential connection of the respondents to the brand, and thus giving biased answers to questions regarding the perception of quality and price. Nevertheless, according to the review of the relevant literature, it can be concluded that the authors use a wide range of products from different product categories as the subject of observation (Quartier, 2011). Therefore, due to the greater possibility of generalizing the results, the recommendation for any future research would be to continue with the similar methodology, using more products from different categories as the subjects of evaluation.

Six treatments were used in order to create the lighting colour temperature treatment. The justification for selecting the six lighting colour temperature treatments cited in this study can be found in the literature describing the most common light sources in retail outlets specializing in the sale of consumer goods. The literature usually cites two lighting colour temperature treatments (warm and cold). The use of multiple treatments is justified because of the fact that the average subject can see a difference in light colour temperature of 28 Kelvin at a light colour temperature of 3000 Kelvin, 75 Kelvin at a light colour temperature of 4000 Kelvin, 122 Kelvin at a light colour temperature of 5000 Kelvin, and 192 Kelvin at a light colour temperature of 6500 Kelvin (Bieske & Vandahl, 2008). The recommendation for future research is to use fewer lighting treatments, and to compare such research with research that includes more treatments, all in the scope of the impact of lighting on retail shopper's behaviour.

Only one light source (LED bulb), which had the ability to regulate the light colour temperature, was used to create light colour temperature treatments. The justification for this approach was the effort of researchers to keep other lighting characteristics, such as brightness and colour rendering index, constant (Feng, Xu, Han, & Zhang, 2017). The treatments were defined on the basis of the colour temperature of the lighting, which was emitted by artificial (electric) light sources mostly used in retail facilities. Minor corrections in achieving the desired lighting colour temperature were made with the help of computer software. Based on the abovementioned, the recommendation for future research would be to use several different light sources when photographing the product. This recommendation correlates with the first recommendation concerning the inclusion of multiple lighting characteristics in the research.

Finally, as one of the limitations of the research comes the possibility that the screen characteristics of the device, through which the respondent accesses the questionnaire, produce a different product image and lighting colour

temperature, due to different screen resolution. Although some authors claim that there is no difference in colour representation on different screens (Quartier, 2011), this limitation is relativized by sample size, which was created with the help of a reputable market research agency, hired for the purpose of greater representativeness. In addition, in order to relativize this limitation, the study involved respondents who accessed the questionnaire exclusively through a desktop computer, thus excluding the possibility of using other devices, such as a mobile phone. Recommendation for future research would be the identification of the device by which the respondent accessed the questionnaire, and the subsequent comparison of the obtained results, according to the device by which the respondent accessed the questionnaire.

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The key changes to the hospitality business model under COVID-19

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Abstract
The rapid spread of new digital technologies has brought fundamental changes in the hospitality industry. The digital transformation of the hospitality industry was accelerated during COVID-19 pandemic. The impacts of the crisis have led to rethinking hospitality business models. In order to survive during the crisis, hospitality businesses has tried to find innovative solutions and transform their businesses. Therefore, this paper aims to investigate the key changes to hospitality industry business models induced by the COVID-19 crisis. A systematic literature review is provided to analyse three main business model components: value proposition, value chain, and revenue. The paper has the following findings. First, four major changes to the value proposition in the hospitality business model are identified: use of hotels as rooms/offices during lockdowns, offer of new innovative products and services, offer of digital services, and use of hotels for quarantining. Second, value chain changes include new safety measures, and changes to capacities and numbers of workers (amount of work). Third, the changes to the revenue model include fewer foreign tourist offers and more domestic offers, last-minute cancellations or postponements, and better quality and more individualized services. Policies like innovation and digital technologies, customized and flexible services, qualitative services and virtual experiences should be priorities for the future of hospitality business models. The paper has some limitations and future research should be focused on a specific hospitality business model, specific group of countries or country and showing what will happen in post-COVID-19 period.

Keywords
business models; hospitality; COVID-19; value creation; value chain

Introduction

The business model enables the creation, delivery, and capture of value (Magretta, 2002; Zott, Amit & Massa, 2011; Slávik & Bednár, 2014; Saebi, Lien & Foss, 2017). Firm business models offer two types of value: customer value and firm value.

The tourism literature refers to business models in terms of "how the business works" or "how the firms do business" and ignores their development and transformation (Alegre & Berbegal-Mirabent, 2016). Work on tourism business models seems to be split between a strand of work that considers the activities involved from a systems perspective, and a strand which adopts a business model perspective. Although innovation is important for enabling firm growth in the hospitality sector (Thomas & Wood, 2014), research on this topic is scarce.

The COVID-19 pandemic was accompanied by major effects on the hospitality industry, which put many jobs at risk and resulted in a considerable drop in tourism incomes. The main impacts of pandemic on the tourism industry have been addressed by several studies (Wen, Kozak, Yang & Liu, 2020; Gössling, Scott, & Hall, 2020; Ben Youssef, Zeqiri & Belaid, 2020a, 2020b; Ying,

Wang, Liu, Wen & Goh, 2020; Fong, Law, & Ye, 2021; Jamal & Budke, 2020; Lau, Khosrawipour, Kocbach, Mikolajczyk, Ichii, Zacharski, Bania & Khosrawipour, 2020; Zenker & Kock, 2020). These works focus mainly on the current impacts of the pandemic on tourism, the post-COVID-19 tourism and the extent of the effects of the crisis compared to other epidemics.

The containment measures put in place have had and continue to have a severe impact on all sectors of the world economy (Ben Youssef, 2021). Aviation continues to be affected by travel bans, the sports sector has suffered from cancelation of sporting events, and the events and entertainment industries have been affected by the ban on mass gatherings. Some economic sectors were affected from the start of the crisis and have experienced dramatic losses which might be temporary but could be long run depending on the persistence of the impact of the virus. Tourism is near the top of the list of the worst affected sectors.

The COVID-19 pandemic has had major effects on hospitality industry business models. The airline industry, which was affected immediately by the outbreak of infections, has had to adjust its workforce and ask employees to take paid or unpaid leave. According to International Civil Aviation Organization (ICAO) estimates, passenger seat capacity dropped 50% in 2020.

Developing countries rely heavily on tourism and the huge disruption caused by the pandemic is likely to increase other problems related to capital flows, weak health systems, and limited fiscal space to allow support. Some of these developing country economies were already suffering from slow economic growth and this latest crisis is likely to have major consequences in the very near future. Both the advanced and the emerging and developing economies are experiencing the biggest recession since the Great Depression and in most developing countries the contribution of the hospitality sector to economic growth will be very weak or even negative.

During summer 2020, many countries, like Tunisia, Egypt, Italy, Morocco, Spain, Germany, France, etc., opened their borders to tourists[1]. However, this led to a second wave of infection with travel, the main mechanism of the further spread of COVID-19 worldwide. The tourism sector was also affected by the new restrictions on mobility and travel imposed to stem this second wave of infection and consumers felt even less confident about traveling. The second wave which was accompanied by new restrictions and lockdowns paralyzed the tourism sector, and although vaccination programs are now in place, it will take time for this sector to recover.

The impact of the crisis in some industries (like e-commerce, advertising, information and communication sector, and petroleum industry) has had only minor consequences; however, the hospitality industry has lost months and months of business (Baum & Hai, 2020) which has forced them to try to devise innovative solutions. The literature on the impact of COVID-19 on hospitality business models is quite limited (Kraus, Clauss, Breier, Gast, Zardini, & Tiberius, 2020; Breier, Kallmuenzer, Clauss, Gast, Kraus, & Tiberius, 2021) and most studies focus on model innovations in hospitality firms introduced during the crisis. Most analyses find that these result in new revenue streams and higher levels of liquidity.

This paper contributes to work on the transformation of hospitality industry business models in two ways. First, it discusses hospitality industry business models, their typologies, and their transformations based on Industry 4.0 technologies.[2] Second, it discusses the main impacts so far of the COVID-19 crisis on the hospitality industry and its business models. The paper identifies ten major hospitality industry business model changes induced directly by the crisis which affect the value proposition, the value chain, and revenue. These changes include use of hotel spaces as office spaces during lockdowns, offers of new innovative products and services, offers of digital services, use of hotels for quarantining, changes to safety measures, capacity, work, and workers, reduced offers to foreigners' tourists and increased offers to domestic customers, flexibility related to last-minute cancellations or postponements, and higher quality and more individualized services.

The paper is organized as follows. Section 1 proposes some business model definitions and reviews the literature on hospitality sector business

[1] Reopening tourism activities was done under security labels developed by UNWTO and other organizations like: guidelines, recommendations and "Safe Travel Stamp" certification.

[2] Industry 4.0 is defined "as a new industrial maturity stage of product firms, based on the connectivity provided by the industrial Internet of things,where the companies' products and processes are interconnected and integrated to achieve higher value for both customers and the companies' internal processes." (Frank, Mendes, Ayala, & Ghezzi,2019, p.343). It includes a set of technological developments such as Cyber Physical systems (CPS), the Internet of Things (IoT), Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), robotics, big data, blockchain, and 3D printing.

models. Section 2 provides explanations on business models transformation; section 3 discusses the tourism business models; and section 4 discusses ten major business model changes under COVID-19 pandemic.

1. Business model definitions

Despite the large literature on business models, it does not offer a single agreed-upon definition (Foss & Saebi, 2017). While the concept of business model was first proposed by Drucker (1994), debate is ongoing over the definition and ontology of this idea. Work focuses variously on business model components such as the value proposition, market segmentation, value chain structure, and value capture mechanisms, and their inter-relationships (Saebi et al., 2017).

Most current business model definitions are similar to or consistent with Teece's (2010, p. 191) description of a business model as "the design or architecture of the value creation, delivery and capture mechanisms employed". The term business model encompasses a range of different firm activities, and how and when they are performed in order to provide the best benefits and the highest firm revenue (Afuah, 2003). The business model is designed to allow the firm to earn revenue in the business environment by exploiting its structural and operational attributes.

Zott and Amit (2009) suggest the need to take account of two main elements in any discussion of business models. The first refers to the elements representing how the activity system is designed. The second refers to design themes to explain the sources of value creation in the activity system.

According to Slávik and Bednár (2014), the business consists of the resources and activities which result in the creation of value for the client and higher revenue for the firm.

2. Business model transformation

The rapid digitalization of firms has led to the need to rethink current business model structures. Business model innovation in the context of the fourth industrial revolution (Industry 4.0) is vital for technological innovation. However, existing research focuses more on the business model rather than innovation and transformation in a business model context.

Industry 4.0 technologies are considered general purpose technologies (Ben Youssef, 2020) which allow complementary developments (Bresnahan & Trajtenberg, 1995). While the three first industrial revolutions were characterized by mechanization, electricity, and information technology, Industry 4.0 is powered by cyber physical systems (CPS) and interconnections between the virtual and physical worlds.

Industry 4.0 enables the development of a new kind of customer value (Ehret & Wirtz, 2017) based on the provision of new services and is transforming how these new services are offered and is providing new organizational opportunities, more cooperative environments, improved consumer relationships, and improved services. All of these improvements are requiring either changes to existing business models or the design of entirely new business models, or business model innovations.

According to Foss and Saebi (2017, p. 207), business model innovations are "designed, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements". The authors propose a business model typology which distinguishes between the perspectives of scope and novelty. They also identify four types of business model innovation: evolutionary, adaptive, focused, and complex business model innovation. Evolutionary and adaptive business model innovations tend to be innovations that are new only to the firm (Saebi et al., 2017). Focused and complex business model innovations are more radical and are new to both the firm and the industry.

3. Tourism business models

The impact of new digital technologies has transformed business models in the tourism industry (Reinhold, Zach, & Laesser, 2020; Ammirato, Felicetti, Linzalone & Carlucci 2021; Härting et al., 2021). Digitalization of the tourism industry has created new opportunities for innovative tourism business models, like value proposition, building better networks, managing the customer relationship (Perelygina, Kucukusta & Law, 2022).

In the literature, there is not a broadly accepted typology for digital tourism business models. Kabir, Jahan, Adnan and Khan (2012) distinguished between five types of tourism business models which exploit digital technologies: business to consumer models, business to business models, consumer to consumer models, government to business models, and business to business to consumer models. Reinhold et al. (2020) provides a 4C typology, which classifies digital tourism business models based on content, commerce, context, or

connection.

The business to customer model is considered the most common tourism 4.0 business model, and involves direct communication between tourist service providers and would-be tourists. The business to business model involves tourism service providers selling their products or services to other tourism businesses to promote tourism through collaboration and the provision of tourism packages.

The customer-to-customer model facilitates communication among tourists and the establishment of tourist communities via virtual tourism platforms. Exchanges with members of the tourist community provide advice related to hotel reservations, purchase of airline tickets, tourism sites, etc. which can help tourists plan their trips.

The government to business model involves interaction and cooperation between government and tourism businesses, and the rules and permissions imposed on them in relation to their use of digital technologies to promote tourism.

Finally, the business to business to customer model involves companies providing products or services to other companies which, in turn, sell these products and services to consumers online. It involves transactions facilitated by an intermediary firm to allow another firm to sell its services or products to consumers.

The sharing economy has introduced some important tourism business model innovations. For instance, Airbnb is expected to have a major impact on hotel revenues (Consigli, Iaquinta & Moriggia, 2012). However, there is a certain consensus that Airbnb "is bad for hotels but good for tourism" (Oskam & Boswijk, 2016).

The tourism business model needs to be customer oriented. According to Runfola, Rosati and Guercini (2013), in the context of online hotel distribution there are three important business model dimensions: target segment, value proposition, and revenue model. Coles, Warren, Borden and Dinan (2017) suggest that tourism business models should include cost control, and value capture, and value proposition, and should target customers, key resources, and processes in order to create value for small and medium sized tourism enterprises.

4. Major changes to tourism business models due to the COVID-19 crisis

In the recovery from a crisis, it is important to retain loyal and local consumers (Alonso-Almeida & Bremser, 2013). However, consumers want to benefit from new, innovative, and unique experiences (Pikkemaat, Peters, & Chan, 2018; Zeqiri, Dahmani & Ben Youssef, 2021; Ben Youssef, Dahmani & Zeqiri, 2021) which means that hospitality companies need to engage in continuous innovation efforts (Thomas & Wood, 2014) to try to meet their customers' expectations (Kallmuenzer, 2018).

Hospitality businesses which have survived the COVID-19 crisis are being forced to innovate. The triangle business model identifies ten major changes (see figure 1). The main elements of the business model are value proposition, value creation, and value capture (Clauss, 2016; Clauss, Abebe, Tangpong & Hock, 2021). For each element or component there are discussed the main changes to the hospitality business model which have been triggered by the COVID-19 pandemics.

The value proposition refers to the set of firm solutions which are offered to its customers (Johnson, Christensen & Kagermann, 2008). During the COVID-19 pandemic the value proposition experienced four main changes. First, hotels became office spaces during lockdown. Second, several new and innovative products and services were offered by the hospitality sector. Third, digitalization of hospitality services was accelerated. Fourth, hotels were utilized as quarantine facilities to isolate people potentially infected with the COVID-19 virus.

Value creation refers to the whole of the firm's value chain, which is characterized by its capabilities (Achtenhagen, Melin, & Naldi, 2013). During the period of the pandemic, value creation changed in at least three ways. First, new protocols and certifications were introduced to ensure safe operations in the hospitality industry. Second, hospitality businesses reduced their capacity and increased the quality of their services. Third, employment in the hospitality industry changed drastically due to devastating effects of the COVID-19 crisis.

Value capture allows the firm's value proposition to be translated into revenue (Clauss, 2016). Hospitality business models experienced three main changes during COVID-19. First, greater promotion of domestic rather than international tourism. Second, implementation of flexible cancellation and changes to tourism arrangements. Third, offer better quality and more individualized services.

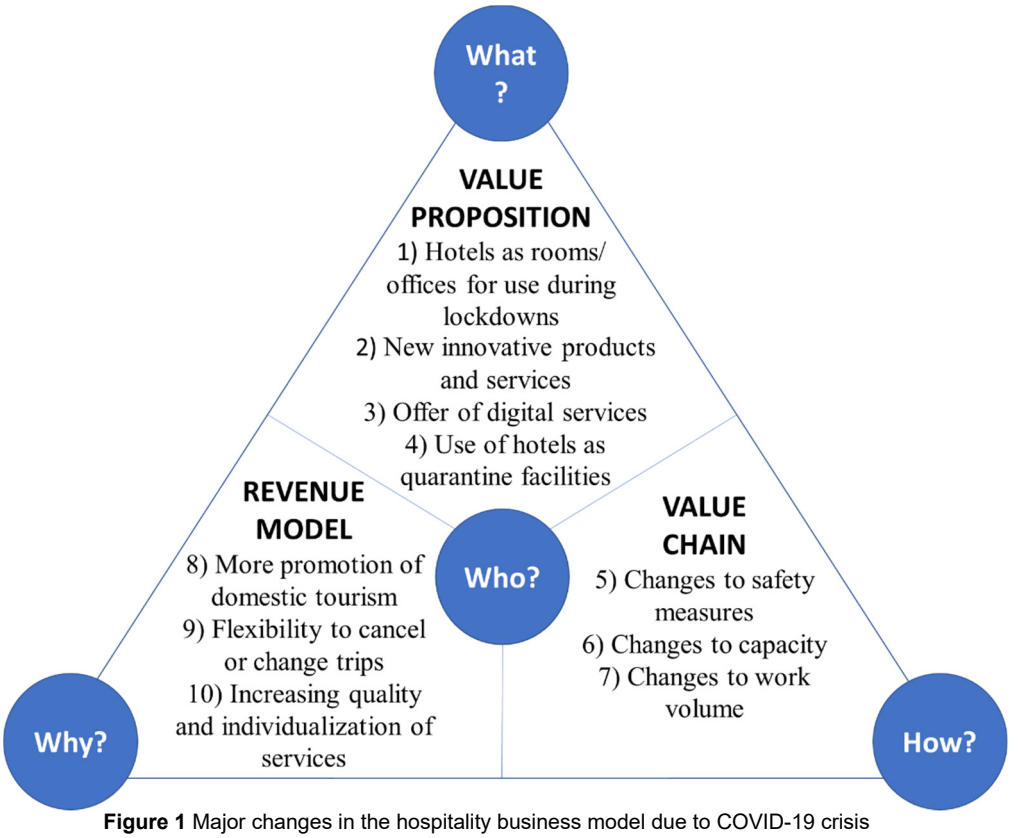

Figure 1 Major changes in the hospitality business model due to COVID-19 crisis
Source: the authors

4.1. Hotels as living/office spaces for use during lockdowns

During the COVID-19 crisis, many employees were asked to work from home. However, the effects of the pandemic have differed across occupations and labour market segments (ILO, 2020) and the possibility to work from home has become very important and has had repercussions for productivity, location, working hours and the traditional separation between the work and home environments (Caringal-Go, Teng-Calleja, Bertulfo & Manaois, 2021; Wong, Lau, & Chan, 2021). This new way of working resulted in increased productivity for some and for others in loss of focus and problems related to engaging in time-consuming online meetings (Birkinshaw, Cohen & Stach, 2020).

In order to survive, hotels began to offer innovative solutions including the offer of hotel rooms to provide those instructed to work from home with a quiet work space while offices were closed. Some of the hotels that have converted the rooms into work space offices are: the Crosby Street Hotel in New York, the Langham in Manhattan, the Figueroa in Los Angeles, the Hoxton in London, the Galleria Vik Milano etc. (Trimble, 2020). They offered their facilities at reduced rates and gave access to other of the hotel's facilities within the confines of the restrictions imposed. This gave some freedom and distraction for individuals who were forced to work from home, and in some cases has been crucial to maintain productivity. At the same time, it helped the hotels involved to avoid bankruptcy.

4.2. New innovative products and services

To prevent the spread of COVID-19 and to maintain relationships with consumers, hospitality companies have had to devise new products and services. Following the imposition of restrictions on travel, in some cases virtual tourism has substituted for real tourism with many museums, galleries, and other tourist destinations and attractions are offering virtual tours. Also, to reduce the spread of COVID-19 and maintain distance among guests, hotel checking-in and checking-out procedures are based on apps and require no interaction with hotel staff. The closure of restaurants led hotels to convert unused hotel rooms into private dining rooms. For instance, on

Valentine's Day, several hotels (the Brussels hotel, the Qbic Hotel) offered packages which included a hotel bedroom and a separate room to dine in (Burleigh, 2021). This allowed some escape from the everyday routine and confinement in the home, and allowed hotels to maintain relations with consumers and to create value.

4.3. Offer of digital services

Entrepreneurship and digital transformations have helped the hospitality industry to face the challenges posed by the COVID-19 crisis. Popular destinations have offered virtual experiences to allow consumers to experience attractions around the world from their homes (Ben Youssef, Zeqiri & Dedaj, 2020; Ben Youssef & Zeqiri, 2022). For instance, several museums (the Metropolitan Museum of Art, the Solomon Guggenheim Museum, Amsterdam's Rijksmuseum, the National Gallery and the British Museum in London, the Musée D'Orsay, the Palace of Versailles in Paris, and the Uffizi Gallery in Florence) have shifted to virtual museums (Bianchini, 2021).

Touchless tech has become particularly valuable. Use of digital technologies has enabled hotels to receive and respond to questions and requests from guests without the guest needing to use the phone or visit the reception desk. Also, platforms which use mapping technology combined with booking and payment systems have been introduced to enable contactless reservations.

Hotels have also implemented technology to protect staff by eliminating touch points in their in-house operations. Digital tools are being used to manage security and cleaning procedures and provide information on which cleaning solutions to use in specific areas. They allow the hotels to track areas subject to the most guest traffic which helps both guests and staff to prevent the spread of COVID-19.

4.4 Use of hotels as quarantine facilities

Several hotels (the Essex in Chicago, the Park Hyatt Paris, the New York Marriott, the Ayre Gran Hotel in Madrid etc.) have become official quarantine facilities. Also, in countries, Italy, Spain, US, China, etc. where hospitals were overwhelmed, local governments cooperated with hotels to transform their spaces into care facilities or quarantine centres (Johanson, 2020).

Many hotels (Hilton Hotel, American Express Hotel, etc.) offer healthcare workers working long shifts free or low-cost accommodation to avoid putting their families at risk.

Arrivals from abroad are required to quarantine in a designated hotel for 14 days to prevent the spread of COVID-19, and some hotels (Park Lane Hong Kong's, Fairmont Singapore etc.) offer 'quarantine packages' to allow people to self-isolate away from their homes.

4.5. Changes to safety measures

New protocols and certification have been developed to try to ensure safety related to hospitality industry activities. Hotels have focused on implementing measures to keep guests safe and healthy. Touch points are cleaned and disinfected more frequently, and public spaces are ventilated regularly. Many hotels require guests to complete health check forms and have their temperatures checked on entry, while guest numbers in enclosed spaces are limited to ensure social distancing. Sanitizers for use by guests are available in all public areas.

In the case of Airbnb-type accommodation, hosts can register for the "Cleaning Protocol" certification which includes training in how to prepare accommodation for guests. The training includes provision of information on preventing COVID-19 infections such as use of face masks and gloves by hosts and cleaners, use of appropriate disinfectants and cleaning materials, etc.

Airline companies are subject to extremely strict cleaning measures. Planes are ventilated and sanitized using special sanitizing products daily. IATA certification ensures that the air circulating within planes is clean and safe. The EASA (European Aviation Safety Agency) found that the air quality in aircraft cabins is superior to that in other environments such as schools, homes, and offices.

4.6. Changes to capacity

The COVID-19 crisis has enforced changes to hotel capacities. During summer 2020, many countries (Tunisia, Egypt, Italy, Morocco, Spain, Germany, France, etc.) gradually started to reopen their tourism activities. Social distancing guidelines forced hotels to leave a certain number of their rooms empty and these limitations on accommodation capacity-imposed limits on other offers such as restaurants. Also, after guest checkout, housekeeping cannot access the room for a certain period - between 48 and 72 hours.

Capacity changes have also affected the aviation sector. Airline companies were forced to reduce capacity in order to maintain social distancing, enhanced their cleaning procedures, and adapted their food and beverage services. As COVID-19 continues to affect this sector, airline companies have been forced to reduce the number of their flights and to furlough or lay off workers or offer them unpaid leave or reduced working hours. For instance, the airline company Air France plans to cut 6 500 jobs by 2022 due to the impacts of COVID-19 (Nikolaeva, 2020).

4.7. Changes to work volume

The devastating impact of COVID-19 on the tourism sector has forced many companies to reduce the number of their workers. Prior to the pandemic crisis, tourism accounted for 10% of world GDP and jobs. Most of this employment was in either direct tourism sector jobs or tourism related jobs, i.e. restaurant workers, shop owners, suppliers. According to UNWTO (2020), some 100 million to 120 million tourism jobs are at risk.

Hotels, airline companies and other related tourism businesses reduced their activities temporarily in order to cut costs, and employees were made redundant, asked to work from home, or asked to work reduced hours. Grounded airlines have had to adjust their staffing levels and ask employees to take paid or unpaid leave. In other cases, companies are not hiring, which could cause problems when the crisis ends. Employment in the tourism sector will continue to be affected in the post-COVID world since many firms will be forced into bankruptcy, and recovery will take time.

4.8. More promotion of domestic tourism

Domestic tourism is recovering faster than international tourism. People are looking for travel options close to home which carry a smaller risk of catching or spreading COVID-19, and tourism companies are customizing their services to satisfy this demand by offering more domestic than international travel packages.

According to UNWTO (2020), financial incentives and better marketing and promotion would strengthen the domestic tourism sector. These incentives might include vouchers, fiscal inducement, and weekend offers. In addition, communication campaigns and digital promotions via social media channels are being used to promote and market domestic destinations.

4.9. Flexibility to cancel or change trips

Many hotels (the Hilton Hotel, the Marriott Hotel, etc.) and airlines (Air France, British Airways, Eurowings, Lufthansa, etc.) have updated their change and cancellation policies to make them more flexible to respond to the COVID-19 crisis. The outbreak of COVID-19 resulted in massive flight cancellations worldwide. In order to support passengers, airlines are offering refunds, vouchers, or ticket exchanges. Most travel – including originally non-refundable bookings - that was suspended in the first months of the COVID-19 crisis was cancelled or refunded. This policy has remained in place; in the case of the need to cancel a trip, a refund is provided and many airlines, hotels, and travel agencies are not imposing change or cancellation fees.

4.10. Increasing quality and individualization of services

The constraints necessitated by the COVID-19 pandemic in terms of reduced capacity are improving the customer experience, and allowing tourism businesses to respond to certain customer demands. The focus on quality should reduce mass tourism which is damaging to nature and natural resources, and curtails the services offered. Virtual travel will help to reduce mass tourism and travel although its value depends on the consumer's perception of the technologies, and the level of satisfaction derived from virtual as opposed to real travel and physical presence at a destination (Zeqiri, Dahmani, & Ben Youssef, 2021). The relationships between customers and companies are changing in favour of the consumer, and this new power and control is leading to demands for personalized services enabled by hospitality industry 4.0.

Conclusions and Policy implication

This paper has identified and described ten major hospitality industry business model changes which occurred during the COVID-19 crisis. It conducted a qualitative analysis to examine the business model components of value proposition, value chain, and revenue model.

This paper identified four value proposition changes including use of hotel rooms as living/office spaces during lockdowns, offer of innovative products and services, offer of digital services, and use of hotels for quarantine purposes. The business model has also experienced changes related to safety measures, capacity, and work

volumes. The revenue model changes include fewer offers to foreign tourists and more to domestic tourists, flexible booking and cancelling, and higher quality more personalized services.

Countries whose GDP is derived mostly from tourism (Italy, Spain, Tunisia, Egypt, Morocco) have been hit hard. As a result of the second wave of infections countries are offering tourism only for domestic tourists. Recovery of the tourism industry will depend on the strategies put in place to protect consumers, tourism employees, and tourism companies.

Changes to consumer behaviours and preferences under the lockdowns may lead to greater use of technologies, virtual tourism, and sustainable travel. There should be no return to business-as-usual and there should be more investment in technology to transform tourism into sustainable tourism based on the sustainable development goals.

Policy implications

COVID-19 pandemic has drastically changed the hospitality business models. Given these changes, there is a need for policies in order to foster the development and adoption of the new practices in the hospitality business models.

First, innovation and digital technologies should be key priorities for the future of the hospitality business models. There is a need to adopt a set of technologies and deep organizational change, as COVID-19 has shown that innovation and digitalization were at the heart of the hospitality industry during the crisis.

Second, there is a need to offer customized and flexible services. Customized and flexible services may increase the satisfaction of the consumers and make the hospitality businesses adopt the new practices easier.

Third, it should be focused on offering more qualitative services. More qualitative services would lead to the improvement of the consumer experience.

Fourth, increase the investments on virtual experiences. The promotion of virtual tourism would allow even people with budget constraints and disabilities to have a virtual tour and to enjoy this experience.

Limitations and future research

The paper has some limitations. First, the paper shows the key changes to the hospitality business model during COVID-19, without being specified in only one change and describing it in detail. Future research should present a specific change in the hospitality business models and treat it in more detail. Second, the paper is not focused only on a country or group of countries, but it is in general. In the future research, it would be important to present a specific country and how hospitality business models have changed during the crisis. Third, the paper is focused only on showing what happened during the crisis, but now what will happen in the future. However, it would be interesting to show the changes of the hospitality business models in the post-COVID-19 period.

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Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number* (issue number), pages.

➲ Journal article, one author, paginated by issue

Journals paginated by issue begin with page 1 in every issue, so that the issue number is indicated in parentheses after the
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Seliverstova, Y. (2021). Workforce diversity management: A systematic literature review. *Strategic Management*, *26*(2), 3–11.
https://doi.org/10.5937/StraMan2102003S

➲ Journal article, one author, paginated by volume

Journals paginated by volume begin with page 1 in issue 1, and continue page numbering in issue 2 where issue 1 ended, e.g.

Perić, O. (2006). Bridging the gap: Complex adaptive knowledge management. *Strategic Management, 14*, 654–668.

➲ **Journal article, two authors, paginated by issue**

Dakić, S., & Mijić, K. (2020). Regression analysis of the impact of internal factors on return on assets: A case of meat processing enterprises in Serbia. *Strategic Management*, *25*(1), 29–34. https://doi.org/10.5937/StraMan2001029D

➲ **Journal article, two authors, paginated by volume**

Ljubojević, K., & Dimitrijević, M. (2007). Choosing your CRM strategy. *Strategic Management, 15*, 333-349.

➲ **Journal article, three to six authors, paginated by issue**

Marić, S., Uzelac, O., & Strugar-Jelača, M. (2019). Ownership structure as a measure of corporate performance. *Strategic Management*, *24*(4), 28–37. https://doi.org/10.5937/StraMan1904028M

➲ **Journal article, three to six authors, paginated by volume**

Boškov, T., Ljubojević, K., & Tanasijević, V. (2005). A new approach to CRM. *Strategic Management, 13*, 300-310.

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Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., et al. (2005). Putting the user at the center of software testing activity. *Management Information Systems, 3*(1), 99-106.

➲ **Journal article, more than six authors, paginated by volume**

Strakić, F., Mirković, D., Boškov, T., Ljubojević, K., Tanasijević, V., Dimitrijević, M., et al. (2003). Metadata in data warehouse. *Strategic Management, 11*, 122-132.

➲ **Magazine article**

Strakić, F. (2005, October 15). Remembering users with cookies. *IT Review*, *130*, 20-21.

➲ **Newsletter article with author**

Dimitrijević, M. (2009, September). MySql server, writing library files. *Computing News, 57,* 10-12.

➲ **Newsletter article without author**

VBScript with active server pages. (2009, September). *Computing News,57,* 21-22.

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Basic format for books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: "Location" always refers to the town/city, but you should also include the state/country if the town/city could be mistaken for one in another country.

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Ljubojević, K. (2005). *Prototyping the interface design*. Subotica: Faculty of Economics in Subotica.

➲ **Book, one author, new edition**

Dimitrijević, M. (2007). *Customer relationship management* (6th ed.). Subotica: Faculty of Economics in Subotica.

➲ **Book, two authors**

Ljubojević, K., Dimitrijević, M. (2007). *The enterprise knowledge portal and its architecture*. Subotica: Faculty of Economics in Subotica.

➲ **Book, three to six authors**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., & Perić, O. (2006). *Importance of software testing*. Subotica:
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Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., Boškov, T., Strakić, F., et al. (2007). *Supply chain management*.
Subotica: Faculty of Economics in Subotica.

➲ **Book, no author or editor**

Web user interface (10th ed.). (2003). Subotica: Faculty of Economics.

➲ **Group, corporate, or government author**

Statistical office of the Republic of Serbia. (1978). *Statistical abstract of the Republic of Serbia.*
Belgrade: Ministry of community and social services.

➲ **Edited book**

Dimitrijević, M., & Tanasijević, V. (Eds.). (2004). *Data warehouse architecture*. Subotica: Faculty of Economics.

➲ **Chapter in an edited book**

Boškov, T., & Strakić. F. (2008). Bridging the gap: Complex adaptive knowledge management. In T. Boškov, & V.
Tanasijević (Eds.), *The enterprise knowledge portal and its architecture* (pp. 55-89). Subotica: Faculty of Economics in Subotica.

➲ **Encyclopedia entry**

Mirković, D. (2006). History and the world of mathematicians. In *The new mathematics encyclopedia* (Vol. 56, pp. 23-45).
Subotica: Faculty of Economics.

C. UNPUBLISHED WORKS

➲ **Paper presented at a meeting or a conference**

Ljubojević, K., Tanasijević, V., Dimitrijević, M. (2003). *Designing a web form without tables*. Paper presented at the annual meeting of the Serbian computer alliance, Beograd.

➲ **Paper or manuscript**

Boškov, T., Strakić, F., Ljubojević, K., Dimitrijević, M., & Perić, O. (2007. May). *First steps in visual basic for applications*.
Unpublished paper, Faculty of Economics Subotica, Subotica.

➲ **Doctoral dissertation**

Strakić, F. (2000). *Managing network services: Managing DNS servers*. Unpublished doctoral dissertation, Faculty of
Economics Subotica, Subotica.

➲ **Master's thesis**

Dimitrijević, M. (2003). *Structural modeling: Class and object diagrams*. Unpublished master's thesis, Faculty of Economics
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D. ELECTRONIC MEDIA

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Tanasijević, V. (2003, March). Putting the user at the center of software testing activity. *Strategic Management*, *8* (4).
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Faculty of Economics. (2008, March 5). *A new approach to CRM*. Retrieved July 25, 2008, from http://www.ef.uns.ac.rs/papers/acrm.html

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According to Mirković (2001, p. 201), "The use of data warehouses may be limited, especially if they contain confidential data".

Mirković (2001, p. 201), found that "the use of data warehouses may be limited". What unexpected impact does this have on the range of availability?

If the author is not named in the introductory phrase, the author's last name, publication year, and the page number in
parentheses must be placed at the end of the quotation, e.g.

He stated, "The use of data warehouses may be limited," but he did not fully explain the possible impact (Mirković, 2001, p. 201).

➲ **Summary or paraphrase**

According to Mirković (1991, p. 201), limitations on the use of databases can be external and software-based, or temporary and even discretion-based.

Limitations on the use of databases can be external and software-based, or temporary and even discretion-based
(Mirković, 1991, p. 201).

➲ **One author**

Boškov (2005) compared the access range…

In an early study of access range (Boškov, 2005), it was found...

➲ When there are **two authors**, both names are always cited:

Another study (Mirković & Boškov, 2006) concluded that…

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(Jovanov, Boškov, Perić, Boškov, & Strakić, 2004).

In subsequent citations, only the first author's name is used, followed by "et al." in the introductory phrase or in parentheses: According to Jovanov et al. (2004), further occurences of the phenomenon tend to receive a much wider media coverage.

Further occurences of the phenomenon tend to receive a much wider media coverage (Jovanov et al., 2004). In "et al.", "et" is not followed by a full stop.

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The first author's last name followed by "et al." is used in the introductory phrase or in parentheses:

Yossarian et al. (2004) argued that…

… not relevant (Yossarian et al., 2001).

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A similar survey was conducted on a number of organizations employing database managers (Limiting database
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>
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(Mirković & Boškov, 2006, p.12)

Mirković & Boškov (2006, p. 12) propose the approach by which "the initial viewpoint…

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(K. Ljubojević, personal communication, May 5, 2008).

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